ASPECTS OF TACTILE STIMULATION WITH INFANTS IN INTENSIVE AND SPECIAL CARE BABY UNITS

Volume 1

Eilis Aine Mhaire de Roiste B.A. (Cork)

Thesis submitted for the degree of Doctor of Philosophy, in the Department of Psychology, Faculty of Social Science, University of Glasgow.

December, 1991.

DEDICATION

In loving memory of my father.

The moon blackened at my birth
and long night's cry began.
Pain became my bed-fellow
and despair my song.
God disappeared behind the clouds;
I lost my star-signpost to hope.

Light found a chink to peep through
when poems were read to my starved soul.
Lonliness brought moments of repose;
lines poured through my veins
and love glimmered on my tongue.
Little birds became my inspiration.

Left with my own silent melody,
I painted notes of long-forgotten tunes
trembling in my trapped heart .
Light burst through my dark mouth
and myriad songs flew heavenwards.
I was poised for flight........

(My life, My voice, My story D. Hanna 1990)

ACKNOWLEDGEMENTS

I would like to extend my gratitude and appreciation to a number of people.

Firstly to my supervisor Dr. I.W.R. Bushnell, whose guidance and advice were invaluable in carrying-out this research.

For their co-operation and assistance I would like to thank Drs. Turner, Holland, Logan and Hamilton, as well as all the nursing and medical staff at both the Queen Mother's Hospital, Yorkhill, Glasgow and St. George's Hospital, Tooting, London.

For her encouragement and inspiration I am very grateful to Dr. E. Adamson-Macedo at Wolverhampton Polytechnic.

Thanks are also due to Joan Burns, Maria di Finizio, Lorna Rintoul, Fiona McColl and Jane Wilson, all undergraduate students who helped in conducting the experiments.

I am also indebt to all those parents who participated themselves and gave their permission for their infants to be involved in the research.

For assistance in the instrumental conditioning study, I would like to thank Dr J. Oates at the Open University and for making the equipment, Miller Systems in Milton Keynes.

I am grateful as well to Mr P.J. O'Donnell, Dr. L. Moxey, Miss Anne-Marie Fleming and all the staff at the Department of Psychology at the University of Glasgow for all their assistance. I would also like to thank this department for providing me with demonstrating and teaching work which funded me when I had no scholarship and from which I gained both knowledge and experience.

For financing this research I would like to thank the University of Glasgow for the scholarship awarded to me, the Department of Psychology at the said University for covering the expenses of my experimental work and the charities I-LENS and the Buttle Trust for bursarys granted to me.

A special thanks is due also to Mrs A. Wilson for acting as a "blind" examiner in the ventilated infant study and to Graham Benny for my graphics.

For making me so welcome in Glasgow, I would like to thank all those I have come to know, both within and outside of the Psychology Department.

Thanks also to fellow PhD students, Elizabeth MacNulty, Judith Ramsey and Roseanna Mohammed, for their endless encouragement and patience and to Hugh Neil, a final year medical student for assistance in the physiological side of the thesis.

Finally, for their encouragement and reassurance I am indebt to my family and friends at home in Cork, Ireland.

"Go raibh maith agaibh"

Aine de Roiste

ABSTRACT

A series of studies was conducted to investigate the effects of a programme of tactile stimulation, "Tac-Tic" (Macedo, 1984), on preterm and low-birthweight infants. This programme of sequenced stroking was administered for 20 minutes daily for the duration of the infant's hospitalization. In comparison to their matched retrospective controls, on the short-term measures of:

(1) age at first suck of all feeds in a day

(2) age at removal from an incubator into a cot

(3) age at discharge

the stroked infants were found to display significantly earlier ages in measures (2) and (3). Using prospective controls the same pattern was found with the experimental, group compared to controls, being significantly younger on the first measure.

At fifteen months these infants were assessed using the Bayley Scales of Infant Development (Bayley, 1969) with measures of stimulation in the home and parenting also being taken. The experimental as compared to control infants were found to have significantly higher scores on mental development (M.D.I).

Using Meisels et al.'s (1987) I.B.R. factor structure, experimental infants were also found to be significantly more advanced than their controls on a number of behavioural factors such as Social Orientation and Test-Affect-Extraversion.

Mothers of the experimental as compared to control sample were also found to be significantly more satisfied with the parental role when measured by the Self Perceptions of the Parental Role questionnaire (McPhee et al., 1986).

A sample of ventilated preterms were also administered a shortened version (4 minutes per day) of the Tac-Tic procedure and the effects on heart rate, respiration rate and tcpo2 (oxygenation) were monitored using an interrupted time-series design. A significant drop in heart rate and increase in respiration rate were found to take place after the stroking. In comparison maternal touching showed no significant differences in percentage increase in heart rate, respiration rate or tcpo2.

Overall, it was concluded that the shortened version of the Tac-Tic stroking programme did not compromise the health of these very-ill infants.

In a further study, the effects of the stroking programme on infant performance in an instrumental conditioning task were examined. This task involved sucking at/above a particular pressure to obtain the mother's voice (reinforcer) on a tape-recorder. Experimental, in comparison to control, infants were found to show a better performance on this task which closely approached significance, in terms of percentage increase in sucking pressure during those times when sucking pressure brought on the mother's voice.

The mechanism by which Tac-Tic has its' influences was examined through the gastric effects of the stroking programme. Using a pretest-posttest design, gastric aspirates were taken before and after:

(1) the Tac-Tic stroking in experimental infants

(2) a control period of non-intervention time in control infants.

A significantly higher drop in ph was found in the experimental as compared to control sample, which suggests an association between stroking and feeding.

No significant differences were found between the experimental and control samples in either daily average weight gain or daily average food volume intake.

In the above studies (except that with ventilated infants), the experimental and control samples were sub-divided into high-risk and low-risk categories, according to gestational age and birthweight. This was done to determine whether the Tac-Tic stroking had a greater effect on the high-risk (low gestational age and birthweight) as opposed to low-risk (high gestational age and birthweight) infants. This pattern was found in the results and was statistically significant in the first study.

The behavioural effects of the Tac-Tic stroking on preterms and low-birthweight infants was then looked at, with both parents and the experimenter all recording infant's reactions while s\he was being stroked by the mother and father (seperately).

Limb movements were found to be significantly the most frequent infant reaction across all three of the bodily categories of strokes (head, trunk and limb).

Parental anxieties and attitudes were also examined in this study. Experimental, in contrast to control parents, were shown the stroking programme, participated in the above mentioned infant reaction recording procedure and were given diaries to fill-in all the activities they engaged in with their infant. The study found that parents in the experimental sample enjoyed stroking their infant using the Tac-Tic procedure and suffered from less anxiety than those in the control sample.

Finally, attitudes of the medical and nursing professions (students and staff) to psychological interventions in the neonatal unit were considered using a questionnaire designed specifically for this study. The nursing profession and overall female sample were found to hold significantly more favourable attitudes to this than the medical profession and the overall male sample respectively.

In sum, the studies conducted suggest that Tac-Tic stroking:

(1) benefits preterm infant short and long-term development

(2) does not compromise the health of ventilated preterms

(3) promotes digestion

(4) enhances performance on a learning assessment

(5) elicits predominantly limb reactions in the infant

(6) may have a greater effect on high-risk as compared to low-risk infants

(7) is a pleasurable activity for parents to engage in with their infant

(8) reduces parental anxiety in the post-birth, post-partum period.

AIMS

This research set out to answer a number of questions:

(1) Does the "Tac-Tic" programme of supplemental tactile stimulation benefit premature infants in both their short and long-term development ? (Chapters 6, 8 and 9)

(2) Does this programme compromise the health of ventilated preterms cared for in neonatal intensive care units ? (Chapter 7)

(3) Are the immediate physiological effects of the tactile stimulation programme in preterms different from those of maternal touching ? (Chapter 7)

(4) What are the immediate gastric effects of this programme in preterms? (Chapter 8)

(5) What behavioural reactions in the preterm are elicited by this programme and do these vary according to the bodily area being stroked ? (Chapter 10)

(6) Is parental anxiety and behaviour affected by their involvement in a programme of preterm tactile stimulation ? (Chapter 10)

(7) What are the attitudes of the medical and nursing professions towards psychological interventions in the neonatal unit ? (Chapter 11)

(8) Does tactile stimulation benefit high-risk preterms more than those of low-risk ? This is examined as a side-issue (Chapters 6, 8 and 9).

Before addressing these questions, the following will be discussed:

A. the area of psychology that this research belongs to (Developmental Psychology and Pediatrics; Chapter 1)

B. the subject sample this research is concerned with (Premature infants and their parents, Medical and Nursing professions; Chapter 2)

C. the setting in which this research was undertaken (Neonatal unit; Chapter 3)

D. the background theories and research (Chapters 4 and 5)

CONTENTS

VOLUME 1

ABSTRACT

CHAPTER 1 DEVELOPMENTAL PSYCHOLOGY AND PEDIATRICS 1

1.1 Introduction 2

1.2 Developmental Psychology: its practical significance 2

1.3 Developmental Psychology: its significance for Pediatrics 4

1.3.1 Greater understanding of infancy 4

1.3.2 Detection, treatment and prevention of problems 5

1.3.3 Recognition of environmental influences 6

1.3.4 Improved pediatric training 6

1.4 Conclusion 8

CHAPTER 2 PREMATURE INFANTS: THEIR NEED FOR PSYCHOLOGICAL INTERVENTION 9

2.1 What is a Premature Infant ? 10

2.2 Etiology of Prematurity 12

Chapter 2 Cont'd

2.2.1	Risk factors	12
2.2.2	Elective premature birth	14
2.2.3	Spontaneous premature birth	14
2.2.4	Conclusions	15
2.3	**Characteristics of Premature Infants**	**15**
2.4	**Consequences of a Premature Birth**	**17**
2.4.1	Physical effects:	17
2.4.1.1	Difficulties in adjustment	17
2.4.1.2	Physical ailments	18
2.4.1.3	Physical appearance	19
2.4.1.4	Sensory/Motor deficits	19
2.4.1.5	Cognitive deficits	22
2.4.1.6	Arousal/Alertness deficits	24
2.4.2	Parent-Infant effects:	24
2.4.2.1	Effects on parents	24
2.4.2.2	Early touching	25
2.4.2.3	Labelling	27
2.4.2.4	Uneven developmental patterns	28
2.4.2.5	Disturbed patterns of interaction	29
2.4.2.6	Child abuse	32
2.4.3	Early experience	33
2.4.3.1	Concept of the critical period	33
2.4.3.2	Early neonatal period	34

Chapter 2 Cont'd

2.4.3.2.1	Physical significance	34
2.4.3.3	Fetal period as a critical period	35
2.4.3.3.1	Fetal stimulation as a rhythm-giver	36
2.5	**Conclusions**	**36**
2.5.1	Intervention programmes	37
CHAPTER 3	**THE NEONATAL UNIT**	**38**
3.1	**Characteristic Features**	**39**
3.1.1	Sensory Bombardment	39
3.1.1.1	Noise	40
3.1.1.2	Illumination	42
3.1.1.3	Caretaking	43
3.1.2	Sensory Deprivation	47
3.1.2.1	Infrequent positional change	47
3.1.2.2	A lack of co-ordinated sensory experience	50
3.1.2.3	Inadequate positive tactile contact and loving behaviour	52
3.1.3	Developmentally Inappropriate Stimulation	54
3.1.4	Physical Layout	55
3.1.5	Conclusion	55

Chapter 3 Cont'd

3.2	**Medical and Nursing Professions**	**56**
3.2.1	Education and training establishments	56
3.2.1.1	Greater emphasis on research	56
3.2.1.2	Greater interdisciplinary work	57
3.2.1.3	Communication, social skills and coping style	58
3.2.2	Medical and Nursing Staff	59
3.2.2.1	Emphasis on psychological as well as physical care	59
3.2.2.2	Greater self-awareness	60
3.3	**Preterm Intervention Programmes**	**63**
CHAPTER 4	**STIMULATION AND EARLY EXPERIENCE**	**65**
4.1	**Introduction**	**66**
4.1.1	What is stimulation ?	66
4.1.2	Stimulation, experience and development	67
4.1.3	Self-stimulation	69
4.1.4	Early experience	70
4.2	**The Critical Period Concept**	70
4.2.1	Categories of critical period	73
4.2.2	Underlying mechanisms	75

Chapter 4 Cont'd

4.2.3 Critical periods in early life 76

4.2.4 Stimulation and critical periods 78

4.2.4.1 Animal studies 78

4.2.4.2 Human studies 79

4.3 The Period of Early Infancy 80

4.3.1 Structural development of the C.N.S. 81

4.3.2 Sensori-motor structural development 82

4.3.3 Hebb's (1949) theory 83

4.3.4 Tactile stimulation 85

4.3.5 Deprivation of tactile stimulation 87

4.4 Premature Infants - A Special Population 88

4.4.1 Deprivation experiences 88

4.4.1.1 Motor Effects 89

4.4.1.2 Sleep Effects 89

4.4.1.3 Attachment/Emotional Effects 90

4.4.1.4 Behavioural Effects 90

4.4.1.5 Neural Discharge Effects 91

4.5 Conclusion 91

CHAPTER 5 STIMULATION INTERVENTION PROGRAMMES 93

5.1 Introducation 94

5.1.1 Intervention programmes 94

Chapter 5 Cont'd

5.2	**Intervention Programmes in the Neonatal Unit**	**96**
5.2.1	Aims of intervention programmes	97
5.2.2	Preterms: a target population	98
5.3	**Stimulation Interventions**	**98**
5.4	**Categories/Dimensions of Sensory Intervention Programmes**	**104**
5.4.1	Parameters of stimulation programmes	105
5.4.1.1	Content	105
5.4.1.2	Quantity/Duration	106
5.4.1.3	Quality	108
5.4.1.4	Context and Level of Arousal	112
5.4.1.5	Subject Sample	112
5.4.1.5.1	Gender	113
5.4.1.5.2	Prematurity	115
5.4.1.5.3	Age	116
5.4.1.6	Features measured and assessed	118
5.5	**General Sensory/Multimodal Stimulation**	**121**
5.5.1	Animal programmes	121
5.5.2	Human programmes	122
5.6	**Tactile Stimulation**	**124**
5.6.1	Introduction	124
5.6.1.1	Tactile stimulation in early infancy	125
5.6.1.2	Tactile stimulation with preterms	125

Chapter 5 Cont'd

5.7	**Tactile Intervention Programmes**	**126**
5.7.1	Tactile intervention programmes with animals	127
5.7.1.1	Physical effects	128
5.7.1.2	Cognitive effects	130
5.7.1.3	Socio-emotional effects	132
5.7.2	Tactile intervention programmes with human infants	133
5.7.2.1	Physical effects	134
5.7.2.2	Cognitive effects	137
5.7.2.3	Socio-emotional effects	140
5.7.2.4	Conclusion	142
5.8	**Influential Subject Variables**	**142**
5.8.1	Individual behavioural differences	143
5.8.2	Past experience	144
5.8.3	State at/response to stimulation	148
5.8.4	Genetic Inheritance	150
5.8.5	Subject's current condition	151
5.8.6	Miscellaneous factors	152
5.8.7	Overall Conclusions	155

CHAPTER 6 AN INVESTIGATION INTO THE SHORT AND LONG-TERM EFFECTS OF A PROGRAMME OF TACTILE STIMULATION WITH PREMATURE INFANTS 157

6.1 **Introducation: Tactile Stimulation Programmes** **158**
6.1.1 Rice (1977)
6.1.2 Rose et al. (1980)
6.1.3 Field et al. (1986)
6.1.4 Macedo (1984)

6.1.5 Study 1 165
6.1.5.1 Macedo (1984) Replication 165

6.1.5.2 Extension of the Replication study with Prospective controls and long-term follow-up 170

6.2 **Method** **173**

6.2.1 Method: Macedo (1984) Replication Study **173**
6.2.1.1 Design 173
6.2.1.2 Subjects 175
6.2.1.3 Stimulation 177
6.2.1.4 Procedure/Equipment 178

6.2.2 **Method: Extension Study** **178**
6.2.2.1 Design 178
6.2.2.2 Subjects 180

Chapter 6 Cont'd

6.2.2.2.1 Long-term subjects 183

6.2.2.3 Stimulation 188

6.2.2.4 Procedure/Equipment 188

6.2.2.4.1 Long-term assessment 188

6.2.2.5 Data Analysis 189

6.3 Results 191

6.3.1 Results: Macedo (1984) Replication Study 191

6.3.1.1 Descriptive Statistics 191

6.3.1.2 t-tests 195

6.3.1.3 Correlations 197

6.3.1.4 High/Low risk groups 198

6.3.1.5 Conclusions 202

6.3.2 Results: Extension of the Macedo (1984) replication study with Prospective controls and a long-term follow-up 203

6.3.2.1 Descriptive Statistics 203

6.3.2.2 t-tests 206

6.3.2.3 Correlations 208

6.3.2.4 High-risk and Low-risk groups 210

6.3.2.5 Long-term data 213

6.3.2.5.1 Bayley Scales 213

Chapter 6 Cont'd

A.	Cognitive Measures	213
A.1	Descriptive Statistics	215
A.2	Co-variate Analyses	222
A.3	Experimental vs Control t-tests	222
A.4	High-risk and Low-risk groups	224
B.	Motor Measures	227
B.1	Descriptive Statistics	227
B.2	Co-variate Analyses	229
B.3	Experimental vs Control samples	229
B.4	High-risk and Low-risk groups	229
C.	Infant Behavioural Record Measures	231
C.1	Descriptive Statistics	232
C.2	Behavioural Co-variate Analyses	237
C.3	Experimental vs Control t-tests	237
C.4	High-risk and Low-risk groups	237
6.3.2.5.2	Home Measure	241
A.	Descriptive Statistics	241
B.	Experimental vs Control t-tests	243
C.	High and Low-risk groups	243
6.3.2.5.3	Parental S.P.P.R. Measure	245
A.	Descriptive Statistics	245
B.	Experimental vs Control t-tests	246
C.	High and Low-risk groups	250
D.	Correlations	252

Chapter 6 Cont'd

6.3.3	Conclusions	254
6.4	**Discussion**	**256**
6.4.1	**Macedo (1984) Replication Study**	**256**
6.4.1.1	Improved Thermoregulation	256
6.4.1.2	Improved Prognosis	261
6.4.1.3	High vs Low-Risk groups	265
6.4.1.4	Overall Conclusions	266
6.4.2	**Extension of the Macedo (1984) replication study with prospective controls and a long-term follow-up**	**267**
6.4.2.1	Short-term variables	267
6.4.2.2	Long-term variables	274
A.	Cognitive Measures	274
B.	Motor Measures	282
C.	Infant Behavioural Record Measures	285
D.	Home Measure	290
E.	Parental S.P.P.R. Measures	291
F.	Conclusions	293

CHAPTER 7 THE IMMEDIATE, PHYSIOLOGICAL EFFECTS OF A PROGRAMME OF TACTILE STIMULATION ON VENTILATED, PREMATURE INFANTS. 294

7.1 Introduction: Intervention Programmes and Ventilated, Very Low-Gestation Infants 295

7.1.1 Heart Rate 297
7.1.1.1 Prematurity and Heart Rate 298
7.1.1.2 Early Heart Rate and Long-Term Development 299
7.1.1.3 Heart Rate and Stimulation 299
7.1.1.4 Heart Rate and Tactile Stimulation 300

7.1.2 Respiration 303
7.1.2.1 Prematurity and Respiration 303
7.1.2.2 Early Respiration and Long-Term Development 305
7.1.2.3 Respiration and Stimulation 306
7.1.2.4 Respiration and Tactile Stimulation 307

7.1.3 Oxygenation 310
7.1.3.1 Prematurity and Oxygenation 311
7.1.3.2 Oxygenation and Long-Term Development 311
7.1.3.3 Oxygenation and Stimulation 313
7.1.3.4 Oxygenation and Tactile Stimulation 314

7.1.4 Conclusion 316

Chapter 7 Cont'd

7.2	**Method**	319
7.2.1	Design	319
7.2.2	Subjects	320
7.2.3	Stimulation	321
7.2.4	Equipment	321
7.2.5	Procedure	324
7.3	**Results**	**326**
7.3.1	**Heart Rate**	**329**
7.3.1.1	Inter-Rater Reliability	329
7.3.1.2	Effect of order of stimulation presentation on Heart-Rate	329
7.3.1.3	Experimenter1 Tac-Tic Touching	331
7.3.1.4	Experimenter2 Tac-Tic Touching	332
7.3.1.5	Maternal Touching	334
7.3.1.6	Experimenter2 Tac-Tic vs Maternal Touching	334
7.3.1.6.1	One Way Anovas: % Increase in Heart-Rate	335
7.3.1.7	Correlations	336
7.3.2	**Respiration Rate**	**338**
7.3.2.1	Respiration Rate Reliability	338
7.3.2.2	Effect of order of presentation of stimulation on respiration rate	338
7.3.2.3	Experimenter1 Tac-Tic Touching	340
7.3.2.4	Experimenter2 Tac-Tic Touching	340
7.3.2.5	Maternal Touching	340

Chapter 7 Cont'd

7.3.2.6	Experimenter2 Tac-Tic vs Maternal Touching	342
7.3.2.6.1	One Way Anovas: % increase in Respiration Rate	343
7.3.2.7	Correlations	344
7.3.3	**Tcpo2**	**346**
7.3.3.1	Inter-Rate Reliability	346
7.3.3.2	Effect of order of stimulation presentation on Tcpo2	346
7.3.3.3	Experimenter1 Tac-Tic Touching	349
7.3.3.4	Experimenter2 Tac-Tic Touching	349
7.3.3.5	Maternal Touching	349
7.3.3.6	Experimenter2 Tac-Tic vs Maternal Touching	351
7.3.3.6.1	One Way Anovas: % increase in Tcpo2	351
7.3.3.7	Correlations	353
7.3.4	**Interaction Analyses**	**355**
7.3.4.1	Multivariate Anovas	355
7.3.4.2	Post-hoc Scheffe t-tests	358
7.3.5	**Conclusions**	**360**
7.4	**Discussion**	**363**

7.4.1 The immediate physiological effects of the tactile stimulation programme (Tac-Tic) 363

7.4.2 The immediate physiological effects of the tactile stimulation programme (Tac-Tic) as compared to maternal touching 365

CHAPTER 8 THE IMMEDIATE GASTRIC EFFECTS OF A TACTILE STIMULATION PROCEDURE ON PREMATURE INFANTS. 369

8.1 Introduction: How do stimulation programmes exert their effects 370

8.1.1 The endocrine system: possible mediating mechanisms 370

8.1.1.1 Ornithine Decarboxylase 370

8.1.1.2 Stress Response 374

8.1.2 The Digestive System: possible mediating mechanisms 376

8.1.2.1 Tactile Stimulation and Digestion 376

8.1.2.2 Tactile Stimulation and Weight Gain 377

8.1.2.3 Macedo's (1984) Mechanism 379

8.1.2.4 Hydrochloric Acid Mechanism 382

8.1.3 Conclusion 387

Chapter 8 Cont'd

8.2	**Method**	**389**
8.2.1	Design	389
8.2.2	Subjects	390
8.2.3	Stimulation	394
8.2.4	Apparatus/Procedure	394
8.3	**Results**	**395**
8.3.1	Before and After Gastric Aspirate PH	395
8.3.2	Before to After Gastric Aspirate Ph Difference	399
8.3.3	Daily average food intake	402
8.3.4	Daily average weight gain	403
8.3.5	Age in days when first sucked all feeds in a day	404
8.3.6	Age in days at removal from care in an incubator to care in a cot (thermoregulation)	406
8.3.7	Age in days at discharge	407
8.3.8	Manova	407
8.3.9	Pearson Correlations	409
8.3.10	Conclusions	410
8.4	**Discussion**	412
8.4.1	Lingual Lipase	412
8.4.2	Ph Drop	413
8.4.2.1	Direct Neural Stimulation	415
8.4.2.2	A Learning Mechanism	415

Chapter 8 Cont'd

8.4.3	Food Intake/Weight Gain	418
8.4.4	Age at: First Suck of All Feeds/ Removal from Incubator/Discharge	420
8.4.5	Conclusion	422

Volume 2

CHAPTER 9	**THE EFFECT OF A PROGRAMME OF TACTILE STIMULATION UPON PRETERM INFANT PERFORMANCE IN AN INSTRUMENTAL CONDITIONING TASK.**	**424**
9.1	**Introduction: Cognitive Sequelae of Prematurity**	**425**
9.1.1	Learning	425
9.1.2	Animal Studies	427
9.1.3	Human Studies	428
9.1.4	General Studies of Infant Learning using Conditioning Tasks	431
9.1.4.1	Classical Conditioning Studies	431
9.1.4.2	Instrumental Conditioning Studies	434
9.1.5	Sucking Behaviour	437
9.1.5.1	Sucking and Physical Development	440
9.1.5.2	Sucking and Psychological Development	441
9.1.5.3	Sucking and Stimulation	444
9.1.6	Conclusion	447

Chapter 9 Cont'd

9.2	**Method**	449
9.2.1	Design	449
9.2.2	Subjects	451
9.2.3	Equipment	454
9.2.3.1	Calibration of Pressure Transducer	456
9.2.3.2	Running of program/experimental procedure	457
9.2.4	Procedure	460
9.3	**Results**	**464**
9.3.1	**Instrumental Learning Measures**	**464**
9.3.1.1	Descriptive statistics	464
9.3.1.2	MANOVAs, Co-Variate analyses, ANOVAs and t-tests	468
9.3.1.3	Pearson Correlations	472
9.3.2	**Sucking Pressure Measures**	**473**
9.3.2.1	Descriptive Statistics	473
9.3.2.2	MANOVAs, Co-Variate analyses, ANOVAs and t-tests	475
9.3.2.3	Pearson Correlations	477
9.3.3	**Developmental Measures**	**478**
9.3.3.1	Descriptive statistics and a-priori t-tests	478

Volume 2

CHAPTER 9	THE EFFECT OF A PROGRAMME OF TACTILE STIMULATION UPON PRETERM INFANT PERFORMANCE IN AN INSTRUMENTAL CONDITIONING TASK.	424
9.1	Introduction: Cognitive Sequelae of Prematurity	425
9.1.1	Learning	425
9.1.2	Animal Studies	427
9.1.3	Human Studies	428
9.1.4	General Studies of Infant Learning using Conditioning Tasks	431
9.1.4.1	Classical Conditioning Studies	431
9.1.4.2	Instrumental Conditioning Studies	434
9.1.5	Sucking Behaviour	437
9.1.5.1	Sucking and Physical Development	440
9.1.5.2	Sucking and Psychological Development	441
9.1.5.3	Sucking and Stimulation	444
9.1.6	Conclusion	447

Chapter 9 Cont'd

9.3.3.2	ANOVAs and post-hoc Scheffe t-tests	480
9.3.3.3	Pearson Correlations	481
9.3.4	**Conclusions**	**482**
9.4	**Discussion**	**484**
9.4.1	Learning Performance	484
9.4.2	Sucking Pressure	487
9.4.3	Developmental measures	490
9.4.4	Validity of the data	491
9.4.5	Conclusion	491
CHAPTER 10	**THE IMPACT OF A PROGRAMME OF TACTILE STIMULATION IN THE SPECIAL-CARE BABY UNIT, UPON INFANT BEHAVIOUR AND PARENTAL ANXIETY.**	**492**
10.1	**Introduction: Effects of Infant Care Within a Neonatal Unit upon the Parents**	**493**
10.1.1	Parental Effects	493
10.1.2	Intervention Programmes in the Neonatal Unit	497
10.1.2.1	General Intervention Programmes: Effects on Parents	497
10.1.2.2	Supplemental Early Tactile Contact	498

Chapter 10 Cont'd

10.1.2.3 Tactile Stimulation Programmes: Effects on Parents 500

10.1.3 Parent Implemented Sensory Stimulation in the Neonatal Unit 502

10.1.3.1 The Need for Early Father-Infant Contact 502

10.1.3.2 The Need for Partner Support 505

10.2 Method 509

10.2.1 Design 509

10.2.2 Subjects 514

10.2.3 Stimulation 517

10.2.4 Materials 517

10.2.5 Procedure 519

10.3 Results 527

10.3.1 What are the effects of the tactile stimulation programme (Tac-Tic) on parents ? 527

10.3.1.1 Descriptive statistics and t-tests: P.A.A.S total 527

10.3.1.2 MANOVA/Co-variate analysis: P.A.A.S total 527

10.3.1.3 Descriptive statistics: P.A.A.S Sub-sections 528

Chapter 10 Cont'd

10.3.1.4 P.A.A.S Sub-sections: t-tests 530

10.3.1.5 Mothers 531

10.3.1.6 Fathers 532

10.3.1.7 Mothers as compared to Fathers 533

10.3.1.8 Correlations 534

10.3.1.9 Stroking Questionnaire 534

10.3.1.10 Diaries 536

10.3.2 What are the most frequent reactions elicited by the various Tac-Tic strokes, categorized according to bodily area stroked, for each stroker? 536

10.3.2.1 Which reactions occurred significantly more than the others to each bodily category of the Tac-Tic strokes ? 539

10.3.2.2 Which bodily category of the Tac-Tic strokes elicited significantly more reactions than the others 566

10.3.3 What is the number of reactions elicited by the various categories of Tac-Tic strokes, when the mother as compared to the father is the stroker? 569

Chapter 10 Cont'd

10.3.4 Correlations 570

10.3.4.1 Maternal Stroking Session 572

10.3.4.2 Paternal Stroking Session 573

10.3.4.3 Reaction Correlations 575

10.3.5 Conclusions 576

10.4 Discussion 580

10.4.1 Arm and leg movements: the most common reactions to Tac-Tic stroking 581

10.4.2 Maternal and Paternal Tac-Tic stroking 585

10.4.3 Head, trunk or limb Tac-Tic strokes, in comparison to each other 587

10.4.4 Experimental as compared to Control parents: P.A.A.S Results 588

10.4.5 The Stroking Questionnaire 589

CHAPTER 11 AN INVESTIGATION INTO THE ATTITUDES OF THE MEDICAL AND NURSING PROFESSIONS TOWARDS PSYCHOLOGICAL INTERVENTIONS IN THE NEONATAL UNIT. 591

11.1 **Introducation: Psychology and Medicine 592**

11.1.1 Nurse Training 594

11.1.2 Medical Training 595

11.1.3 Conclusion 598

Chapter 11 Cont'd

11.2	**Method**	**600**
11.2.1	Design	600
11.2.2	Subjects	601
11.2.3	Materials	603
11.2.4	Procedure	603
11.2.4.1	Scoring of A.T.P.I.Q.	604
11.3	**Results**	**606**
11.3.1	Introduction	606
11.3.2	Gender, Age and Attitude Score	606
11.3.3	Profession and Attitude Score	607
11.3.4	Level of Training and Attitude Score	610
11.3.4.1	Students Only	612
11.3.4.2	Staff Only	613
11.3.4.3	Nursing Students Only	614
11.3.4.4	Medical Students Only	615
11.3.5	Attitude Scores across Hospitals	618
11.3.6	Conclusions	619
11.4	**Discussion**	**621**
11.4.1	Attitudes of Medical vs Nursing Profession	621
11.4.2	Attitudes of Staff vs Students	623
11.4.3	Attitudes of Medical vs Nursing students	624

CHAPTER 12 FINAL CONCLUSIONS 627

12.1 Does the "Tac-Tic" programme of supplemental tactile stimulation benefit premature infants in both their short-term and long-term development ? 628

12.2 Does this programme compromise the health of ventilated preterms cared for in neonatal intensive care units ? 630

12.3 Are the immediate physiological effects of the tactile stimulation programme in preterms different from those of maternal touching ? 631

12.4 What are the immediate gastric effects of this programme in preterms ? 631

12.5 What behavioural reactions in the preterm are elicited by this programme and do these vary according to the bodily area being stroked ? 632

12.6 Is parental anxiety and behaviour affected by their involvement in a programme of preterm tactile stimulation? 633

12.7 What are the attitudes of the medical and nursing professions towards psychological interventions in the neonatal unit ? 633

12.8 Does tactile stimulation benefit high-risk preterms more than those of low-risk ? 634

12.9 Implications 635

REFERENCES 638

APPENDICES

TABLES INDEX: VOLUME 1

CHAPTER 6 AN INVESTIGATION INTO THE SHORT AND LONG-TERM EFFECTS OF A PROGRAMME OF TACTILE STIMULATION WITH PREMATURE INFANTS

		Page
6.2.1.2.1	BIRTHWEIGHT: REPLICATION STUDY	175
6.2.1.2.2	GESTATION: REPLICATION STUDY	176
6.2.1.2.3	APGAR AT 1 MINUTE: REPLICATION STUDY	176
6.2.1.2.4	APGAR AT 5 MINUTES: REPLICATION STUDY	176
6.2.2.2.1	BIRTHWEIGHT: EXTENSION STUDY	181
6.2.2.2.2	GESTATION: EXTENSION STUDY	181
6.2.2.2.3	APGAR AT 1 MINUTE: EXTENSION STUDY	182
6.2.2.2.4	APGAR AT 5 MINUTES: EXTENSION STUDY	182
6.2.2.2.1.1	BIRTHWEIGHT: MISSING LONG-TERMS	184
6.2.2.2.1.2	GESTATION: MISSING LONG-TERMS	184
6.2.2.2.1.3	APGAR AT 1 MIN.:MISSING LONG-TERMS	184
6.2.2.2.1.4	APGAR AT 5 MINS.:MISSING LONG-TERMS	184
6.2.2.2.1.5	BIRTHWEIGHT: LONG-TERM STUDY	186
6.2.2.2.1.6	GESTATION: LONG-TERM STUDY	186
6.2.2.2.1.7	APGAR AT 1 MINUTE: LONG-TERM STUDY	187
6.2.2.2.1.8	APGAR AT 5 MINUTES: LONG-TERM STUDY	187

Chapter 6 Cont'd

6.3.1.1.1	AGE (IN DAYS) WHEN ALL FEEDS IN A DAY WERE FIRST SUCKED: REPLICATION STUDY	192
6.3.1.1.2	AGE (IN DAYS) AT REMOVAL FROM CARE IN INCUBATOR TO CARE IN COT: REPLICATION STUDY	193
6.3.1.1.3	AGE IN DAYS AT DISCHARGE: REPLICATION STUDY	194
6.3.1.3.1	CORRELATIONS: REPLICATION STUDY	197
6.3.2.1.1	AGE (IN DAYS) WHEN ALL FEEDS IN A DAY WERE FIRST SUCKED: EXTENSION STUDY	204
6.3.2.1.2	AGE (IN DAYS) AT REOVAL FROM CARE IN INCUBATOR TO CARE IN COT: EXTENSION STUDY	204
6.3.2.1.3	AGE IN DAYS AT DISCHARGE: EXTENSION STUDY	205
6.3.2.3.1	CORRELATIONS: EXTENSION STUDY	209
6.3.2.4.1.1	MENTAL DEVELOPMENT INDEX (MDI)	216
6.3.2.4.1.2	MENTAL FULLTERM DIFFERENTIATION	217
6.3.2.4.1.3	EYE-HAND CO-ORDINATION	217
6.3.2.4.1.4	MANIPULATION	218
6.3.2.4.1.5	OBJECT-RELATIONS	218
6.3.2.4.1.6	IMITATION-COMPREHENSION	219
6.3.2.4.1.7	VOCALIZATION-SOCIAL CONTACT	219
6.3.2.4.1.8	CO-VARIATE ANALYSES WITH HOME	223
6.3.2.4.1.9	EXPERIMENTAL VS CONTROL T-TESTS	223

Chapter 6 Cont'd

6.3.2.4.1.10	MOTOR DEVELOPMENT INDEX	228
6.3.2.4.1.11	MOTOR FULLTERM DIFFERENTIATION	228
6.3.2.4.1.12	TEST AFFECT-EXTRAVERSION	233
6.3.2.4.1.13	ACTIVITY	233
6.2.3.4.1.14	TASK ORIENTATION	234
6.3.2.4.1.15	AUDITORY-VISUAL AWARENESS	234
6.3.2.4.1.16	MOTOR CO-ORDINATION	235
6.3.2.4.1.17	SOCIAL-ORIENTATION	235
6.3.2.4.1.18	CO-VARIATE ANALYSES WITH HOME INVENTORY SCORES	236
6.3.2.4.1.19	EXPERIMENTAL VS CONTROL T-TESTS	236
6.3.2.4.1.20	HOME INVENTORY SCORES	242
6.3.2.4.1.21	S.P.P.R. TOTAL SCORES	244
6.3.2.4.1.22	INVESTMENT	247
6.3.2.4.1.23	COMPETENCE	247
6.3.2.4.1.24	INTEGRATION	248
6.3.2.4.1.25	SATISFACTION	248
6.3.2.4.1.26	EXPERIMENTAL VS CONTROL S.P.P.R T-TESTS	249
D.1	CORRELATIONS: COGNITIVE/MOTOR	252
D.2	CORRELATIONS: I.B.R. VARIABLES	253

CHAPTER 7 THE IMMEDIATE, PHYSIOLOGICAL EFFECTS OF A PROGRAMME OF TACTILE STIMULATION ON VENTILATED, PREMATURE INFANTS.

		Page
7.2.2.1	SUBJECT CHARACTERISTICS	321
7.3.1.3.1	EXPERIMENTER1: HEART-RATE	332
7.3.1.4.1	EXPERIMENTER2: HEART-RATE	332
7.3.1.5.1	MOTHER: HEART-RATE	333
7.3.1.6.1	% INCREASE IN HEART-RATE DATA	335
7.3.1.7.1	PEARSON CORRELATIONS	337
7.3.2.3.1	EXPERIMENTER1: RESPIRATON RATE	341
7.3.2.4.1	EXPERIMENTER2: RESPIRATION RATE	341
7.3.2.5.1	MOTHER: RESPIRATION RATE	341
7.3.2.6.1	% RESPIRATION RATE INCREASE DATA	342
7.3.2.7.1	PEARSON CORRELATIONS	345
7.3.3.3.1	EXPERIMENTER1: TCPO2	350
7.3.3.4.1	EXPERIMENTER2: TCPO2	350
7.3.3.5.1	MOTHER: TCPO2	350
7.3.3.6.1	% INCREASE IN TCPO2	351
7.3.3.7.1	PEARSON CORRELATIONS	354

CHAPTER 8 THE IMMEDIATE GASTRIC EFFECTS OF A TACTILE STIMULATION PROCEDURE ON PREMATURE INFANTS.

		Page
8.2.2.1	BIRTHWEIGHT	391
8.2.2.2	GESTATION	393
8.2.2.3	APGAR AT 1 MINUTE	393
8.2.2.4	APGAR AT 5 MINUTES	394
8.3.1.1	BEFORE ASPIRATE PH	396
8.3.1.2	AFTER ASPIRATE PH	396
8.3.2.1	BEFORE TO AFTER ASPIRATE PH DIFFERENCE	399
8.3.3.1	DAILY AVERAGE FOOD INTAKE (ml)	402
8.3.4.1	DAILY AVERAGE WEIGHT GAIN (kg)	403
8.3.5.1	AGE IN DAYS WHEN FIRST SUCKING ALL FEEDS IN A DAY	405
8.3.6.1	AGE AT REMOVAL FROM AN INCUBATOR TO A COT (Thermoregulation)	406
8.3.7.1	AGE IN DAYS AT DISCHARGE	407
8.3.8.1	PEARSON CORRELATIONS	410

TABLES INDEX: VOLUME 2

CHAPTER 9 THE EFFECT OF A PROGRAMME OF TACTILE STIMULATION UPON PRETERM INFANT PERFORMANCE IN AN INSTRUMENTAL CONDITIONING TASK.

		Page
9.2.2.1	BIRTHWEIGHT (kg)	452
9.2.2.2	GESTATION	452
9.2.2.3	APGAR AT 1 MINUTE	453
9.2.2.4	APGAR AT 5 MINUTES	453
9.2.2.5	AGE IN DAYS AT LEARNING PROCEDURE	454
9.3.1.1.1	OVERALL AVERAGE CRITICAL PHASE LENGTH (SECONDS)	464
9.3.1.1.2	MEAN PERCENTAGE INCREASE IN CRITICAL PHASE SUCKING PRESSURE	466
9.3.1.1.3	MEAN PERCENTAGE INCREASE IN STIMULATION SUCKING PRESSURE	468
9.3.1.3.1	PEARSON CORRELATIONS:LEARNING MEASURES	473
9.3.2.1.1	SUCKING PRESSURE THRESHOLD	474
9.3.2.1.2	OVERALL AVERAGE SUCKING PRESSURE	474
9.3.2.3.1	PEARSON CORELLATIONS: SUCKING PRESSURE AND LEARNING MEASURES	478
9.3.3.1.1	AGE AT FIRST ALL SUCK FEED	479
9.3.3.1.2	AGE IN DAYS AT DISCHARGE	479
9.3.3.1	PEARSON CORRELATIONS	481

CHAPTER 10 THE IMPACT OF A PROGRAMME OF TACTILE STIMULATION IN THE SPECIAL-CARE BABY UNIT, UPON INFANT BEHAVIOUR AND PARENTAL ANXIETY.

	Page
10.2.2.1 GESTATIONAL AGE	515
10.2.2.2 BIRTHWEIGHT	515
10.2.2.3 APGAR AT 1 MINUTE	515
10.2.2.4 APGAR AT 5 MINUTES	515
10.2.2.5 PARENTAL AGE	516
10.2.2.6 PARITY1: LIVE BIRTHS	516
10.2.2.7 PARITY2: UNFINISHED PREGNANCIES AND STILLBIRTHS	516
10.2.2.8 MARITAL STATUS	516
10.2.2.9 SOCIO-ECONOMIC STATUS	517
10.3.1.1 NEW MODIFIED PAAS TOTAL (NEWT)	527
10.3.1.3.1 NSP1: % NEW SECT1 PREG ATT TO SELF	528
10.3.1.3.2 NSP2 % NEW SECT2 PREG ATT TO FETUS	528
10.3.1.3.3 NSP3 % NEW SECT3 ATT TO LABOR/BIRTH	529
10.3.1.3.4 NSP4 % NEW SECT4 ATT TO POST-BIRTH	529
10.3.1.3.5 NSP5 % NEW SECT5 ATT TO POSTPARTUM	529
10.3.1.3.6 NSP6 % NEW SECT6 ATT TO PREG	530
10.3.1.8.1 CORRELATIONS	534
10.3.1.9 STROKING QUESTIONNAIRE: % DATA	535
10.3.2.1 FREQUENCIES OF INFANT REACTIONS	538
10.3.2.2.1 TOTAL AND % NUMBER OF REACTIONS	567

CHAPTER 11 AN INVESTIGATION INTO THE ATTITUDES OF THE MEDICAL AND NURSING PROFESSIONS TOWARDS PSYCHOLOGICAL INTERVENTIONS IN THE NEONATAL UNIT.

		Page
11.2.1.1	AGE	602
11.2.1.2	AGE BY HOSPITAL	603
11.3.2.1	GENDER AND ATTITUDE SCORE	607
11.3.3.1	MEDICAL VS NURSING PROFESSION ATTITUDE SCORES	608
11.3.3.2	MEDICAL VS NURSING NEONATAL UNIT STAFF ATTITUDE SCORES	609
11.3.3.3	MEDICAL VS NURSING STUDENT ATTITUDE SCORES	610
11.3.4.1	STUDENT VS STAFF ATTITUDE SCORES	611
11.3.4.1.1	ATTITUDE SCORES ACROSS STUDENT LEVELS OF STUDY	612
11.3.4.2.1	ATTITUDE SCORES ACROSS LEVELS OF STAFF	614
11.3.4.3.1	ATTITUDE SCORES ACROSS LEVELS OF NURSING STUDENTS	615
11.3.4.4.1	ATTITUDE SCORES ACROSS LEVELS OF MEDICAL STUDENTS	615
11.3.5.1	ATTITUDE SCORES ACROSS THE HOSPITALS	618

FIGURES INDEX: VOLUME 1

CHAPTER 6 AN INVESTIGATION INTO THE SHORT AND LONG-TERM EFFECTS OF A PROGRAMME OF TACTILE STIMULATION WITH PREMATURE INFANTS

		Page
6.2.1.3.1	PALM STROKE	177
6.2.1.3.2	TOE STROKE	177
6.3.1.1.1	AGE (IN DAYS) WHEN ALL FEEDS IN A DAY WERE FIRST SUCKED: REPLICATION STUDY	192
6.3.1.1.2	AGE (IN DAYS) AT REMOVAL FROM CARE IN INCUBATOR TO CARE IN COT: REPLICATION STUDY	193
6.3.1.1.3	AGE IN DAYS AT DISCHARGE FROM HOSPITAL: REPLICATION STUDY	194
6.3.1.4.1	AGE WHEN ALL FEEDS IN A DAY WERE FIRST SUCKED: RISK GROUPS	199
6.3.1.4.2	AGE AT REMOVAL FROM CARE IN INCUBATOR TO CARE IN COT: RISK GROUPS	199
6.3.1.4.3	AGE IN DAYS AT DISCHARGE FROM HOSPITAL: RISK GROUPS	200
6.3.2.4.1.1	MENTAL DEVELOPMENT INDEX (MDI)	216
6.3.4.1.1.2	VOCALIZATION-SOCIAL CONTACT AND IMITATION-COMPREHENSION	220

CHAPTER 7 THE IMMEDIATE, PHYSIOLOGICAL EFFECTS OF A PROGRAMME OF TACTILE STIMULATION ON VENTILATED, PREMATURE INFANTS.

		PAGE
7.2.3.A	PHOTOGRAPH OF EXPERIMENTATION	322
7.2.3.B	DATA COLLECTION MODEL	323
7.2.3.C	EQUIPMENT	323
7.3.1	HEART RATE	333
7.3.2	RESPIRATION RATE	341
7.3.3	TCPO2	350

CHAPTER 8 THE IMMEDIATE GASTRIC EFFECTS OF A TACTILE STIMULATION PROCEDURE ON PREMATURE INFANTS.

		Page
8.1.2.3.1	MACEDO'S (1984) MODEL	380
8.1.2.4.1	TACTILE STIMULATION AND DIGESTION	385
8.2.4.1	A GASTRIC ASPIRATE BEING TAKEN	395
8.3.1.1	BEFORE AND AFTER STIM./CONTROL PERIOD GASTRIC ASPIRATE PH	397
8.3.2.1	BEFORE TO AFTER STIM./CONTROL PERIOD DROP IN PH	400

FIGURES INDEX: VOLUME 2

CHAPTER 9 THE EFFECT OF A PROGRAMME OF TACTILE STIMULATION UPON PRETERM INFANT PERFORMANCE IN AN INSTRUMENTAL CONDITIONING TASK.

		Page
9.2.3.1	EQUIPMENT	455
9.2.3.2.1	FLOW CHART DIAGRAM	459
9.2.4.1	PHOTO OF EXPERIMENTAL SITUATION	463
9.3.1.1.1	OVERALL AVERAGE CRITICAL PHASE LENGTH	465
9.3.1.1.2	MEAN PERCENTAGE INCREASE IN CRITICAL PHASE SUCKING PRESSURE	467
9.3.2.1.1	SUCKING PRESSURE THRESHOLD	475
9.3.2.1.2	OVERALL AVERAGE SUCKING PRESSURE	475

CHAPTER 10 THE IMPACT OF A PROGRAMME OF TACTILE STIMULATION IN THE SPECIAL-CARE BABY UNIT, UPON INFANT BEHAVIOUR AND PARENTAL ANXIETY.

		Page
10.3.2.1	MEAN FREQUENCY OF INFANT REACTIONS	537

Chapter 10 Cont'd

10.3.2.1.A MEAN FREQUENCY OF REACTIONS ACROSS BODILY CATEGORY OF STROKES WITH MOTHER AS STROKER 540

10.3.2.1.B MEAN FREQUENCY OF REACTIONS ACROSS BODILY CATEGORY OF STROKES WITH FATHER AS STROKER 541

CHAPTER 11 AN INVESTIGATION INTO THE ATTITUDES OF THE MEDICAL AND NURSING PROFESSIONS TOWARDS PSYCHOLOGICAL INTERVENTIONS IN THE NEONATAL UNIT.

Page

11.3.2.1 GENDER AND ATTITUDE SCORE 607

11.3.3.1 MEDICAL VS NURSING PROFESSION ATTITUDE SCORE 608

11.3.4.3.1 MEAN ATTITUDE SCORES ACROSS STUDENT LEVEL 616

CHAPTER 1

DEVELOPMENTAL PSYCHOLOGY AND PEDIATRICS

1.1 INTRODUCTION

Over recent decades there has been increased interest in the application of Psychology to all spheres of human life. It has been contended that Psychology should display a greater concern for everyday issues and problems, including those that have been traditionally perceived as outside of the realm of Psychological interest.

Tizard (1990) proposed that Psychology should contribute to social policy and the affairs of everyday existence thereby enlarging its utilitarian value. She argued that even if psychologists do not see it as their personal role to influence policy, they may still hold the belief that research findings should have an input into decision making.

Miller (1969) equally has argued that Psychology should discover how best to "give itself away". He was concerned that Psychology, as a result of a narrow, introverted vision, was in the process of decay despite possessing the potential to be of inestimable value and use to society.

1.2 DEVELOPMENTAL PSYCHOLOGY: ITS PRACTICAL SIGNIFICANCE

Developmental Psychology is that domain of Psychology which Singer and Singer (1969) believed to represent "*...an approach to understanding children through description and explanation of the psychological changes which children undergo in the course of time*" (p1).

They asserted that Developmental Psychology can improve the transmission and alteration of cultural values and information as well as modes of thinking.

Intervention programmes represent one avenue through which Psychology in general and Developmental Psychology in particular, can "give itself away" (Miller, 1969), contributing both to an improved quality of life and the development and expansion of Psychology as a discipline.

Platt and Wicks (1979) recognised that Psychology needs to demonstrate the value of Psychological intervention to acquire a greater applicability and to obtain increased relevance in society. By becoming a reservoir of applicable knowledge, skills, practices and techniques, it can thus fulfil this need.

With regard to this, the National Institute of Child Health and Human Development (1968) argued that research scientists need to work in partnership with both the policy maker and practitioner. Identification of the most significant variables and processes in any given problem, followed on by the design and implementation of selected intervention programmes should be thus a culmination of the policy maker, research scientist and practitioner working together in a co-operative harmony.

Harzem (1987) identified this development in current Psychology and argued that the "*..virtues of being a Psychologist lie in the building of this new science of Psychology..and in the reformation of this much maligned yet desperately needed academic discipline ..the experimental analysis of behaviour must enter into every area of investigation involving human behaviour*". "*We are..*", according to Harzem (1987), "*..no longer simply patching holes in the fabric of society but shaping that society in providing for a better quality of life*" (p176-177).

He also proposed that in this construction of a renovated Psychology, Psychology must continually be stimulated to sell itself as a vast reserve of methods and information which can be tailored to meet the demands and requirements of other professions as well as being communicated in a way that others can understand and put into practice.

One sphere of life where Psychology could "sell itself", as a fund of knowledge and skills, which could be employed to improve the quality of caretaking therein is Pediatric care.

1.3 DEVELOPMENTAL PSYCHOLOGY:ITS SIGNIFICANCE FOR PEDIATRICS

1.3.1 Greater understanding of infancy

A multi-disciplinary approach within the medical domain of Pediatrics, has long been identified as essential for a full comprehension of the problems of early infancy (Fremont-Smith, 1978).

Fremont-Smith's (1978) viewpoint was an echo of Engel's (1977) earlier recognition that Pediatrics strictly adhered to the medical model in viewing illness, construing such as the sole result of a problem within biological functioning, thus ignoring the social and behavioural dimensions of the illness.

Psychology however, according to Kagan (1965), offers Pediatrics a broader understanding of the relationship between pre-natal and peri-natal casualty and later behavioural problems. He believes that Pediatrics needs assistance particularly in the early detection of severe childhood disturbances, delinquency and other psychopathologies.

1.3.2 Detection, treatment and prevention of problems

The prevention of such problems as childhood disturbances and disabilities is but another area in Pediatrics within which Psychology can transmit knowledge and practices for the greater good of both infants and their families.

Wexler (1976) proposed that for Psychology to benefit Pediatrics in such ways, behavioural scientists have to "*..effectively translate their theories, methods and knowledge into a format that has crucial applicability, as without the provision of practical skills to a variety of clinical problems, physicians will remain sceptical and elusive about the value of Psychology to Pediatrics*" (p67).

1.3.3 Recognition of environmental influences

Pediatrics has also increasingly become concerned with child rearing practices, environments and the consequences these have.

As far back as 1938, Dewey acknowledged that *"Whatever else organic life is or is not;it is a process of activity that involves an environment ..it is a transaction extending beyond the special limits of the organism. An organism does not live in an environment; it lives by means of an environment"* (p25-26).

Environmental modification may often be the means of treating and preventing various illness, problems and disabilities. For example, within neonatal units, noise buffering and alternation of levels of illumination have been argued to minimize infant stress and cut down on both the incidence and severity of sensory deficits in later life, amongst infants hospitalized within such a "modified" environment (Gottfried, 1985).

1.3.4 Improved Pediatric training

In agreement with this "environmental awareness", Harper (1951) contended that the concept of growth and development should thus always be viewed in a very broad sense encompassing the influences of the social and physical environment.

He advocated, on the behalf of Psychologists, that they should be keen on providing Pediatricians with teaching on mental, physical, emotional and social growth and their interrelations given that one of the most important roles of a Pediatrician was guidance of the individual's total growth, development and social adjustment.

The Pediatrician Brazelton (1981), was another who recognised the inadequacies of a training in Pediatrics, illuminated in his statement that he studied developmental Psychology *"..in order to flesh out a more complete model of infancy and of parent-child development than I could do from my limited and pathology oriented training in Pediatrics"* (p66).

Turner (1981) assigned the blame for such inadequate Pediatric training to teaching institutions which he believed neglected the communication of research to those who actually care for patients. Those who are actually out on "the front line" in dealing with patients, on a continuous basis within hospitals, are both the nursing and medical professions and not Psychologists.

It is thus in the best interests of all concerned if:

(1) Pediatric training incorporates Developmental Psychology.

(2) Pediatricians, Psychologists and parents all work together in diagnosing, caring for and treating an infant's problems, so that all the problem's dimensions (physical, cognitive, social and so on) are addressed.

1.4 CONCLUSION

Yogman (1981) contended that "*Pediatric care now stands on the threshold of a metamorphosis, influenced by other biosocial disciplines such as Developmental Psychology and Anthropology. The goal for Pediatrics as a science now is the establishment of both a new set of assumptions and a new set of research and clinical strategies for studying and managing all pediatric problems, biosocial as well as biomedical*" (p29).

Psychological interventions, such as those in neonatal units with premature infants, their families and the unit staff constitute one such research and clinical strategy.

CHAPTER 2

PREMATURE INFANTS: THEIR NEED FOR PSYCHOLOGICAL INTERVENTION

2.1 WHAT IS A PREMATURE INFANT ?

Premature infants are commonly said to be those born at or before 37 weeks gestational age (g.a.) and with a birthweight below 2.5 kilograms.

Much controversy however, surrounds the definition of prematurity as opinions vary regarding its' most salient or characteristic feature. Indeed, prematurity may be measured by one or more of the following possible criteria:

1. Gestational age (De Sa, 1969)
2. Birthweight below 2.5 kg.(Apgar and James, 1962; W.H.O., 1961)
3. Crown-heel length (Cassady, 1970)
4. Head circumference (Ellis and Lawley, 1951)
5. Reflex responsivity (Chickermore et al., 1969)
6. Head-length ratio (Hogman, 1969)
7. Sole creases (Caputo et al., 1979)
8. Radiological measurement of ossification centres (Caputo et al., 1979)

All of these measures are highly intercorrelated (Caputo et al., 1974) and routine medical practice favours gestation and birthweight in the identification of premature infants, with the other measures being resorted to when indecision occurs.

Little time is lost in their calculation and both are also excellent predictors of neonatal mortality (Friedman and Sigman 1981). Birthweight has also been most often used as the criterion of prematurity in epidemological studies (Berendes, 1963).

Premature infants are often confused with those who are small for their gestational age (below the tenth centile of the normal weight curve) as both are of low birthweight with a head to heel length of 47 cm. or less, a disproportionate head in relation to the body (Sinclair, 1972) and are both relatively inactive and unresponsive to the environment (Crosse, 1963). However, the central nervous systems of infants who are small for their gestational age (also known as small-for-dates infants) are more mature than those of preterms as indicated by their reflexes.

This is due to the fact that fetal malnutrition (the primary cause of infants being small for their gestational age) has less of an effect on the developmental organization of the brain than on the growth of other organs. For example, the automatic walking reflex, present in small for gestational age infants, is absent in preterms of less than 32 weeks g.a. and does not achieve its full form except in premature infants of 34 weeks g.a. and older (Amiel-Tison, 1968).

A birthweight falling two standard deviations below the normal birthweight for the gestation is the common measure used to identify such infants and if this also applies to a preterm, s\he then is considered both premature and small for gestational age (Gandy and Roberton, 1987).

Differential diagnosis between premature, small for gestational age, premature and small for gestational age infants, though is crucial as it plays a pertinent role in the planning of appropriate medical and psychological strategies for dealing with the infants.

In sum, a premature infant may thus be seen to be an infant that is born before her/his time and thus may be quite small and weak, like small for gestational age infants but more vulnerable to insult. In comparison to fullterm counterparts, both groups of infants are much smaller and more vulnerable to insult and thus are described as "high-risk" infants. Special care is thus required for the survival and optimal growth and development of such "high-risk" infants.

2.2 ETIOLOGY OF PREMATURITY

2.2.1 Risk factors

With regard to what actually causes prematurity, there are a number of risk factors, which are not necessarily independent of each other, including:

1. Teenage pregnancy
2. Maternal smoking, drug addiction, alcoholism malnutrition and stress.
3. Maternal heart disease/hypertension.
4. Previous termination of pregnancy.
5. Major illness during pregnancy.

6. Low socio-economic status.

Chamberlain (1973) found that premature births were twice as common in classes 4 or 5 than in classes 1 or 2.

7. Ethnic group membership.

8. Multiple pregnancy.

9. Previous premature birth(s).

Women who delivered prematurely in their first pregnancy have a 14.2 % risk of a subsequent premature birth with the risk increasing to 28.1 % after 2 consecutive premature births (Bakketels et al., 1979).

10. Placental seperation and/or bleeding.

11. Geography, as in high altitude regions there is less oxygen available.

12. Low maternal weight (under 54 kg.).

13. Short maternal stature (under 160 cm.).

14. Obstetric factors.

Niswander (1977) revealed an increased risk of prematurity in mothers with poor obstetric history, malformation of the genital tract and/or medical diseases prior to pregnancy eg. diabetes or asthma.

15. Medical error.

Inaccurate estimation of fetal weight or gestational age may incite an unnecessary elective induction of labor.

16. Single, separated or divorced mothers.

2.2.2 Elective premature birth

This procedure is undertaken when mothers display various conditions including:

1. Hypertension.

2. Kidney disease.

3. Premature rupture of membranes resulting in the danger of infection by bacteria.

It may also be conducted when the fetus displays:

1. Polydroaminos (excess surrounding fluid).

2. Anaemia (due to maternal immune response to fetus).

3. Signs of distress.

4. Poor growth.

2.2.3 Spontaneous premature birth

Mothers susceptible to this include those who have undergone two or more previous mid-trimester miscarriages or premature births. Intervention in a further pregnancy may be necessary with such mothers, if this cause of premature labor is suspected as a stitch can be inserted at the cervical opening before dilation becomes too advanced.

With spontaneous premature labor, the associated low backpains and stomach cramps may not be recognised as labor contractions until a late stage and at such an advanced point, treatment to inhibit the process of birth is unlikely to be effective.

B antagonist type drugs, eg. ritudine, salbutamol, are then given to the mother with the objective of gaining 24-48 hours, so that the steroid hormone (glucocorticoid) also given to the mother, may have had sufficient time to enhance the maturity of the infant's lungs.

2.2.4 Conclusions

A premature birth may thus occur due to one or more of a variety of circumstances, each of which may impart its own effects upon the infant. To provide a mental picture of such infants, before such effects or consequences of a premature birth are discussed, the general physical characteristics of such infants are outlined.

2.3 CHARACTERISTICS OF PREMATURE INFANTS

As a population, premature infants display a number of physical features which can be outlined as follows:

1. Their skin is thin, somewhat transparent enabling the perception of blood vessels beneath it and skin colouration can vary dramatically from one moment to the next, going from pink to pale and vice-versa.

2. They tend not to change position often and lie with their arms and legs stretched out, showing frequent, jerky sudden movements compared to the slower more controlled movements of fullterms and their weak muscles endow them with a "floppy look".

3. Due to the immaturity of their organs and physical systems, they are prone to a number of debilitating conditions including respiratory distress and jaundice.

4. The bones of their heads are very soft, joined by strong, fibrous membranes (which are the soft spots on their heads, the fontanelles) and move with the normal pressure changes in the head that accompany breathing and crying.

5. Those of less than 32 weeks have ribs and chest muscles which protrude since there was insufficient time in utero for fat tissue to accumulate under the skin resulting in a "scrawny" appearance. Their chests also tend to dip inwards with breathing as their chests are less firm than those of fullterms and their skin may also be covered with a coat of fine lanugo hair, which disappears soon after birth.

   Small, white pinhead spots called "milia" are also common over the face and upper chest and these are underdeveloped sweat glands which are not yet mature enough to secrete their sweat onto the skin's surface.

6. Those of less than 25 weeks g.a. may have fused eyelids which open with maturity.

2.4 THE CONSEQUENCES OF A PREMATURE BIRTH

These may be categorized into:

2.4.1 Physical effects

2.4.2 Parent-Infant effects

2.4.3 Early experience

2.4.1 Physical effects of a premature birth These are multiple and varied as the preterm dwells in an environment for which s/he is unprepared, thus the normal sequence of development and subsystem differentiation and integration, generally found in fullterms, is not yet accomplished. They face immense difficulties as despite some subsystems eg. those of the reflexes (Graves, 1980) and the hearing (Tanaka and Arayana, 1969) and tactile (Humphrey, 1970) senses having already been activated and functioning efficiently in utero, others, such as the lungs, are not yet mature enough to function.

2.1.1.1 Difficulties in adjustment

Preterm difficulties in adjusting to the environment are expressed in terms of degree of respiratory distress, temperature instability, weight loss and slow weight gain. Their primary developmental objective is the establishment of homoeostasis of physiological functions, then motor control, followed by state differentiation along with communication and interaction with the environment.

The younger and more physiologically vulnerable the infant is, the greater the amount of energy s\he uses in maintaining physiological homeostasis. This leaves little energy available for engaging in environmental interaction and it is thus understandable why preterms display some later developmental delays as the energy that preterms need to maintain physiological functions may be diverting energy normally available for maturational processes during growth in utero.

2.4.1.2 Physical ailments

Proneness to such ailments as apnoea, infections, respiratory distress, intraventricular and subarchanoid hemorrhage, jaundice, feeding difficulties and retrolental fibroplasia, characterize preterms. They also exhibit the physical features of:

(a) A lack of myelinization of nerve fibres

(b) Immature size, shape and number of cortical cells

(c) Immature size, length and number of such cell processes as axons and dendrites (Conel, 1939).

Preterms are again disadvantaged due to their shorter gestation as they receive fewer antibodies from their mother and thus are more susceptible to infection. They also suck less strongly and effectively than fullterms and thus receive less nourishment which inhibits their growth.

2.4.1.3 Physical appearance

The small size and little body fat in premature as compared to fullterm infants results in a somewhat "drawn look" in preterms, especially in the arms, legs and cheeks. Their eyes are often half-closed, sunken and surrounded by dark circles while their skin tends to have a greyish, mottled cast and/or a jaundiced appearance. Thus, they do not epitomise "cuteness", a trait highly regarded in infants. Along with this, stigmata from medical treatments and a distorted head shape (due to the softness of the bones of the skull) also take away from their appearance.

Frodi et al. (1978) disclosed that preterms are perceived as less healthy, less robust and less attractive than their fullterm counterparts and are more likely to elicit avoidance responses. This may also be a factor contributing to their over-representation amongst the child abuse population and may contribute to impaired parent-infant interactions as the infant does not look like the bouncing baby the parents expected.

2.4.1.4 Sensory/Motor deficits

Preterms, like other infants cared for in a neonatal unit for a period of time have also been found to exhibit sensory deficits later on in life.

Hearing deficits, prevalent amongst such infants, have been attributed to the high levels of disorganized noise in conjunction with the extreme sensitivity of the hearing apparatuses of these infants cared for in neonatal units (Northern and Downs, 1984).

Medical treatments, such as oxygen and phototherapy administered to treat respiratory distress and jaundice, may also bring about visual impairment such as that incurred through retrolental fibroplasia (Gandy and Roberton, 1987). Motor development scores in the Bayley (Bayley, 1969) and other assessment scales, have been found to be very sensitive to high risk factors such as prematurity resulting in lower developmental scores (Sepkoski et al., 1977).

Using the Bayley scales (Bayley, 1969) at one year, Stave and Ruvalo (1980) found motor deficiencies in preterms which could have arisen as a consequence of a number of factors:

1. Motor skills are more sensitive to minimal brain damage in early life. The white matter, especially the periventricular zone, is particularly vulnerable to insult in preterms. Low blood pressure can cause ischaemic injury to the white matter by diminishing the blood flow beneath safe levels. Inadequate blood flow to the neurons in the cerebral cortex, although not damaging the braincells themselves, may damage their connections with the rest of the body.

   This has the consequence of a relative preservation of cognitive skills in the presence of motor abnormalities as in spastic diplegia which preterms, as compared to fullterms, show an increased incidence of (Lubchenko et al., 1963).

2. The small size and physical weakness of their bodies may interfere temporarily with gross motor activity and inadequate physical stimulation accompanied by too few opportunities for motor activity in the neonatal unit may also act against optimal acquisition of motor skills.

Along with this, as a result of their physiological immaturity, their various reflexes are quite poor. At term conceptual age, preterm infant reflexes have been found to be significantly weaker and slower than fullterms (Howard et al., 1976).

Hunt and Rhodes (1977) argued that delayed mot or skills in preterms, especially in the second half of the first year of life, were possibly due to the forced inactivity of the neonatal unit where infants are kept in the one position for long periods of time (Fetters, 1980), preventing movements which foster muscle tone. Infants may then come to prefer this position when it is no longer necessary,thereby limiting further their motor activity and development.

They may also lack the strength to nurture their abilities if their recovery from early illness suffered is not complete.

2.4.1.5 Cognitive deficits

Prematurity is a contributing factor in such conditions as cerebral palsy, epilepsy, mental retardation as well as sensory deficits (Caputo and Mandel, 1970; Cohen 1986; Largo et al., 1990) all of which have an impact upon cognitive abilities. In a sample of mentally retarded children, 21.3 % were found to have been born premature (Rosanoff and Inman-Kane, 1934) and prematurity has also been found to be associated with reading and behavioural disorders (Pasamanick et al., 1956).

The most consistent deficits have been shown to occur in the visual-motor and general cognitive-motor spheres (Bjerre and Hansen, 1976; Hunt et al., 1982; Klein et al., 1985; Caputo et al., 1979) and these have, not surprisingly been associated with poorer school performance (Cohen, 1986; Corrigan et al., 1967; Frances-Williams and Davies, 1974). With regard to school performance, whether or not high-risk infants as children show any deficits in intelligence, they still have been found to show poorer school performance than their low-risk counterparts (Rubin et al., 1973; Fitzhardinge and Steven, 1972).

Field (1979) found that at 2 years, preterms talk at a lower level of maturity than fullterms, as shown in a 10 minute free play session where fullterms produced an average of 146 words, preterms an average of 58 words. Fullterms used an average of 5 or more different words whereas preterms used only an average of 2.2 and whilst fullterms used words with an average of 1.75 morphemes in length, preterms had 1.23 as their average.

Remaining with speech development, preterms at the ages of 5-7 years display inferior linguistic abilities compared to fullterms (De Hirsch et al., 1966; Dunn, 1986) and though preterm intelligence at this age is roughly comparable to that of term infants, 8% of preterm males and 2% of preterm females show lower I.Q. scores than any of those born at term (Largo et al., 1990). Largo et al.'s (1990) finding that between 15-17% of preterm males and 9-12% of preterm females failed to attend school compared to only 4% of term males and 2% of term females, insinuates that other influences, possibly familial or social could be contributing to preterm cognitive problems.

Particular caution needs to be exercised before attributing any cognitive problems to prematurity as such problems may be due to social/familial factors eg. parental expectations, social interaction skills, though these may have arouse as a consequence of the infants prematurity.

Socio-economic status still remains the most predictive variable in determining childhood mental performance though its predictive capacity has been found to be reduced in at-risk (eg. preterm) or retarded populations possibly because these infants are less responsive to environmental stimuli or maybe as a result of their genetic endowment being over ridden by organic impairment (Largo et al., 1990).

If prematurity is accepted as debilitating cognitive abilities, the issue that then needs answering is whether such cognitive (as well as sensory/motor) deficits are due to either or both a:

(a) delayed or impaired development (due to hampered cerebral/nervous system maturation)

(b) lowered "ceiling" of ability (due to cerebral or nervous system insult or lowered parental expectations) that can be achieved.

2.4.1.6 Arousal/Alertness Deficits

Preterms, in comparison to fullterms, have been consistently found to show poorer:

(a) responsiveness to stimulation (Rose et al., 1976)

(b) alertness (Lester et al., 1976; Miranda, 1976)

(c) attention duration (Katona and Berenyi, 1974; Field, 1977a)

all of which may impede their development and performance on assessments of infant development.

Poorer cognitive or motor performance by premature infants may thus not be an index of lags or compromises in cognitive and motor development, but rather a consequence of one or more of the aforementioned deficits.

2.4.2 Parent-infant effects

2.4.2.1 Effects on parents

Giving birth to a premature infant can come as quite a shock to a mother, especially if she has never given birth to a premature or any infant previously.

The parents of premature infants suffer an inevitable grieving process during the early post-natal period, for the typical, idealized infant of their expectations. This is likely to retard them in making the necessary adjustments to their behaviour to facilitate their premature infant. In addition, parents of preterms need to come to term with feelings of loss of self-esteem (arising from giving birth to an "abnormal" infant), of crisis, of feeling "cheated" out of the infant of their expectations and of guilt emanating from experiencing such feelings about their infant.

Herzog (1979) referred to the feelings some mothers experience after giving birth to a premature infant as "narcissistic mortification".

Parents have to recognise that prematurity is only a temporary condition yielding to "normality", to a certain extent, and resolve the discrepancy between their idealized image of their infant and their actual infant, for adequate interaction. They also have to cope with the stress of the whole situation of having their infant in hospital, surrounded by a maze of technological equipment which many parents have not encountered previously.

2.4.2.2 Early touching

The importance of immediate contact between mother and infant, along with continued contact during the infants hospitalization, cannot be over-emphasized. Leiderman and Seashore (1975) found that mothers who were allowed to touch their infants very soon after birth, touched their infants more than mothers whose first touching of their infant was delayed.

Similarly, it has been found that primiparous mothers given 45 minutes extra of skin to skin contact with their infant in the delivery room, showed more attachment behaviour towards their infant 12 hours later than those not given the opportunity to avail of extra contact (Hales et al., 1975).

Separation of the mother and infant should be prevented whenever possible, as this separation may be construed by the mother as a form of punishment for inadequately taking care of herself and her unborn baby during pregnancy, thereby resulting in the premature birth.

Problems varying from mild maternal anxiety to child abuse may, according to Klaus and Kennell (1970), occur as a result of separation or other unusual circumstances after birth within the hospital. Barnett et al. (1970) argued that separation during the early newborn period is sufficient to attenuate the strength of the mother-infant bond. These authors advocate early contact between mother and infant as a necessary component of "good clinical practice".

Early tactile contact has thus been identified as crucial for the mother-infant relationship though its importance for the father-infant or sibling-infant dyads have yet to be explained.

2.4.2.3 Labelling

Goldberg (1979) recognised that every parent-infant relationship has 3 major objectives:

1. Survival
2. Establishment of conditions that promote growth and development
3. Creation of a long-term effect

With satisfaction of the initial goals being required before progression onto the remaining goals.

It is often weeks however before parents of preterms know if their infant is going to survive, and this results in the parents experiencing an often long period of immense stress, not knowing what to expect, with feelings of "lack of control over" and contribution to their infants health. This, along with the "special care" such infants receive, may culminate in the "china doll syndrome", where the infant is treated as if s\he were a fragile, frail, delicate, porcelain object (Owens, 1960).

The very labelling of preterm infants as "infants at risk" adds to this effect. As Rosenthal (1966) noted, labelling may incur many consequences and could result in a "self-fulfilling prophecy". In the case of preterms, the term "at-risk" implies some greater than average chance of later disabilities. Thus, sufficient emphasis cannot be placed upon the need for adequate discussion with and education of, the parents on the impact of their expectations within the immediate and distant future.

2.4.2.4 Uneven developmental patterns

Premature infants are of course vulnerable to insult and this together with their immaturity and their unusual early experiences in the neonatal unit, leads to uneven developmental patterns. Their achievement of various developmental hurdles may not occur at the age when term infants achieve them or more pertinently, when parents expect them to be achieved. A number of adjustments thus have to be made by the parents to these unusual patterns in sleeping and feeding cycles.

Such adjustments would include, for example, adaptations in their interaction behaviour to accommodate their infants poor attention capacity and in their expectations regarding their infants achievement of developmental milestones, to match the infant's developmental pace. Forces that have been found to complicate such adjustment include the parents:

1. being in some way "disturbed" (Klien and Stern, 1971)
2. being young, single and of low socio-economic status (Field et al., 1977)
3. having a lack of support systems (Hunter et al., 1978)
4. suffering familial neglect (Hunter et al., 1978).

An informative discussion especially with such parents, on their infants likely growth and developmental trends is thus essential and follow-up support should also be available to answer queries with regard to infant development at later stages.

2.4.2.5 Disturbed patterns of interaction

High-risk infants (including preterms) show disturbed patterns of interaction (Field, 1977), often characterized by unresponsiveness and gaze aversion (Main, 1975; Greenberg and Crinic, 1988) along with overstimulation from adults within such interactions (Stern, 1974). Preterms also have been found to be less responsive and less rewarding to their parents from birth to 3 months (Brown and Bakerman, 1980) as well as eliciting higher arousal levels in adults (Leavitt, 1977).

Parents of preterms have been found to be less actively "engaged" with their infants, holding them further away, talking to them less, making fewer attempts at face-face contact as well as showing less affectionate touching in comparison to parents of fullterms (DiVitto and Goldberg, 1979).

It has also been argued that parents of ill infants, such as preterms, are less "appropriate" in their interactions with their infants as they are less attuned to their cues, and display less bodily contact, smiling and talking to them (Field, 1978). Similarly, Leifer et al. (1972) found that mothers of preterms show less proximal and more ventral contact than mothers of term infants, though Smith et al. (1969) found no difference between the behaviours of term and preterm infant mothers.

It is conceivable that this early lack of bodily contact, smiling and so forth exhibited by parents of preterms, may be due to the fragile appearance of preterms as well as to the large amount of time they spend sleeping amongst other factors.

With regard to later infancy (2-6 months), the behaviour of parents of preterms has been found to change though remaining "atypical". Mothers have been found to become increasingly active, initiating more of the interaction sequences, though eventually cutting off the infants opportunities to respond (Field, 1978). Greater use of techniques that provide structure during interactions (eg. physically orienting infants to toys, using imperatives) has also been found to characterize preterm infant parents as compared to term infant parents' interactions (Brachfeld et al., 1980; Buium et al., 1974; Field, 1980). Akin to this is the contention of Wasserman et al. (1980) that mothers of preterms come to establish a "self designed programme of intervention" to provide more stimulation in order to assist their infants' "catching up" with their term counterparts.

The fact that although preterms show significant delays in I.Q. and academic achievement at nursery age (Holmes et al., 1988), their overall I.Q. is similar to their term counterparts in latter childhood (Largo et al., 1990), suggests that this parental behaviour may be of crucial significance for their infants long-term cognitive development.

However, such behaviour may also further augment preterm unresponsiveness by eliciting avoidance behaviour, which also reduces the amount of stimulation within the infants "attention range". This may then result in a vicious circle culminating in psychosocial disorders, developmental delays (De Hirsch et al., 1966; Fitzhardinge, 1975) and lower I.Q. and general cognitive functioning (Holmes et al., 1984; Cohen, 1986).

Finally, interaction is also negatively influenced by the preterm's fewer and shorter periods of alertness, lower signal emission and low rate of attention seeking (Field et al. 1980).

To summarise, a variety of factors, all influenced by the infants prematurity, thus can be seen to impinge upon the interaction of the preterm with her/his parents:

1. Parental attitudes, expectations and beliefs
2. Accuracy of parental perceptions about the baby's needs
3. Parental contingency and regulation of stimulation
4. Infant state of alertness
5. Signals/cues from the infant
6. Amount of attention sought by the infant

7. Extent to which the infant responds and the quality of these responses.

Awareness amongst parents of preterms of the influence of such factors and how they can be employed/modifed to improve parent-infant interactions, has been nurtured through self-help groups. Such support groups have been set up assisting the parents in their observation and interaction skills and care of their infant and resulting in short-term improvements in parenting and quality of mother-infant interaction (Minde et al., 1980; Barrera et al., 1986).

2.4.2.6 Child abuse

The finding that children who are born prematurely are overrepresented in child abuse populations (Elmer and Gregg, 1967; Schmitt and Kempe, 1979) may be related to difficulties permeating early parent-infant interactions.

Gestational illness and possibly also the feature of preterm crying being perceived as more aversive and arousing than term infant crying (Zeskind and Lester, 1978), contribute to the incidence of child abuse as these may "tip" parental motivation from altruistic to egocentric (Murray, 1979).

Not only infant features however contribute to child abuse. Parental features of social isolation, being abused as a child and having an abnormal pregnancy, labor and delivery (Lynch, 1978) also enhance the risk of child abuse.

Intervention programmes and/or self-help groups working with both the parents and preterm may act as preventative measures of this problem by fostering improved parent-infant interaction.

2.4.3 Early experience

Premature infants arouse particular concern in the study of early experiences. They are especially vulnerable to what Nash (1970) termed as "critical period abnormality", where they may fail to experience a critical event that is part of the normal developmental history of his/her species (i.e they suffer a deprivation of some kind). They are particularly susceptible to this due to their premature entry into the world, hospitalization in a neonatal unit and experience of such medical interventions as mechanical ventilation amongst other features. This renders them incapable or unable to participate of certain possibly important experiences.

James (1890) attributed much importance to early environmental experience, as illustrated by his discussion of the transitiveness of instincts, where he advanced the notion of organisms having enhanced susceptibility to given experiences at particular stages of development.

2.4.3.1 The concept of the critical period

Related to this is the notion of infancy as a "critical period" in development. Nash (1970) referred to critical periods as ongoing maturational processes that result in a particular sensitivity of the biological substratum to certain psychological events.

He contended that "*...the critical period involves some constitutional basis, probably genetically determined and is part of the normal maturation of the species*" (p125).

2.4.3.2 Early neonatal period as a critical period

A transition (i.e any change in the biological status of the individual) invariably involves a cost in terms of increased vulnerability (Adams et al., 1976).

The transitions required by birth and early life must thus represent the most extreme transitions in the life cycle. The precise forms of demands on the neonate for adaptation and the consequences of the baby's reactions to these demands, are major concerns in every area of neonatal study and it is thus quite understandable why the neonatal period is often construed as a critical period.

2.4.3.2.1 Physical significance of neonatal period

Much brain and general C.N.S.. development occurs before and immediately after birth (Dobbing, 1975) and thus this time period and experiences therein, may be of significance for optimal C.N.S. development and the establishment of certain "thresholds" of sensitivity and coping (Levine, 1960; Ambrose, 1969) and ceilings of abilities.

The neonatal period is one of active cellular proliferation (glial), active cerebral organization and corticalization of behaviour which enhances the co-ordination of behaviours which Humphrey (1969) believed to be ultimately due to the growth of C.N.S. circuits.

Sensorimotor structures are first activated during this period by stimulation bringing about the development of the nervous system, according to Gesell (1928). The neonatal period is thus one of immense biological vulnerability, and unlike earlier phases of high-risk, one in which a successful outcome depends largely upon the appropriate adaptive reactions, on the part of the baby.

2.4.3.3 Fetal period as a critical period

As well as experiencing the "critical period of infancy" in an "abnormal" fashion i.e within a neonatal unit, preterms also miss out on some time in utero. The fetus is subjected to beneficial/ crucial opportunities of exercise, action or being enacted upon/influenced by his/her maternal rhythms.

Continuous tactile, kinaesthetic, vestibular, auditory stimulation, emanating from maternal movements, the amniotic fluid, the uterine walls, mother's heartbeat, digestive processes and the extrauterine environment as well as from the fetus's own body characterize life in utero (Vaughn, 1969). Raphall-Left (1982) postulated that the loss of such intrauterine stimulation in the last trimester contributes towards making attachment difficult as well as contributing to behavioural and physiological difficulties.

This is due to the loss of a variety of stimulation experiences, opportunities for activity and regulation of activity by maternal stimulation/cycles.

2.4.3.3.1 Fetal stimulation as a regulator or rhythm-giver

Salk (1960) believed that the maternal heartbeat acts as an imprinting stimulus for the fetus providing a soothing effect of rhythmic motion and sound. While, maternal sleep cycle and nervous system discharges were emphasized by Vaughn (1969), who argued that they regulate fetal activity and organization of sleep-wake cycles.

Sterman (1967) similarly, saw a regulatory relationship between maternal sleep states and intrauterine fetal activity. Hofer (1975) demonstrated this postnatally in rat pups, which when separated from their mother displayed fragmentation in the organization and rhythmicity of their sleep patterns and reduced cycle length as well as producing hyperactivity since the rhythmicity of maternal behaviour acts as a zeitgeber or rhythm-giver for the pups.

2.5 CONCLUSION

It is understandable why Robinson (Ambrose, 1969) criticised typical stimulus depriving methods of preterm infant care which, on top of the debilitating effects of prematurity, may further hamper preterm development. Robinson (Ambrose, 1969) recognised the potential value of intervention programmes in neonatal units, for both the immediate and long-term development of premature and other high-risk infants.

2.5.1 Intervention programmes

Intervention programmes, within and outside of the neonatal unit, operate with the aim of curbing what Pasamanick and Lilienfield (1974) termed the "continuum of reproductive casualty".

The birth of a premature/high-risk infant may produce a vicious cycle with a downward spiral, through subtle alterations in the environment, its quantity and quality of stimulation, parent-infant interaction and the quality of parental care-taking.

One of the primary purposes of intervention programmes is to break this cycle by improving overall infant and parent care within the hospital as well as supporting, informing and assisting the parents, during and after their infant's hospitalization.

CHAPTER 3

THE NEONATAL UNIT

The neonatal unit is where many premature infants spend their first few weeks of life.

3.1 CHARACTERISTIC FEATURES

In general neonatal units are characterized by non-contingent, random, unpatterned, continuous, low quantity and reduced variety of stimulation (David and Appell, 1961), noise levels in excess of 70-90 decibels (League et al., 1972) and constant light illumination with little or no diurnal patterning (Parmelee, 1975).

Infants in such units may receive contact with as many as 70 different nurses during a 7 week stay in the hospital for routine care (Minde et al., 1975), with restricted opportunities for parent-infant interaction being yet another feature of this highly artificial and technological environment.

In short, infants experience sensory bombardment (Korones, 1976a; Lucey, 1977) as well as sensory deprivation (Hasselmeyer, 1964) within such units.

3.1.1 Sensory bombardment

In many ways neonatal units are perceived as being "too intense" in terms of some of the sensory stimulation, in particular their levels of noise, illumination and caretaking.

3.1.1.1 Noise

Lawson et al. (1977) found sound pressure levels in the intermediate nursery and intensive care units to be comparable to those of traffic at a busy street corner. Similarly, Newman (1981) found that incubated infants were subjected to relatively loud constant non-speech sounds caused by slamming or squeaking doors, which penetrate the incubator more clearly and loudly than human voices and coincide with startle, jerk and jump responses in infants in their first weeks.

Infant incubators have been found to produce continuous noise levels between 50-80 dbs on the A weighted scale (Bell et al., 1979), with the opening of incubator doors increasing the levels up to ten fold (Anagnostakis et al., 1980).

The consequential effects of all this noise pollution may be extremely detrimental, both in the short and long-term for infants who have spent time within such units.

Sudden loud noises have been found to cause agitation and crying leading to decreased Tcpo2 (oxygenation), followed by a rise in intracranial pressure (Long et al., 1980). Disturbed sleep, increased heart rate and peripheral vasoconstriction (Gadakeety al., 1969; American Academy of Pediatrics, 1974) as well as hearing loss (Douek et al., 1976) are other effects exhibited by infants, within such units.

Noise reduction can however be achieved through a variety of means (Bess et al., 1979) including:

(a) The use of washable sound proofing for ceilings and walls (eg. acoustic tiles) (Peabody and Lewis, 1985).

(b) Moving noisy equipment into a room adjoining the unit (Peabody and Lewis, 1985).

(c) Muffling the noise emitted from medical equipment via the use of foam and eliminating the forceful closure of incubator port holes by making gentle closure a routine procedure (Peabody and Lewis, 1985).

(d) Replacing telephone, monitor and alarm noise with a light signal system (Korones, 1983).

(e) The removal of capillary tube centrifuge and the silencing of the systolic beep on cardiac monitors (Long et al., 1980).

In a study conducted by Long et al. (1980), a reduced incidence of hypoxemia and elevated intracranial pressures in premature infants was achieved by removing the capillary tube centrifuge from the neonatal unit and silencing the systolic beep on cardiac monitors and bells on telephones, thereby reducing the noise levels.

(f) Providing the infant with a specific auditory stimulus, eg. the maternal heartbeat over a taperecorder, to attract attention away from disturbing noise to what has been deemed as more pleasant, soothing sound (Salk, 1960).

3.1.1.2 Illumination

High levels of fluorescent light in neonatal units have been shown to exert detrimental effects resulting in:

1. alternations of endocrine functions (Gantt, 1979)

2. increased incidence of hypoglycaemia (Hakanson and Bergstrom, 1981)

3. cell transformations (Kennedy et al., 1980)

4. immature gonadal development (Mayron and Kaplan, 1976)

5. chromosome breakage (Wurtman, 1975)

Illumination levels over the 100 footcandle intensity minimum, recommended by the American Academy of Pediatrics (1977), are often found within neonatal units, leading to various tissue injuries (Spikes and Glad, 1964). High levels of illumination emitting stimulation too intense for preterm infants also inhibits eye-opening behaviour and visual attention paid to the surroundings and thus may be argued to have a negative impact upon cognitive development.

These harmful effects incurred can be prevented by taking a number of steps including:

(a) Using spectrum lights which approximate the spectrum of solar light while eliminating the negative effects (see section A.1.2 of this chapter) associated with cool-white fluorescent lighting (Wurtman and Weisel, 1969).

(b) Adopting the practice of day/night light variation using rheostats or an individual localized type of lighting over each infant (Peabody and Lewis, 1985).

(c) Having a dimmer attached to each light switch and simply lowering this after each medical intervention.

(d) Utilizing as much natural light as possible via large ceiling and wall windows with blinds to dim this light when deemed necessary.

3.1.1.3 Caretaking

Neonatal care has also been construed as "too intense" (Lucey, 1977), in that premature and other infants within neonatal units are "negatively handled" to an extreme, on a daily basis (eg. nappy changes, blood sampling, injections).

It has been suggested that they are allowed little time for uninterrupted sleep as a result of various procedures and tests (Lawson et al., 1977). On average, preterms are disturbed 132 times a day with these disturbances occurring relatively consistently across the day. 36% occurring between 7 a.m. and 3 p.m., 31% between 3 p.m. and 11 p.m. and 33% between 1 a.m. and 7 a.m. The mean duration of these being from 4.6 to 9.2 minutes (Korones, 1976b). This pattern of disturbance may inhibit proper sleep, which Oswald (1969) viewed as extremely important for neuronal maturation.

Hypoxemia, hypotension, elevations in intracranial pressure, apnoea and feeding problems have all been found to be associated with sleep disorders (Peabody et al., 1978; Long et al., 1980), and such problems may impede infant growth and development.

Out of all of these disturbances, medical procedures eg. suctioning, have been found to be the most frequent, with an average of 22.4 (range 1-66) episodes daily while social touching episodes were found to be the least frequent disturbance, with an average of only 5.2 (range 1-31) episodes daily (Blackburn, 1979).

In terms of time consumption, procedures such as moving an infant out of an incubator/cot have been found to have the highest mean duration (out of all the disturbances) at 86 minutes (range 1-437) whilst social touching shows the shortest duration of all the disturbances, at 18.6 minutes (range 1-100) (Blackburn, 1979).

These effects however may be reduced or eliminated by:

(a) Careful monitoring of physiological measures, eg. tcpo2, before and after handling as well as whilst handling is ongoing and the modification of handling procedures when necessary to ensure no compromise of the infant's physiological measures occurs (Long et al., 1980).

(b) Carrying out a few medical procedures consecutively (if the infant can cope with this amount of stimulation at one time) so as to reduce the number of occasions the infant is interrupted for an unenjoyable routine procedure.

(c) Stroking and relaxing the infant after each handling procedure to assist her/him in "settling down again".

(d) The use of Self-Regulation aids such as;

1. Boundaries eg. pillows supporting the back when the infant is on his/her side

2. Finger and foot rolls to hold onto

3. Sheepskin rugs

Scott and Richards (1979), found that infants fidgeted less and gained weight more rapidly in the days when they had lambswool pads in their incubators. The tactile quality of these pads seemed to reduce stress experienced by the infants which decreases an infant's metabolic rate (other stress hormones eg. thyroxine and the catecholamines increase metabolic rate).

4. Water matresses

5. Opportunities for non-nutritive sucking

The benefits of providing non-nutritive sucking opportunities to preterms (especially those being tube fed), within neonatal units include:

A. Strengthening the oral musculature for nutritive sucking.

B. When temporarally linked with tube feeds, it becomes associated with a sense of satiation, as is normal of sucking in fullterms or all-suck feed preterms.

C. It stimulates, in a neutral way, the means by which nutrients are ingested, thereby improving digestion (Measel and Anderson, 1979).

D. It enhances behavioural state control, increases alertness, decreases irritability and crying, improves the conservation of calories and the use of energy more efficently (Anderson and Vidyasagar, 1979).

E. It results in earlier and easier transitions to bottle feeds, earlier discharge and greater weight gain despite comparable caloric intake (Measel and Anderson, 1979; Bernbaum et al., 1983; Field et al., 1983).

F. Tcpo2 is elevated during and immediately after sessions of non-nutritive sucking, especially in infants less than 36 weeks gestation and on ventilation, (Burroghs et al., 1978).

Tactile sensations alone within a non-nutritive sucking experience, have also been found to exert positive benefits. Tryowski (1979) applied touch pressure over the arbocularis oris and buccinator muscles of the mouth in 31 preterms and found this to result in significant increases in formula volume and sucking rate but not sucking pressure, when the tactile stimulus was applied during a feed as compared to non-stimulated controls.

Overall positive, pleasurable, peri-oral and intra-oral experiences (including non-nutritive sucking), as well as tactile sensations, may be seen to be of extreme benefit to preterms within the period of early infancy.

3.1.2 Sensory deprivation

The sterile environment conventionally used to care for premature infants is often perceived as being "overprotective" of such infants, insulating them from stimulation experiences essential for optimal development (Hayden and Haring, 1976). This sensory deprivation may be seen within neonatal units especially in terms of:

1. infrequent positional change
2. a lack of co-ordinated sensory experiences
3. insufficient positive tactile contact and loving behaviour

3.1.2.1 Infrequent positional change

Ventilated infants are commonly cared for in the supine position with few daily prone positional experiences thereby being deprived of the beneficial effects of the prone position for:

1. the development of head control (Bobarth, 1972)
2. respiration (Martin et al., 1979)
3. nrem sleep (Brackbill et al., 1973)

4. gastric emptying (Yu, 1975)

5. arterial tension (Brackbill et al., 1973)

6. decreased crying and increased sleep (Brackbill et al., 1973)

In general, preterms are moved only at arbitrary and for brief intervals when dictated by medical exigencies (Korner, 1981) and as a consequence of such few daily changes in body position, preterms in comparison to both their fullterm and fetal counterparts, miss out on the large quantity of proprioceptive, vestibular and general movement stimulation experienced by such infants, both inutero and at home (Korner, 1981).

As well as this they also lack an invaluable discharge of central neural activity, as Wolff (1959) contended that behaviours such as random startles, reflex activity and movements, which may occur during positional changes, are a discharge of central neural activity.

Such caretaking features may contribute, in some degree, to the motor retardation prevalent amongst the preterm infant population. Holmes et al. (1982) found that infants who stayed in neonatal units performed significantly poorer on motor and interactive items of the Brazelton (1973) scale, regardless of gestational age with long-term hospitalized infants performing more poorly on state organization items as well, in comparison to their controls.

Infants in the supine position for too long a time also miss out on their "normal" flexed posture, which facilitates flexor muscle tone, decreases extensor tone and encourages self-quieting behaviour eg. hand-mouth activity, an important component of emotional behaviour and homeostasis.

Many studies and programmes that have set out to improve muscle tone, motor organization and physiological behaviour, have also employed positioning changes as part of their procedure and techniques. Spahr et al., (1981), found the knee-chest position alone to result in significantly increased blood pressure and decreased available oxygen. Pelletier et al., (1985), defining motor organization as the balance between approach (eg. hand-mouth behaviour) and avoidance (finger splay and salute behaviour) movements, found that infants placed on a waterbed for 30 minutes immediately after a tube feed, displayed fewer avoidance behaviours than their controls.

The value and necessity of time spent lying in the prone position as well as in the supine position, thus cannot be ignored in the caretaking of premature infants.

3.1.2.2 A lack of co-ordinated sensory experiences

For preterms in neonatal units, opportunities to integrate sensori-motor information from the environment, to which Piaget (1952a) attributed immense importance, are drastically reduced as a result of a lack of co-ordinated sensory experiences.

Most preterms are fed via tube for a period of time and thus do not experience the tactile, olfactory, vestibular and proprioceptive experiences associated with being either bottle or breast fed. Similarly, as a consequence of their isolation within an incubator and their poor physiological condition, they are exposed to little contingent stimulation and thus may have less opportunity to associate one sensory experience with another.

With some infants the upper extremities are often restricted to prevent any tubes from being pulled out by the infant. Such constraints however, also inhibit tactual exploration and hand to mouth activity which is important for self-consolation.

Infants normally exhibit hand to mouth exploration at the median age of 167 minutes and the onset of hand to face, head, ear, nose and eyes, in this sequence, in the first 3 days of life (Kravitz et al., 1978) thus restrained infants may show delays in this development.

Medication, such as phenobarbitol (administered for seizures), may also inhibit co-ordinated sensory experiences and reflex exercise, as this tends to produce lethargy and reduced movement exploration (Illingworth, 1972).

Exercise of the reflexes is the first substage of Piaget's (1952a) sensori-motor stage, occurring from birth until one month. During this time, according to Piaget (1952a), the infant engages in reflex exercise, orienting responses to lights and sounds, waving of the arms and so on, in response to any strong stimulus. As a consequence of this, organized patterns of activity are built up which are the foundations of more complex functioning later on.

Any prevention of such activities and the co-ordination of these into sequences and patterns of action, is thus of concern as it may debilitate, slow down or lower the range or ceiling of cognitive and physiological development of the infant, as the "early exercise nurtures development" school of thought believes (Hebb, 1955).

The findings that length of stay of a preterm within a neonatal unit is correlated with poorer mental and physical development at 24 months (Sanford-Zeskind and Iacino, 1987) and that length of time spent on a respirator is negatively and linearly related to composite and poorer measures on visual recognition memory and cross modal transfer (Rose et al., 1988), highlight the need for greater concern over the iatrogenic effects of neonatal care.

3.1.2.3 Inadequate tactile contact and loving behaviour

A pressing need for tactile stimulation or "contact comfort" (Shevrin and Tousseing, 1965; Harlow, 1959) has been advocated to prevail in infancy and to be necessary for normal development (Casler, 1965).

Parent-infant interaction represents the primary mechanism through which this occurs, with mother's touching their infants as often as 33-61 % of any given interaction time period (Kaye and Fogel, 1980). During mother-infant activities in early life (first 6 weeks) tactile stimulation has also been identified as significantly the most prevalent form of stimulation (Day, 1982).

Such tactile contact serves, for example, to maintain infant state (Barrera and Maurer, 1981; Kaufman and Kaufman, 1980), soothe (Birns et al., 1966; Korner and Thoman, 1972) and/or feed their infant's need for tactile stimulation (Montagu, 1973; Shevrin and Tousseing, 1965; Harlow, 1959).

Unless parents visit extensively, preterms experience only minimal tactile interaction (Gottfried et al., 1981). The consequent reduced spontaneous movement may cause decreased tactile exploration in such infants with possible negative long-term effects, e.g. poorer cognitive abilities (Anderson, 1986).

Rothschild (1966) believed incubator isolation to add to this by inhibiting the mothers from touching their infants and that this may be a contributing factor in the high incidence of emotional disorders seen in premature infants as children. This is understandable in that tactile contact of one's infant has been argued to be the beginning of the maternal relationship (Rubin, 1963), playing a primary role in the establishment of an affective relationship (Dunbar, 1977). The existence of a critical period for this has been discussed previously in Chapter two.

In sum, the vulnerability of the preterm infant, the lack of responsiveness shown by such infants and the technological gadgetry that cocoons these infants, all act as physical and psychological barriers to optimal parent-infant contact and thus may impede the development of the parent-infant relationship. Equally, a means of alleviating behavioural and physiological distress, (i.e positive tactile contact), commonly acknowledged (Long et al., 1980) to be aroused by such procedures as heel sticks and intubation, through positive tactile contact (Field, 1990; Stack, 1988), is not exploited.

One means of correcting this is through increasing familial involvement in the neonatal unit. Fardig (1980) showed the benefits of maternal involvement in infant care in the neonatal unit. He compared the skin and core temperatures of infants given immediate skin to skin contact with their mothers following delivery and the temperature of infants placed in radiant heated cribs. The later were found to show lower skin temperature with an accompanying increased likelihood of a rectal temperature below the thermoneutral zone.

As well as nurturing parent-infant interaction, increased familial involment in the neonatal unit would bolster parental confidence in their caretaking abilities and their understanding of their infants condition.

3.1.2.4 Developmental-stage inappropriate stimulation

Developmental-stage inappropriate, rather than insufficient stimulation, was argued by Barnard and Bee (1983), to be suffered by preterms within neonatal units. They suggested that the temporally unpredictable quality of the stimulation received in the unit, contributes to preterm inability to organize physiological and behavioural reactions to critical events.

Similarly, Lawson et al. (1977) as well as Newman (1981) held the view that preterms within neonatal units do not suffer from an inadequate quantity of stimulation but rather from a pattern of stimulation that was disjunctive, disintegrated and inappropriate for their developmental stage.

It is thus no surprise that preterms are quite unresponsive since periods of complete infant shut down of motoric responses may function to insulate the infant from such disruptive stimulation. Positive tactile contact during these inactive periods may however, allow preterms the opportunity to learn how to regulate their arousal and establish self-control (Gaiter, 1985) as well as enhancing parent-infant relations.

3.1.3 Physical Layout

By ensuring that each new unit that is built or altered, is designed approximate to what Riekelawson et al., (1985), termed as an "open unit" (i.e a unit consisting of 5-6 rooms with a nurse station on either side of a corridor) instead of a "corridor unit" (i.e a unit with a dumbbell shape, with one end of each of the two nursery rooms open to a nurse station) neonatal care can again be improved upon. They found that in the open unit infants were in states of eyes closed, body active and eyes open, body active more of the time than corridor unit infants plus they cried less of the time than infants of the corridor unit.

It was also found that in the open unit only, the state of eyes closed, body quiet was related to periodicity of handling while the periodicity of the state of eyes open, body active was related to illumination levels. It could thus be inferred that an open unit is more beneficial than a corridor unit for infant care, though the effects they found may have arisen indirectly through the effect of the shape of the unit upon the staff, illumination, noise or some other factor.

3.1.5 Conclusion

The iatrogenic effects of hospitalization in a neonatal unit require that steps are taken to modify the various forms of sensory bombardment and deprivation to render them more palatable, as well as altering various medical treatments to minimize their side effects (eg. Telzrow et al. 1982 found that infants given phototherapy for hyperbilrubemia show altered behaviour including increased irritability).

Kearsley and Sigel (1979) argued that iatrogenic implies *"an unwanted and frequently unexpected complication of what is considered to be an appropriate mode of therapy based on information derived from generally accepted diagnostic procedures"* (p155). Kearsley (1979) lays the blame for iatrogenic retardation on our *"..incomplete knowledge of brain function, the relative immaturity of the science of behaviour and interdisciplinary gap that presently separates behavioural scientists and physicians"* (p165).

Over the past decade awareness of a communication gap between behavioural scientists and the medical and nursing professions, and its significance for neonatal care has grown. It has become clear that changes need to take place in both the nursing and medical professions and their respective education and training establishments, to acknowledge the psychological dimension of neonatal care.

3.2 MEDICAL AND NURSING PROFESSIONS

3.2.1 Education and Training Establishments

3.2.1.1 Greater emphasis on research

Teaching institutions have long been accused of neglecting the communication of psychological and other research to those who actually care for patients such as premature infants (Turner, 1981). The medical and nursing professions are both in an optimal position to extract and practice the greatest benefits from psychological research.

Lack of attention paid to such research during their training, results in it never filtering through to such professions, at least early on in their careers when it may exert maximal effect. Increased knowledge of psychological research and its possible applications within the medical setting is thus required to promote psychological concerns and contributions to medical care.

A training in research methodology and applications would also do much for the nursing profession as a whole, in that the Royal College of Nursing in 1982 noted that "*..although lip service is paid to the importance of nurses becoming research minded, in practice the knowledge and understanding within the profession is increasing only slowly*" (p1). With research being one of the most important hallmarks of a profession (Hockey, 1980), it is thus imperative that both general and psychological research become ingredients of any nursing or medical training. The value of nurses doing research projects while being trained in conducting research was highlighted by Van Bree (1981) who found that students are more likely to nurture a positive attitude to research when they learn by actually doing a small project of their own.

3.2.1.2 Greater interdisciplinary work

Interdisciplinary collaboration between such professions with Psychology is also called for so that "what is right with a patient" is considered as well as "what is wrong with them", thereby preventing any debilitating or retarding effects resulting from hospitalization or treatment.

The prevention and treatment of iatrogenic damage cannot be overemphasized and inservice programmes involving Psychology with the nursing and medical professions could promote greater awareness of individual needs, possible side effects of various routine procedures and the means of preventing such effects (eg. the prevention of bonding or emotional difficulties through the ensurance of sufficient parent-infant contact, Klaus and Kennell, 1976).

3.2.1.3 Communication, social-skills and coping strategies

Social skills in communication should also be a component of any training in the nursing and medical professions, as individuals and families are dealt with here on a constant basis and often in times of emotional tribulation. Knowing what to say as well as when and how best to say it can facilitate understanding and minimize the trauma likely to be experienced by the person being spoken to.

Similarly, stress and coping skills, if incorporated within the nursing and medical training may serve as an extremely cost-effective measure, reducing the number of staff off work due to stress and facilitating optimal quality and quantity of work conducted. With all the recent cut-backs within the health sector, which have resulted in a lower staff-patient ratio along with more cramped spacing, this takes on greater relevance.

3.2.2 The Medical and Nursing staff

3.2.2.1 Greater Emphasis on Psychological as well as Physical care

Attention not only to what is "wrong" with the infant but also to what is "right" with him/her and the provision of appropriate conditions, facilities and practices (eg. available age-appropriate toys, games, activities) to ensure that development can proceed on as "normal" despite hospitalization cannot be over-emphasized.

Ensuring the infant has opportunities to:

(1) exercise his/her reflexes (eg. providing non-nutritive sucking opportunities),

(2) to engage in self-consolation behaviour (eg. ensuring hand-mouth activity can occur)

(3) to be stimulated sufficiently via all of the senses (eg. provision of rocking, stroking, visual mobiles, different sounds and smells)

(4) to have adequate interaction opportunities with her/his family, are all examples of how psychological development can be catered for within the neonatal unit.

3.2.2.2 Greater Self-Awareness

All medical and nursing staff should also keep an eye on themselves and how they interact with their premature infant patients.

Are they being as gentle as they can when handling them?, do they close incubator doors softly so that they do not startle the infant?, do they stroke or relax the infant in any way after an aversive procedure (eg. heel-prick) ? and do they consider sufficiently when and how best to intervene (eg. is it better to conduct all procedures consecutively or dispersed through out the day ?) with each infant on an individual basis, are all examples of questions which need to be always to the fore of the minds of the neonatal unit staff to ensure optimal care.

The fact that children's memories are usually of places and related sensations "*..the agony of lying still at naptime, not ever being able to get a swing, having one's back rubbed..*" (p2) (Prescott and David, 1976) highlights the overriding influence of sensations for young children and infants and thus sensitivity and gentleness are requirements in caring for these as patients.

Attention to individual differences is also of immense importance as for example, some infants may be able to cope with a lot of negative stimulation (eg. medical treatments) at once while others may not be able to cope so well with this (reflected in degenerative behaviour) and thus require such painful interventions to be dispersed through out the day.

Similarly, whether staff engage in more "positive" behaviours with some infants than with others is another issue that needs addressing as reflected in the finding of Lopez (1983) that infants preferred by staff within a neonatal unit received more soothing and nurturing behaviours than those least preferred. Factors affecting staff preference included:

(1) Positive prognosis

(2) Familial involvement and concern

(3) Staff success derived from working with the infant

(4) Positive staff-parent relationships

(5) Increased duration of hospitalization

(6) Psychological and physical access to the infant.

Awareness should also be engendered in staff with regard to the ease of falling into an habitual, efficient, quick, stereotyped mode of care. According to David and Appell (1961), staff have difficulty in turning from this to a slower, personal, individualized one due to a number of factors such as:

(1) A low nurse to infant ratio (thus long hours, a heavy workload)

(2) Stress of work load

(3) Highly charged atmosphere of neonatal units

(4) The inevitable and repeated loss of an infant at an age when he begins to be rewarding showing signs of affection

(5) A lack of opportunity of seeing an infant's further development

(6) Sympathy/antipathy for some features of the child eg. physical appearance, facial expression, intonation of crying

(7) Individual nurse characteristics

Support should thus be available for staff to turn to, both with their problems and to assist them to improve upon their care-taking skills.

Amongst physicians "crepe hanging" i.e making the most conservative prediction of an infant's future due to an inability to predict should be discouraged. By engaging in crepe-hanging, physicians confirm their prognostic acumen if the worst arises and if a favourable outcome occurs, attribute this to their diagnostic skills, should be discouraged.

This practice has detrimental effects on parental expectations of their infant's future development, lowering the "ceilings of skills and abilities" they may hope their child would achieve by certain age and thereby possibly compromising her/his skills and abilities.

Emphasizing that brain damage might become manifest, although not yet apparent can, according to Kearsley (1979), establish "..*a nidus of unresolved uncertainty*" (p171) in the parents' minds, with resultant anxiety that could exert a profound and continuous effect on parenting practices, modifying them to accommodate the expected status of their child. The consequences of all this may result in the phenomenon of the "self-fulfilling prophecy".

Another means through which psychology can make a significant contribution to improvements in early neonatal care, is through stimulation intervention programmes.

3.3 PRETERM INTERVENTION PROGRAMMES

Premature infants, as a result of spending a period of time of their early life within a neonatal unit, have thus become a focus of concern for intervention programmes. These intervention programmes have been set up to fill the "psychological impasse" deemed to prevail within neonatal care.

Some intervention programmes are run within the neonatal unit providing supplemental sensory stimulation to the sensory modes deemed to be deprived of a certain form(s) of stimulation, though others are run in the home after the infant has been discharged from hospital and tend to involve the family to a greater extent.

Underlying such intervention programmes is the premise of the importance of early stimulation and experience and this is discussed in the following chapter, preceding a discussion on stimulation intervention programmes in the neonatal unit.

CHAPTER 4

STIMULATION AND EARLY EXPERIENCE

4.1 INTRODUCTION

Early experience and adequate stimulation emanating from the environment have long been recognised as critical ingredients for optimal development. As Locke noted as far back as 1693, the environment forms the mind and such a treatise has been the corner stone of concern over what kind of environment the individual requires in her/his earliest years. Old adages eg."As the twig is bent, so the tree's inclined" reflect such concern. This concern is exacerbated for preterm infants for reasons already discussed (see Chapter 3).

One of the most critical environmental ingredients for optimal growth and development in early life though, is the quality and quantity of stimulation experienced.

4.1.1 What is stimulation ?

Stimulation is one of the most pertinent features of the environment for an organism's development. Stimulation is an expansive and meaningful term, whilst also being a "slippery notion", having many connotations including:

1 The prompting of an organism into action.

2 Instigating a change of state.

3 The elicitation of novel sensations, thoughts and so on.

Luddington (1983) defined stimulation as any input issuing from the environment producing either quiesence or arousal as a response, whereas, according to Fiske and Maddi (1961), stimulation refers to physical energy of various forms which impinges upon the individual and usually implies the existence and activation of a sensory receptor in the organism. They also contended that such stimulation may be specified in terms of it's kind of energy and in terms of it's quantitative dimensions.

All definitions of stimulation incorporate the notion of change, which tends to be of a sudden, immediate nature. Such change may arise through eg. stimulation of the tactile receptors, thereby being termed as "tactile stimulation", i.e. physical energy which activates the touch sense of the organism.

As the tactile-kinaesthetic system is the first system to develop in utero (Gottlieb, 1971), it is thus more mature than the other sensory systems in the premature newborn (Gottlieb, 1971). It is thus seen as a more appropriate form of stimulation (Greenough, 1984), to employ in supplemental sensory stimulation programmes with preterms than that of the other sensory systems.

4.1.2 Stimulation, experience and development

Research into the effects of early stimulation experiences has become of increased interest over recent decades. Differentiation of behaviour, in response to varying environmental situations has come to be seen as a life long process of functional differentiation, with early experiences determining the nature of such differentiation (Hebb, 1949).

The stimulation enriched environment has been acknowledged as providing the most desirable kinds of early experience and stimulation, permitting a maximal amount of differentiation of behaviour, which in adaptation terms, enhances survival (Hebb, 1949).

In 1949, Bakwin described the characteristic features of the understimulated infant as listlessness, emaciation and pallor, relative immobility, quietness, unresponsiveness to stimulation, indifferent appetite, frequent stools, poor sleep and appearance of unhappiness, proness to febrile episodes along with an absence of sucking habits.

He was not alone either in recognising the critical role stimulation plays in infancy. Beckwith (1971) was another who advocated the importance of stimulation in early life and found the rate at which children develop to be linearly related to the amount of stimulation that had been given to them. Similarly, Yarrow in 1963, found stimulation to be a significant factor in infant development, with developmental scores at 6 months correlating both with amount of maternal stimulation (0.65) and appropriateness of stimulation provided (0.72) whilst infant ability to cope with stress was found to be correlated with ratings of maternal physical care (0.57) and emotional involvement (0.66).

The appropriateness of stimulation, on the other hand was emphasized by Lodge (1976), who argued that more attention should be paid to providing stimulation appropriate to an individual's age, developmental status and personal preference, as such stimulation, being maximally suited to the child, would be of maximal benefit to him\her.

4.1.3 Self-stimulation

Opportunities for self-stimulation, eg. through activity, also play a critical role in early life. Self-stimulation has been identified as a means of acquiring supplemental stimulation, as a discharge of excess neural energy (Wolff, 1959), as an alerting behaviour as well as a means through which certain behavioural sequences can be brought under individual control, eg. hand-mouth behaviour.

As far back as 1754, Condillac proposed that organisms are active rather than passive beings, seeking out stimulation and sensation rather than waiting for these to come their way. Akin to this was the assertion of McCandless (1967) that newborns are naturally active, with opportunities to engage in activity being an essential component of their overall development.

Prechtl (Ambrose, 1969), impressed by the vast behavioural repertoire of newborns, argued that one can appreciate this by watching a baby on the skin of its mother, where s\he displays such behaviours as rooting, crawling, grasping, antigravity and postural responses.

Always covering the newborn up and not allowing him/her the opportunity to engage in activity, restrains one from viewing the newborn as anything but a "*.vegetable which just cries and sucks from time to time..*" (p98).

The opportunity to engage in self-stimulating behaviour ensures that the infant has a means of acquiring additional stimulation, which is of increased importance in an environment characterized by stimulation deprivation, such as that of the neonatal unit.

However, illness and immature development in preterms, may render them unable to engage in self-stimulating behaviours, which in turn places even greater importance on sufficent infant stimulation from the environment.

4.1.4 Early experience

In the 1950's the early experience paradigm achieved popularity and dominated the predeterministic view of development. Freud's (1905) theory of psychosexual development drew attention to childhood experiences and their role in shaping adult behaviour while ethological concepts, such as Lorenz's (1937) concept of "imprinting", emphasized innate predispositions for learning particular behaviours within set time periods.

The neuropsychological theory forwarded by Hebb (1949), proposed that critical periods of time existed for both social and intellectual development.

This notion in combination with his theory regarding cell assemblies and neuro-psychological phase sequences, (discussed later in both Section 4.3 of this Chapter), both being a function of early experience, further cemented the dominance of the early experience paradigm in developmental theory.

Experimental studies with animals meanwhile, provided concrete examples of how various early experiences could affect both the organization and biological bases of behaviour (Krech et al., 1960). The results of such studies became imbibed into the educational theories of Hunt (1979, 1981) and Bloom (1964), both of whom stressed early environment and experience over heredity. Along with this intellectual deficiencies were thought to arise from the early environment and the prevention of these could be achieved by compensatory experiences early on or within a particular set time period.

4.2 THE CONCEPT OF THE CRITICAL PERIOD

Stimulation is often deemed to be particularly essential during certain periods of time within an organism's development and these have been termed "critical periods". William James (1890) proposed this notion in his discussion on the transitoriness of instincts, asserting that organisms have enhanced susceptibility for particular experiences at specific stages or time-phases of development.

Nash (1970) referred to critical periods as "*ongoing maturational processes*" (p125), which result in a specific sensitivity of the organism's biology to particular psychological events and contended that the critical period is probably genetically determined as well as being part of the normal maturation of the species. According to Nash (1970), critical periods may take two forms, as a particular behaviour may rely upon:

(1) Exposure of the organism to a certain stimulus within a specific time period (with non-exposure inciting lower levels of that behaviour later).

(2) Innate perceptual and response mechanisms within the organism that co-ordinate and organize systems.

With regard to infants hospitalized within a neonatal unit, it has been argued that early deprivation of such stimuli as those of, for example, a positive tactile, pleasant auditory or vestibular/proprioceptive nature, contribute to later developmental delays and retardation (category (1)) or diminished ceiling/inadequate development of behavioural capacities (category (2)).

Held and Hein's (1963) study of the deprivation effects of early kinaesthetic experience (i.e "movement produced sensory feedback") in animals also falls under the second category of critical period.

Kittens harnessed to a machine only enabling them to move around a track passively were found to perform less well in tests of spatial localization than kittens harnessed to the same machine but able to move around the track actively.

One of two distinct phenomena may thus be seen to underlie any critical period:

(1) An ongoing maturational process which results in the biological substratum being especially sensitive to specific psychological events (eg. the deprivation of particular stimulation experiences).

(2) Psychological events (such as stimulation deprivation) affecting later psychological events (emotional and mental development, adaptation), without necessitating a biological change, though such a change may occur.

Critical periods thus, can be viewed as possessing both intrinsic (maturational base) and extrinsic (experiential event) components, though both may be intrinsic, eg. where a neural change occurs along with an hormonal event.

4.2.1 Categories of critical period

Critical periods fall into 3 categories:

(1) Those occurring immediately after birth when the organism is particularly vulnerable to unpatterned stimulation, which has a negative impact upon later emotionality (Nash, 1970).

(2) Those which are dependent upon patterned discrimination. These affect primary socialization and occur sometime after birth (Lorenz, 1937).

(3) Those which require a rich and complex environment, involving fine pattern discrimination and motor co-ordination and affecting the development of learning abilities. These critical periods occur at a later time period than the above and with an undefined upper time threshold (Nash, 1970).

These categories hold much significance for the study of how various types of stimulation intervention programmes with premature infants, exert different effects. It may be that when conducted within a different age range, similar types of stimulation programmes exert different effects due to the fact that the age ranges are critical periods for different behaviours.

The above categorisation however ignores the role of developmental status and past experience in determining when a critical period occurs.

Ruesch (1957) believed that for optimal healthy development, one needs to be given the appropriate type of stimulation, at the appropriate time or age and in a suitable or appropriate amount. This is based on the premise that for each of the various stages of development there are developmentally appropriate types and levels of stimulation, i.e. quantity and quality of stimulation most suitable for an infant/child varies as a function of their developmental stage, past experience and abilities.

Hunt's (1961) principle of the match between environmental stimulation and infants already assimilated schemata from past experiences, is related to this, though he recognised that the matching process is a matter of empirical trial and error.

Clarke-Stewart (1973) followed Hunt in proposing that stimulation should be matched to an infant or child's developmental status and argued there to be a consistent and pronounced relationship between both the amount and variety of appropriate toys and materials, with cognitive development.

4.2.2 Underlying mechanisms of critical periods

With regard to what underlies critical periods, Ginsburg (1984) proposed it to be genetic, with a central mechanism operating between external stimuli and the hypothalmo-pituitary adrenal axis. According to Ginsburg (1984), this matures at varying rates in different genotypes and determines the time parameter within which certain stimulation may exert an effect.

This central mechanism may, according to Levine (1962), also control when external stimuli have an effect via neuroendocrine variables, which organize the neural circuitry with regard to later behavioural capability. Thus, the physiological effects of various environmental stimuli may vary at different stages of development (including endcrinological development), culminating in qualitative differences in behaviour (Levine, 1962).

4.2.3 Critical periods in early life

The earliest years are generally regarded as containing numerous critical periods for the genesis and development of abilities and the establishment of many ranges and potentials (ceilings) of behaviour or ability. As physiology and behaviour are only emerging and developing at this time and thus are most vulnerable to insult or possibly enhancement, external events are thus construed as exerting their greatest impact upon the organism within this time period.

This may be of even greater significance for premature infants who are even less ready and "prepared" for extrauterine existence than their fullterm counterparts.

Given that transitions (i.e changes in the biological status of the individual) invariably involve a cost in terms of increased vulnerability (Adams et al., 1976), those required by birth and early life, on top of the preterm's already weak physiological state, may thus render such infants to be even more susceptible to environmental insult/enhancement than fullterm infants.

The neonatal period and first two months, during which much brain tissue maturation occurs (Dobbing, 1975), is seen to be a critical period in cognitive development (Bower, 1974). Bower's (1974) concern has been to draw attention to the importance of the psychological environment, of the developing infant, in speeding up or slowing down her\his attainment of fundamental cognitive skills.

He believed that "*infancy is the critical period of cognitive development, the period when the greatest gains and greatest losses can occur. Further, the gains and losses that occur here become harder to offset with increasing age*" (pix-x).

The period of infancy is one of active cellular proliferation (glial), active cerebral organization and corticalization of behaviour which enhances the co-ordination between various behaviours which Humphrey (1969) believed is ultimately due to the growth of circuits in the C.N.S.

Sensorimotor structures are first activated during this time by stimuli, helping to bring about the maturation of the nervous system according to Gesell (1928), and the development of cognitive abilities which possess as their foundation, sensori-motor structures.

It is thus quite understandable why Hagberg (1975) amongst others, believes early infancy to be a critical period, a crucial time in which interventions can be of the greatest assistance and benefit.

Yet, Clarke and Clarke (1976), believed that too much emphasis is laid upon the early years and argued that critical periods may also prevail in later months and years. Sigman and Parmelee (1979) for example, found that the best predictors for compensatory recovery of central nervous system deficits rest in the energy of the infant to interact and the richness of environmental input available at four months.

Extending the applicability of the critical period concept even further, Ramey and Bakerward (1982) perceived every phase of human development to be increasingly acknowledged as a critical period.

4.2.4 Stimulation and critical periods

Much work has been conducted, at least with animals, examining the applicability of the critical period concept to the effectiveness of stimulation intervention programmes.

4.2.4.1 Animal Studies

In general it is believed that the earlier (at least before "maturity" is reached) stimulation is provided the better and greater its effects are (Hymovitch, 1952). Denenberg (1962) however proposed that there were differing critical periods for the effectiveness of various forms of early stimulation, dependant upon the intensity of such stimulation and the kind of behaviour measured. Despite this, however, he forwarded two critical periods for the effectiveness of supplemental stimulation with rats.

(1) A critical period based on a physiological process, the development of an adrenal cortical stress mechanism (extending from 0-16 days of life).

(2) A critical period based on a psychological process, the reduction of fear through familiarity (beginning from 17 days, when the eyes open until 30 days of age).

4.2.4.2 Human Studies

Much debate also surrounds the notion of stimulation and critical periods for humans. Theories of intrinsic motivation, especially those involving curiosity and mastery motivation (Yarrow et al., 1975), as well as the cognitive theories of Piaget, Vygotsky and Werner, all recognise the link between early variety of experience and cognitive development.

Piaget's (1952a) sensorimotor period (birth to 2 years) involves thinking dominated by direct sensory experiences, encounters with the environment and manipulations of objects.

This thinking is thus retarded if amount and variety of sensory experiences, environmental encounters and/or variety and quantity of objects provided is low.

Also viewing early infancy as a critical period, Bruner (1973) believed we are innately prepared to organize sensory-motor behaviour into skilled units, with this period being "critical" for the emergence of this "organizing capacity" and its development to its full potential.

Similarly, Papousek (1967) stressed that early learning opportunities affect later learning, with learning skill being initially shaped via innate mechanisms which decline if not exercised early on in a suitably stimulating environment.

An unsuitable environment, lacking in relevant input, may result in behaviour taking an aberrant direction which may become so firmly established that no environmental interaction will suffice to redirect the behaviour on it's proper course. A different view was forwarded though by Ramey and Bakerward (1982), who believed that critical periods prevailed throughout life. They did however single out the newborn period as a "critical", especially for tactile stimulation, which will now be examined.

4.3 THE PERIOD OF EARLY INFANCY

In humans, this period (0-1 year) is often seen as a critical period for optimal development as it is a time of rapid growth as well as being a period of life when the organism is extremely vulnerable to external influences as a consequence of his/her immaturity.

Equally, as infants are capable of responding to and perceiving a wide range of stimuli, it has been argued that the stimulation to which infants, during this period, are exposed may have a greater impact than has been formerly believed (Korner, 1977). In support of this, stimulation in the home during the first year has been found to be significantly correlated with mental development (MDI) at twelve months (McCall, 1981, Bradley et al., 1989).

Stimulation, especially that of the tactile variety, is deemed to be imperative during this phase to ensure optimal attachment (Klaus and Kennell, 1976), development (Bower, 1974) and learning (White, 1961), this time period being when the foundations of cognitive and motor abilities are laid down.

It has also been proposed that during this period, the greatest gains and greatest losses can occur in such abilities and skills which then become increasingly harder to offset with age (Bower, 1974). During this time period stimulation may exert its effects on infant development through acting on the C.N.S..

4.3.1 C.N.S. Structural Development and Stimulation

Gottlieb (1973) proposed that there was both predetermined and probablistic epigenesis of behaviour, predetermined being where structural maturation determines function (with sensory stimulation of any spontaneous, neural and behavioural activities serving to maintain and preserve the system prevalent in early intrauterine life). Probablistic on the other hand, is where a mutual effect occurs with sensory stimulation and motor activity also playing an active role in structural maturation (found in late gestation period and early infancy).

Berry et al., (1978) in relation to this proposition suggested that the post-synaptic sites of purkinje cells (which are primary efferent neural cells in the cerebellum) could be preprogrammed and constant for species. The amount and localization of the sites which become operational synapses could however, be environmentally controlled and thus stimulation can be conceived as essential for optimal neural development.

Programmes of sensory stimulation with animals have shown numerous effects on structural development of the central nervous system including positive effects upon:

(1) dendritic count in the occipital area (Ulyings et al., 1978)

(2) C.N.S. morphology, biochemistry and physiology (Horn et al., 1979)

(3) brain weight (Ferchmin et al., 1975)

(4) brain weight, biochemistry and morphology in the occipital area (Rosenzweig and Bennett, 1978)

(5) purkinje cell number (increased) (Floeter and Greenough, 1978)

With regard to human infants, it is impossible to discern whether programmes of supplemental sensory stimulation induce earlier functioning of already inherent, neural potential or whether it accelerates the development of that neural potential itself, resulting in an elevated ceiling potential of certain abilities or processes.

Touwen (1980) also acknowledged that nothing conclusive could be drawn from such programmes with regard to their effects upon the morphology of the C.N.S..

4.3.2 Sensorimotor structural development

Gesell (1928) proposed that sensory stimulation exerts effects upon the sensorimotor structures of the human infant, whom according to Bruner (1973), is innately prepared to organize such sensorimotor stimulation.

Through such structural effects on the human nervous system, stimulation via the lower, earlier developed sensori-motor levels may also affect the higher, later developed levels of cortical networks in the C.N.S.. The results of this being improved cognitive and motor development as well as more efficient information-processing.

In agreement with this is the contention of Bronson (1965), that the amount of stimulation of the lower level networks of the C.N.S., may affect the higher, later developed networks e.g. the cortical networks, resulting in for example, improved sensori-motor skills.

4.3.3 Hebb's (1949) Theory

Hebb (1949) proposed an alternative mechanism through which stimulation may exert an influential impact on the structures of the human nervous system. He postulated that stimulation results in the growth of "cell assemblies" (diffuse structures of cells in the cortex, diencephalon and basal ganglia of the cerebrum). He believed that these can act briefly as a closed system extending the "critical period" for the development of learning potentials and abilities.

Large association areas in humans, according to Hebb (1949), may account for the inefficiency of man's early learning with regard to immediate results and his amazing efficency at maturity.

The process of perceptual learning, Hebb (1949) argued, must be thought of as establishing a control of association area activity by sensory events. The larger the association areas, both absolutely and relative to the size of the sensory projection areas, the slower the establishment of such a control must be and the less rigid and more complex its final form. This again reiterates the immense significance of stimulation within this period for cognitive development and potential.

Overall, it may be concluded that sensory stimulation exerts a significant impact on development, as a result both of such possible structural effects and through instigating functional activity of various cells, neurons and processes (which occurs in order for one to feel, hear, see and so on). It may be construed as enhancing nervous system development, deriving the morphological structures from the genome and providing the finishing touch during the ontogeny of the infant brain.

Touwen (1980) and Oppenheim (1976) attributed such effects to physical activity which often occurs in conjunction with, or as a response to, sensory stimulation. Like sensory stimulation, such activity is also essential during this time for optimal development.

Programmes of motor stimulation i.e. motor exercise, given to animals have revealed the direct structural effects of such stimulation on the C.N.S. e.g. elevated brain weight of certain brain areas (Ferchmin and Eterovic, 1977) and improved purkinje cell number (Pysh and Weiss, 1979).

4.3.4 Tactile Stimulation

During this period of early infancy, the infant receives much tactile stimulation in various forms eg. stroking, rubbing, touching from her/his mother (Day, 1982). Infants of 4-6 weeks have actually been found to receive from their mothers, significantly more tactile as compared to any other forms of stimulation (Day, 1982).

Mahler (1968) recognised the special role that such tactile stimulation plays during what he termed as the "symbiotic phase of development" (2-7 months), for nurturing a sense of security in the infant. He also emphasized the importance of this stimulation being appropriately dosed and graduated, to match an infant's capabilities, especially during these critical early months.

Harlow (1949) similarly acknowledged the significance of both tactile and kinaesthetic stimulation early on in primate development and provided evidence showing how such features are required to elicit attachment behaviour in infant monkeys with surrogate mothers.

Also working with animals, Reyniers (1946, 1949) reared infant animals in a germ free environment and showed that only those that received stroking on genital and perineal regions, with a wisp of cotton after each feeding, survived.

McCance and Oatley (1951) believed it to be the combination of both licking and directional orientation that facilitated the drive towards sucking in young lambs, with licking being essential for their survival as well through its instigation of the gastrointestinal and gastrourinary systems into action (Montagu, 1978).

Looking again at humans, the skin, according to Freud (1922), is an erotogenic zone, differentiated into sense organs and specific erotogenic zones, eg. oral, anal and genital.

What he calls "infantile sexuality" appears to Frank (1951, 1954), to be largely tactuality and akin to other organ needs, infantile tactuality is gradually transferred as the child learns to accept the mother's voice as a surrogate. Her reassuring words and tones of voice come to provide him/her with an equivalent for his/her physical contacts. With advanced age, s/he comes to engage in greater self-stimulation and physical activity, thereby broadening his/her physical contacts with the world.

Freud in 1954, contended equally that tactile stimulation was essential in early life, as it libidinizes the body image and ego, including its cathexis with narcissistic libido while simultaneously promoting the development of object love by cementing the bond between child and mother.

4.3.5 Deprivation of Tactile Stimulation

Deprivation of adequate tactile stimulation in early life further reveals the significance of tactile stimulation as an ingredient of optimal development. Infants deprived of sufficent tactile sensations (eg. maternally deprived children), instead of showing the roseate firm characteristics of the skin exhibited by healthy infants, rather displays a deep pallor and loss of tone as well as other disorders eg. eczema (Rosenthal, 1952).

Estrangement, lack of identity, detachment and emotional shallowness are all identified as hallmarks of schizophrenia whilst also being recognised as having early tactile stimulation deprivation as one of their causal factors (Jackson in Montagu, 1978).

Infants such as institutional infants, who often experience a lack of physical contact exhibit a need for this reflected in their characteristic activity of piling up on top of each other to obtain such contact, despite having many toys to play with (Vinza, 1971). These infants also engage in many forms of self-stimulation including rocking as noted by Provence and Lipton (1962).

Self-stimulating activity such as this provides stimulation and sensation as well as serving as a means of discharge of central neural activity. As a result of an understimulating environment, there may be few other outlets (eg. play behaviour) for such discharge than self-stimulating activity.

It is thus quite understandable why Hagberg (1975) amongst others, believed early infancy to be a crucial time, a critical period during which stimulation, especially that of the tactile variety, is of the greatest significance.

4.4 PREMATURE INFANTS: A SPECIAL POPULATION

Premature infants pose particular concern in the study of early infant experiences and stimulation as they are especially vulnerable to what Nash (1970) termed as a "critical period abnormality". This is where they may fail to experience a critical event that is part of the normal developmental history of his/her species (i.e a deprivation experience).

As a population they call out for special attention since the absence of appropriate input from the environment during what could be a critical period, may result in behaviour (e.g that of coping with stress) taking an aberrant direction.

4.4.1 Deprivation Experiences

The effects of stimulation deprivation (discussed previously in section Chapter 3) are multiple and varied resulting in many of the sequelae of prematurity, discussed in Chapter 2. The following are some more specific studies into the varied effects of early stimulation deprivation.

4.4.1.1 Motor effects

As infants are still just regaining strength after recovery from their ordeal, the forced inactivity of the neonatal unit, may contribute to impaired performance on motor skill tests in the second half of the first year on which various research including that of Fetters (1980) reported.

4.4.1.2 Sleep effects

Dreyfus-Brisac (1970) contended that abnormalities in the sleep of preterms are due to stimulus deprivation and posited the question of whether the cause of paucity of ocular movements in preterms was sensory deprivation, while eye movements are very rare before 28 weeks, their number remains lower in preterms than fullterms. This may in turn have consequences on visual and cognitive development.

The unicycled lighting pattern of neonatal units has also been found to lead to less optimal regulation of sleep states in infants than those infants who experienced 14 hours of light and 10 hours of dark (Youngberg, 1978).

Vital-Durand and Michel (1969) illustrated this as after sensory deprivation the adult cat did not sleep longer than normally but there was a reduction in the duration of the waking state and of active (rem) sleep, states were intermingled resulting in an atypical, impossible to classify state occurring for 44% of total sleep time.

Associated with this is Schaeffer's (1978) finding that preterm sleep is influenced by various qualities of the environment which thus need to be taken into account and modified where necessary, in order to promote optimal development.

4.6.1.3 Attachment/Emotional effects

The experimental studies of Harlow (1958) with monkeys illustrated the importance of tactile ("contact-comfort") and kinaesthetic stimulation early in the development of primates for attachment behaviour with surrogate mothers. Infant monkeys were found to prefer to cling to a terry cloth covered surrogate mother rather than a wire mother that had a nipple to feed from.

With regard to emotional behaviour, Prescott (1971, 1975), proposed that human violence stems from a lack of bodily pleasure during such a formative period of life, with deprivations of bodily touch, contact and movement being the catalyst or even cause of a number of disturbances, including depressive behaviours.

4.4.1.4 Behavioural effects

Premature infants may miss out on the stimulation of being talked to, held, touched, rocked or looked at by their mothers, all of which Rubenstein (1967) found to correlate with infant exploration and manipulation in new situations. These infants also experience a deficit of a potential "zeitgeber" or rhythm giver in their mother and this may contribute to the disorganization of their behaviour (Dreyfus-Brisac, 1970).

4.4.1.5 Neural Discharge effects

Such high-risk infants may also lack an invaluable discharge of central neural activity as Wolff (1959) found that infants often display a variety of spontaneous behaviours related to any sort of external stimulation and postulated that these behaviours including random startles, reflex smiles and reflex sucking movements are a discharge of central neural activity.

There may be gender and individual differences however in modes of discharge of this neural activity, as Korner (1969) found, early gender differences in the amount and distribution of startle behaviour and smiling, as well as individual differences in spontaneous behaviours.

Akin to this, Stern et al. (1969) contended that "*..developing a capacity to protest, to communicate discomfort, dislike or needs, is part of active coping along with developing some tolerance for frustration, some capacity to delay and some capacity to struggle to meet one's own needs*" (p1113).

4.5 CONCLUSION

Thus, as can be seen stimulation, especially that of the tactile/kinaesthetic variety, along with the activity and responses that it elicits, plays a prominent role in early infant development. Deprivation of such tactile/kinaesthetic stimulation experiences (in terms of quantity or quality) during the critical period of early life is deemed to characterize the hospital stay of such high-risk infants as preterms.

Such deprivation however, may be combated to some extent through the provision of supplemental forms of the "missing experiences" in what are known as "intervention programmes".

These programmes are seen to curb what Pasaminick and Lillienfeld (1974) termed the "*continuum of reproductive casualty*" as well as assisting infant development.

CHAPTER 5

STIMULATION INTERVENTION PROGRAMMES

5.1 INTRODUCTION

Drillien proposed as far back as 1964, that the detrimental effects of prematurity were increased in a nonsupportive (eg. stimulus deprived) and ameliorated in a supportive postnatal environment. The importance of the environment was equally acknowledged by Sameroff and Chandler (1975), who in their transactional model of development emphasized the concept of "bidirectionality of influences", between the organism and her/his environment and how they influence each other reciprocally through time.

5.1.1 Intervention Programmes

Emanating from such environmental awareness, many intervention programmes have been designed and developed to modify, supplement or ameliorate certain environmental features experienced by preterm and other high-risk infants, to enhance their present condition and nurture their future development and growth.

Many intervention programmes seek to compensate for the sensory stimulation deprivation found in neonatal units, by catering for, amongst other things, the "tactile hunger" infants residing in such units experience. Thus Tizard's (1977) statement that it is possible to greatly reduce the negative effects of institutions (e.g the hospital) by improving sensory and physical stimulation, can be seen to be a belief that many intervention programmes adhere to.

Seligman's (1975) theory of learned helplessness is also of relevance to intervention programmes, as it holds that when crucial events in the environment are not contingent on a child's behaviour, the child (or infant) comes to perceive the self as helpless with no role in determining what happens to the self.

Over the long run, perceptions of such helplessness impair the child's ability to recognise actual contingencies when they occur, as well as decreasing the amount of behaviour directed towards the discovery of new contingencies i.e the child's development will be impaired in emotional, social and cognitive areas of functioning. Given the lack of contingent stimulation prevailing in neonatal units this theory may thus hold true for many who were born prematurely and constitute a target area for intervention programmes to act upon.

The birth of a high-risk infant may also produce a vicious cycle with a downward spiral, through subtle alterations in the environment and the quantity and quality of stimulation therein, infant-caretaker interaction and the caregiving quality of the parents.

One of the primary purposes of intervention programmes is to break such a cycle by focusing on the environment, providing enrichment and activity opportunities, thereby reducing, eliminating and/or preventing behavioural disabilities. Such programmes also often incorporate the parents by working with them and providing them with relevant information.

5.2 INTERVENTION PROGRAMMES IN THE NEONATAL UNIT

Ramey et al. (1981) delineated a number of interesting assumptions regarding intervention programmes, the first being that the more valuable and useful ones, are those that examine and measure developmental processes rather than simply outcome measures. The later being less likely to reveal the casual pathways through which effective interventions can exert their influence.

Their second assumption was that intervention programmes could exert their greatest impact if conducted as soon as possible after the identification of a detrimental condition. Thereby affecting the underlying causal processes and mechanisms whilst they are most malleable.

They also assumed that the mode of evaluation adopted should be of a multi-faceted interdisciplinary type and that to be of the greatest benefit to those it seeks to serve, intervention programmes should have their roots in explicit theory and good research practices. Such a grounding according to Ramey et al. (1981), "*..will facilitate a strategic approach to problems of development rather than a more characteristic ad-hoc approach*" (p395).

As interventions require the co-operation of various disciplinarians (physicians, psychologists, environmental health engineers) they should thus also be designed in a manner appealing to all such disciplinarians, taking all their various stances, languages and approaches into account.

All of these assumptions thus illuminate the direction in which future interventions should proceed to achieve optimal success. Other steps however, indicated later, also need to be taken specifically by stimulation intervention programmes to achieve this goal.

5.2.1 Aims of intervention programmes

Four overriding aims may be seen to guide intervention programmes in neonatal units:

1. Compensation for lost intrauterine experiences.

2. Correction of sensory deprivation experienced.

3. Modification of the disruptive effects of the neonatal unit so that it is more like that of the fullterm environment.

4. Promotion of positive infant-parent relationships.

This fourth aim goes along with Jones and Davis's (1965) concept of hedonic relevance. This states that any factor which makes an experience more negative, disappointing or costly, will depress attitudes towards a person or thing associated with that experience even if the person or thing is not at fault.

Conversely, a factor making an experience more pleasurable or satisfying can elevate attitudes toward whatever is associated with it. Thus, by enhancing the enjoyment parents experience with their infant, positive attitudes and expectations they have of their infant can be increased.

5.2.2 Preterms: A target infant population for intervention programmes in the neonatal unit

Ramey et al. (1981) with specific regard to preterms in neonatal units, advocated that they present a case where interventions have to provide an avenue for the preterm to adapt to an environment for which s/he is often not yet prepared. As the infant is neither fetus nor newborn but 'something in between', a preterm's care thus cannot be that of the fetus or newborn but rather something 'in between'.

Schaffer and Emerson (1964) argued that any infant's primary need is not for proximity, as Bowlby (1969) proposed, but rather for stimulation, which again preterms in neonatal units are seen to be deprived of or bombarded with.

Similarly, Spitz (1945) viewed stimulation, as well as care, as being the two factors essential for child rearing with developmental retardation resulting from inadequate stimulation and the syndrome of distress a consequence of disruption of care.

5.3 Stimulation Interventions

Inadequate or inappropriate sensory stimulation has been a prominent focus of concern for psychological interventions within the neonatal unit. As discussed previously (see Chapter 3), stimulation within such an environment has been deemed to be lacking in:

(1) Regulation

(2) Rhythmicity

(3) Pattern

(4) Variety

(5) Contingency

Along with this such stimulation has often been criticized as being inappropriate in both its intensity and form (Newman, 1981).

Preterms have already come to "expect" continuous, cutaneous input, containment, flexor inhibition and maintenance, characteristic of typical head-trunk adjustments and movements of the limbs found in utero.

The deprivation of such experiences within the neonatal unit may thus account for the fact that preterms up to one year display deficits in the integration of tactual-visual sensory information (Gottfried et al., 1977; Rose et al., 1978), hypotonicity in muscle tone (Fetters in Sweeney 1968), as well as being overrepresented in children with organizational impulsivity and attention deficits (Denckla, 1978).

As a consequence, many intervention programmes have been established, employing various forms of sensory stimulation (which has a powerful bearing on development), to prevent such disabilities from arising.

The relationship of sensory stimulation in general to development may be construed, as proposed by Wachs (1974), according to a number of models.

(1) The Linear Model

This model proposed by Wohlwill (1973) argues that as much stimulation as possible should be provided for development to be maximally enhanced. From the position of this model amount of stimulation provided in early life is thus seen to correlate positively with infant development.

(2) The Enhancement Model (Hunt, 1961)

This model forwards the notion that maximum development arises when stimulation is optimally discrepant from an individual's own cognitive level or stimulation processing ability. The concept of pacer stimulation proposed by Dember and Earl' (1957) and Hunt's (1961) concept of "the match" are akin to such a model. Challenging ther infant to advance further in his/her development employing unfamiliar stimuli paced according to the infant's developmental progress is the procedure followed by this model.

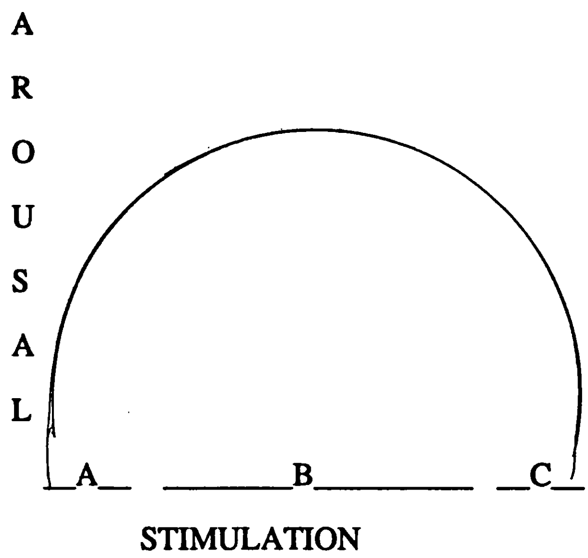
(3) The Inverted U model (Hunt, 1963)

This model proposes that each infant's individual stimulation threshold needs to be identified and the appropriate amount of stimulation provided.

According to this model, modifying stimulation administered to an infant to suit her/his unique stimulation threshold is an inherent component of an effective intervention programme since too much stimulation is as detrimental as too little. This is reflected in the finding that too much handling results in hypoxia (Long et al., 1980; Norris et al., 1982; Lucey, 1981).

Kogan (1970, 1971) likewise proposed that excessively high levels of stimulation act in a similar fashion to understimulation, as when level of complexity and unfamiliarity is too high for the infant, stimulation may become aversive and the infant may refuse to attend thus resulting in undersimulation.

The following graph illustrates the relationship between degree of stimulation and response.



A: Boring stimulation which cannot hold the attention of the individual.

B: Moderate stimulation which is the individual can cope with and enjoy.

C: Aversive stimulation which is overwhelming and is avoided by the individual.

Along similar lines, Fiske and Maddi (1961) postulated that all organisms have individually characteristic levels of activation, dependant upon time of day amongst other factors, which they seek to maintain across varying environmental conditions.

They asserted that organisms operate, function and adapt most optimally at their own characteristic level of activation. If a discrepancy occurs between current environmental conditions and their specific levels of activation, Fiske and Maddi (1961) argued that organisms will seek out or else curb incoming stimulation, thereby sustaining their individually characteristic levels.

It has also been proposed (Field, 1981; Schaffer, 1966), that organisms have individually characteristic levels of activation, with an intrinsic curvilinear relationship between stimulation and the arousal/affect processes. Field (1981) forwarded an activation band model based on the work of Sokolov (1963) and Sroufe et al., (1974) to account for the differing thresholds and range of responses, on the part of the infant to stimulation.

The upper and lower thresholds of this activation band shift and so the relative discrepancy or amount of stimulation perceived by the infant alters. These upper and lower thresholds, as well as the band width all vary as a function of the individual infants' rest-activity cycle and arousal, according to Field (1981).

If or when stimulation and/or an affective response exceeds the moderate level, the upper limit of the activation band is approached at which point the infant manifests an inattentive reponse eg. gaze aversion, as only moderate stimulation falls within the activation band. With advanced development, arousal cycles lengthen, reflected in longer stretches of attentiveness and more modulated affective responses.

Individual differences are seen by Field (1981) to arise in the activation band width and the upper/lower thresholds which may also vary according to experiences of deprivation or developmental delays.

Insufficent stimulation, possibly within a critical period of development, may thus limit the amount of stimulation or activation an infant can cope with, which thus minimizes her/his adaptivity.

Similarly Hebb (1949), enunciated that the extent to which an organism is aroused may be described as a bell shaped curve with the middle section representing the most efficent period of the organism's functioning.

One could infer that the wider the range of stimulation or experience to which an organism has been exposed and habituated to, the more platykurtic will be the curve and the wider will be the middle section, reflecting a wider range of adaptive capacity.

This results in an individual "*who can perform most efficently under a great variety of arousal conditions*" (Thompson, 1958).

5.4 CATEGORIES AND PARAMETERS OF STIMULATION PROGRAMMES

Levine (1962) classified intervention programmes into either a physical/mechanical (eg. noise, electric shock) or a non-mechanical/environmental category. While Macedo (1984), proposed the classification of natural (stroking, heartbeat sound) and artifical (mechanical oscillations, taped maternal voice) stimulation. She acknowledged though the difficulty of classifying multimodal programmes into such dichotomous categories.

It may however, be of greater utilitarian value to utilize categories to functionally describe rather than classify interventions, thereby providing a detailed specification of the stimulation and how it was administered. Such categories could be based on the various dimensions of stimulation provided in intervention programmes as well as on the nature of the subject sample and the variables examined. For example :

(1) Content

(2) Quantity/Duration

(3) Quality

(4) Context

(5) Subject sample used

(6) Features measured and assessed.

By using such a system one can identify the parameters of stimulation which induce the desired results based on previously run intervention programmes that have been subjected to such a functional description as well as dealing with many of the criticisims that have been levied against intervention programmes.

5.4.1 Parameters of stimulation programmes

5.4.1.1 Content

A detailed account of the mode and kind of stimulation employed is essential for any functional description of an intervention programme.

In relation to this, Macedo (1984) indicated that differences in the effects that stimulation has may arise within the mode of sensory stimulation, for example with tactile stimulation, stroking, rubbing and handling, despite all being a form of tactile stimulation, may have different effects which again may vary according to the time period (or "critical period") within which they are provided.

As Bateson (in Ambrose, 1969 p9-10) noted animal intervention programmes do not outline sufficiently the stimulation employed. According to Bateson (1969) more careful definition and description of the stimulation and procedures employed within intervention programmes is called for in order to determine the most significant aspects of such stimulation.

Similarly, Gewirtz (in Dittman 1968) stressed the need for "stimulation" and "environment" as concepts, to be based on clearly delineated functional criteria.

5.4.1.2 Quantity/Duration

Schaffer and Emerson (1964) argued that the amount of stimulation is the major determinant of human infant attachment behaviour, more so than any other feature of such stimulation and thus they emphasized its crucial importance to the parent-infant relationship.

Quantity or intensity was argued by Moltz (1963), to be the foremost critical parameter of stimulation, for animal infants and Schaffer (1963) supported this view seeing it as applicable also to human infants. Jumonville (1968) upheld this claim by showing that 3 minutes per hour as compared to 2 minutes per hour of stimulation is more advantagous for human infants though she only found this in one of her two studies.

Looking at stimulation quantity in terms of duration of stimulation over time, Gray (1974) suggested that the most successful intervention programmes seem to be those that provide more than a single year's preschool provision.

W.E.Freud (1980) similarly believed that the fact that after intervention "*..the gains level off after some time may no more than reflect natures' requirement that to give long lasting benefits, stimulation must be ongoing*" (p292-293).

Also with regard to the duration of stimulation, Wright (1955) found this to influence the stimulation threshold of an individual, with the greater the duration resulting in a higher threshold. Greater stimulation would thus be required in the future, to exert the same impact upon the individual or to reach the individual's satiation level.

This has the knock-on effect of compelling the individual to seek out more stimulation (thereby learning more of, adapting more to and experiencing a greater amount of his/her environment) and so enhancing his/her cognitive development and adaptation to the environment.

Freud (1980) argued that for stimulation intervention programmes to give long lasting benefits such stimulation must be ongoing, though in contrast to this Richards (1978) propounded that even short term stimulation is beneficial.

Quantity of stimulation per minute or intensity is another feature that has often been deemed to be the most critical and influential parameter of any given stimulation intervention programme (Schaffer, 1963). Genzmer (1882) for example, expounded that entirely different responses might be elicited from a point on the body, to weak as compared to strong stimulation (which has manifold implications for tactile stimulation programmes). Meanwhile, both Denenberg (1964) and Moltz (1963) showed the importance of intensity of stimulation, in their findings of a monotonic relationship between this in infancy and adequacy of consumatory behaviour in animals as adults.

The rate of application of any form of stimulation should also receive some attention, as it similarly has been found to have a bearing upon an organism's stimulation threshold (Wright, 1955).

Finally, there also can be no question but that stimulation which is "too intense" or above a certain level above the stimulation threshold of an individual organism (which may vary with his/her state, age or physiological condition) can be harmful rather than beneficial.

However as Cornell and Gottfried (1976) noted in most intervention studies, stimulation intensity, frequency and duration are abitrarily selected without any apparent rationale.

5.4.1.3 Quality

In contrast to both Schaeffer and Emerson (1964), Denenberg (1969) stressed patterned, physical stimulation as the key parameter of effective stimulation programmes, whereas Zubeck and Welch in 1963, argued that variation rather than the level of input per se was what was critical.

Maddi (1961a) deemed a stimulus to possess variation if it is different from it's immediate predecessor, is novel relative to other stimuli or if it is either temporarilly or spatially unexpected.

Thus, according to Maddi (1961a), novelty and surprisingness are features of variation as is incongruity, (since it involves spatial unexpectedness) and complex stimuli since they provide greater opportunities for temporal change.

Bowlby (1969) acknowledged the pertinence of the feature of quality for the impact of any given form of stimulation. His findings that infants are more likely to respond to a moving object than to a static one, a human than a non-human voice, a humanoid pattern or contour than to a non-humanoid one, (believing these tendencies to be of survival value), tie in with such a theory.

Kagan (1971), looking at the work of Haith (1968), reported that the stimulus features of sharpness, contrast and motion, were the most effective determinants of attention during the first 2 months of life. As such they may thus play a role in the effectiveness of any stimulation intervention programme.

These may also be seen to comprise the stimulus feature of distinctiveness, which Kagan (1969) thought to be essential for the effectiveness of any form of stimulation intervention. A one room ghetto with a television and many adults, according to Kagan (1969), contains more physical stimulation than a suburban second floor bedroom, but the child in the later context has the advantage in that s/he is exposed to more distinctive cues.

The response eliciting qualities of stimulation employed within any intervention programme also need to be determined. Bruner (1969) emphasized their importance in arguing that a lively environment is of no extra benefit unless you get some responses from the organism. A postural schema or model can thus be built up to structure the environment and thereby advance cognitive development.

The way (eg. pressure of touch, angle of movement) in which one is stimulated has also been identified as influential in the effectiveness of such stimulation by Carmichael (1934). He found that stimulation of a point on the skin of a fetus may often not bring about a response, while stroking or general touches of the same point may do so, as Windle and Griffin (1931) and Hooker (1936) also found.

Anna Freud (1980) also emphasizes variety of stimulation in her contention that "*piecemeal stimulation is a poor substitute for the wide range of natural and integrated stimuli which only close bodily contact can provide. All channels of communication, but especially the kinesic, should be available to the infant*" (p262).

Contingency is another significant aspect of the quality of any form of stimulation upon the organism, as well as being one that preterm infants rarely experience during their hospital stay. It refers to the degree to which the response of the environment differs as a function of the behaviour of the infant.

Yarrow et al. (1972), emphasized both the variety and contingency of stimulation in their argument that motivational functions were greatly influenced by early stimulation and experience. Contingent stimulation provides the infant with some control over the incoming input which many, eg. Klaus and Kennell (1976), have argued to be beneficial to the infants growing sense of awareness and learning of how the environment works.

However the significance of the feature of contingency within stimulation intervention programmes remains to be adequately answered.

Optimal complexity of stimulation or the "ease of assimilation" of stimulation (Zelazo, 1971), refers to the complexity of stimulation and its suitability or compatability to the infant's capacities and skills (related to the enhncement model spoken of earlier in section 5.2), and may be another determinant of the effects a given stimulation intervention programme imparts.

According to Dember and Earl (1957), complexity is the most basic feature of stimulation which is also capable of arousing exploratory behaviour. Along with this, Dember and Earl (1957) presumed that the organism possesses a complexity value or adaptation level, which determines the level of complexity most comfortably and effectively dealt with.

5.4.1.4 Context and Level of Arousal

The context in which stimulation occurs, as well as the level of arousal elicited by stimulation, has been argued by many to be of importance in determining whether a stimulation programme exerts any effects or not (eg. Escalona, 1968).

Escalona (1968) for example, proposed that the optimal setting for developmental advance and enhanced flexibility of adaptation, is where there is an alteration between mild, moderate and strong arousals. Similarly, given that the preterm is highly sensitive to the environmental features of for example, temperature, noise, illumination and smell, such features should be investigated to determine their impact upon sensory intervention programmes.

However, as Korner and Thoman (1970) recognised, intervention studies fail to delineate the circumstances as well as the organisms internal state which optimally facilitate the effectiveness of stimulation.

5.4.1.5 Subject Sample

A detailed account of the characteristics of the subject sample used is necessary when conducting any stimulation intervention programme as subject features such as gender, prematurity and age have all been found to be affect how stimulation is responded to and experienced.

5.4.1.5.1 Gender

With specific regard to tactile stimulation, Harlow (1971) noted newborn females to be more responsive to skin exposure, reacting more strenuously than newborn males to a covering blanket and being more disturbed when their skin is stimulated by an air jet, as well as showing higher basal skin conductance.

Females also appear to innately prefer more stimulation than males as both Sackett (1972) and Greenberg and Weizman (1971), unearthed in their studies where female animals explored more and prefered more complex stimuli than their male counterparts. Miranda (1970) and Greenberg and O'Donnell (1972) however found the reverse to be the case.

This variance might be accounted for by the complex interaction effect in receptivity to stimuli and reactivity to the test situation, demonstrated amongst the sexes, in animals, by Weizmann et al., (1971). They found that male animals fixated novel stimuli more than females if tested in a familiar environment whereas females fixated more than males if tested in a novel environment.

Employing auditory stimulation in their studies, Friedman and Jacobs (1981) found that in comparison to males, females displayed:

(1) quicker responsivity to stimulation

(2) larger responses on initial trials

(3) greater responsivity to auditory stimulation, reflected in their duration of responsiveness to repeated stimulation and in their activity levels.

Using limb withdrawl to ascending electrical stimulation in the first 4 days of life, females were found to be more sensitive and exhibited lower electrotactual thresholds than males (Lipsitt and Levy, 1959).

Jacklin et al., (1981) however, found no newborn gender difference in tactile sensitivity using the Weinstein-Semmes aethesiometer. They did find that newborn males displayed greater muscular strength than newborn females in prone head reactions and grip strength. Other studies which found no gender differences in measures of tactile sensitivity include:

(1) Birns (1965) employing motor response to the application of a cold disc.

(2) Turkewitz et al., (1967) using head turning to the touch of a brush.

(3) Yang and Douthitt (1974) employing reaction to a jet of air on the abdomen.

(4) Rosenblith and DeLucia (1963) using reaction to cotton and cellophane placed lightly over the infant's face.

Given that males possess less mature skeletal and nervous systems, have less well organized physiological reactions and show greater vulnerability to insult in comparison to females (Stechler, 1964; McDonald et al., 1963), this may result in gender having an influential bearing upon the effectiveness of any stimulation intervention programme.

5.4.1.5.2 Prematurity

Preterms and other high-risk infants may require special consideration in the design and administration of stimulation intervention programmes to accommodate their underdeveloped abilities.

High-risk infants have been found to attend less to stimuli (Miranda, 1970), display slower rates of habituation to stimuli (Eisenberg et al., 1960) and tend to show defensive rather than orienting reactions to auditory stimuli (Schulman, 1969) illustrating the effects of a poor and immature physiological condition on responsiveness to stimulation.

In terms of more basic physiological measures, Field et al., (1979) found that unlike fullterms, preterms do not show habituation in heart rate to repeated stimulation, which again reflects the immaturity of their C.N.S.

Higher sensory acuity but somewhat retarded lingual, manual, postural and locomotor control also characterize preterms in comparison to their fullterm counterparts (Shirley, 1959).

This is of significance to note in comparing an intervention that has been given both to preterms and fullterms. One group may benefit more from such an intervention, given the mode and administration of stimulation employed and the benefited groups sensory acuity and developmental status of the aforementioned behavioural controls.

5.4.1.5.3 Age

Gorski et al., (1979) proposed three age-related stages of behavioural organization in preterm infants which intervention programmes need to accommodate:

(1) Physiological organization (<33 weeks)

(2) Coming out (34-36 weeks)

(3) Reciprocity (36-40 weeks)

They noted that in the second stage infants can respond to visual and auditory stimulation only if the interaction began when the infant was in an alert state, otherwise (eg. if the infant was asleep or fussing) negative responses ensued (eg. sudden colour changes).

It is conceivable that tactile stimulation is the most appropriate and suitable form of stimulation for the first two stages (or that period of infancy) with an increasing importance attributed to other forms of stimulation with increasing age since the touch sense is the first to develop and is well matured by birth.

According to Fitzgerald et al., (1982), sensitivity to stimulation in general and motoric arousal to tactile stimulation diminish with age, while physiological regulation matures with age. Infants can also withstand more and more complex stimulation with increased age (Greenberg and Weizman, 1971). The manoeuvers available to regulate input and avoid overwhelming stimulation and the degree of specificity of attending to appropriate inputs also all improve with age.

These are all indices of an intact, complex and active controlling nervous system which selects or rejects stimulation on the basis of self-regulation.

Looking specifically at tactile sensitivity across age, Gullickson and Crowell (1964) assessed electrotactual threshold in tests conducted at 24, 48, and 72 hours after birth and found this threshold to increase over time. This however could also be due to the fact that greater time is spent in state one in the first few days following birth.

Lipsitt and Levy (1963), in contrast, found electrotactual threshold to decrease with time after birth, again this may be due to state at time of testing amongst other factors.

However, it is well to note that any C.N.S. measure rather than chronological age is a better predictor of eg. habituation rate in preterm infants (Schilman 1969). It may thus be advantagous to use C.N.S. measures, rather than chronological age, as an index of development or ongoing maturity achieved to determine the most suitable or appropriate administration, quantity and quality of stimulation employed in any intervention programme.

Equally, using a broad subject sample with various groups of infants of different ages and developmental stages would assist in determining at what point in time is it most advantagous, in developmental terms, for an intervention to occur.

Intervention programmes in the past have been criticised for not being carried out with those infants who seem to need intervention the most, such as asphyxiated infants. Rather, most research involves healthy preterm infants (Campbell, 1982). This highlights the difficulties found in acquiring ethical permission from hospitals to conduct such research and consent from the parents for the research to be conducted on their child.

Fear of psychologists and their "exploratory antics" still pervades public and medical consciousness and when anxiety levels are high, such as when dealing with people associated with ill infants, these fears may be exacerbated beyond reason.

Thus, the need to renovate the public and scientific face of psychology cannot be overemphasized as without public and medical co-operation, early intervention research can never adequately proceed.

5.4.1.6 Features Measured and Assessed

In any stimulation intervention programme, the variables examined need to be detailed as well as the means through which such variables were measured or assessed.

Many criticisims have been levied already against intervention programmes in terms of the variables and mechanisms chosen and disregarded for examination.

Little attention also has been paid to determining the cost-effectiveness of such programmes, in terms of psychological, financial and time related factors, which is critical in maintaining ongoing programmes and attracting interest and funding for future programmes.

Intervention programmes in general have also been seen to lack an examination of the mechanisms by which the beneficial effects are achieved (Meisels et al., 1983). Cornell and Gottfried (1976) however warned that due to methodological differences amongst studies, specifications regarding the mediating mechanisms between stimulation and outcome could be precipitous.

According to Rauh et al., (1988) and Meisels et al., (1985), intervention programmes do not reveal their "practical significance" and any observed developmental gains. Yet, many studies such as those of Field et al., (1978) and Macedo (1984) indicate that long-term developmental gains do arise from early stimulation.

Long-term studies though, even those conducted one to three years only after treatment, display many of the problems associated with long-term testing. Lerner and Lerner (1983) recognised the interference of the infantile personality in assessment. They postulated that the difficult child's withdrawl and slow adaptability might result in that child scoring lower than those of the approaching, rapidly adapting, easy child when no ability differences exist at all and thereby may disguise certain effects that a stimulation programme may have exerted.

Dispute also arises regarding what certain tests, employed in long-term assessments of early intervention programmes, actually measure. Bayley (1969) believed that her infant behaviour record measured infant personality while others eg. Hubert et al., (1982) thought it to measure temperament.

Sigman and Parmelee 1981, (1981) asserted that the qualitative change in infant behaviour and skills was responsible for the lack of prediction from one age period to another (McCall et al., 1972). They argued that since infant development is a series of stages and not a steady progression they can be interpreted as saying that early intervention programmes thus cannot be accurately assessed in the long-term.

Similarly, Lewis (1976) derogated the use of infant tests to predict an essentially mythical I.Q. and cautioned against their use in evaluating intervention programmes.

On the same note, Scarr-Salapatek (1976) believed that since infant sensorimotor intelligence is mediated by systems much older phylogenetically than those found underlying infant intelligence thus sensorimotor intelligence as such is prone to less phenotypic variability (i.e it is more heavily canalized) than verbal intelligence. As a result, it is not a very useful predictor of later mental abilities.

Intervention programmes which exert positive effects on sensorimotor intelligence thus cannot, according to Scarr-Salapatek (1976), be expected to have a long term benefit on later intelligence.

However, early intervention programmes should nothave to possess a long-term benefit to be accorded a valued status, as long as they benefit the present state of the infant. It may well be that other aspects of intelligence eg. motivation, may be affected by stimulation provided earlier on in life, than those aspects typically assessed.

The lack of examination, by stimulation intervention programmes, of the immediate effects of various stimuli on heart rate, blood pressure, respiratory rate, tcpo2, cerebral blood flow or other physiological parameters was criticised by Harrison (1985). Studies by Jay (1982) and White-Traut and Carrier-Goldman (1988) however did look at the effects of stimulation on some of these measures though few other studies have and thus this was a critical component of the research in Chapters 6-8.

Intervention programmes may thus be seen to be still in their "infancy", requiring much more analysis and modification, so as to become more effective and thereby be of greater value to premature infant care.

5.5 GENERAL OR MULTIMODAL STIMULATION

5.5.1 Animal Programmes

Programmes with infant animals (Appendix 12) have shown many positive results including:

(1) Altered brain neurochemistry (Tapp and Markowitz, 1963)

(2) Enhanced response to pathogens (Ader, 1969)

(3) Increased brain weight and improved occipital morphology (Rosenzweig et al., 1972)

(4) Altered eeg activity (Meier, 1961)

(5) Improved avoidance learning (Melzack and Scott, 1957)

(6) Altered purkinje cells (Pysh and Weiss, 1979)

7) Increased occipital dendritic count (Ulyings et al., 1978)

(8) Increased brain ache (Krech et al., 1960)

Such programmes have included:

(a) motor training (Ferchmin et al., 1975)

(b) maze learning (Greenough et al., 1979)

(c) an enriched environment (Melzack and Scott, 1957)

(d) physical activity (Pysh and Weiss, 1979)

(e) visual stimulation (Barlow, 1975)

and have generally been conducted within the time period of early infancy (first 3 months).

5.5.2 Human Programmes

With human infants, stimulation programmes conducted with high-risk infants have been found to impart a number of benefits, such as:

(1) greater nrem sleep (Brackbill and Fitzgerald, 1969)

(2) improved motor development (McGraw, 1935; Clark et al., 1977)

(3) improved state modulation (Rose et al., 1980)

(4) increased weight gain (Scarr-Salapatek and Williams., 1973)

(5) faster growth (Wright, 1971)

(6) decreased incidence of apnea (Korner et al., 1975)

(7) improved mental development (Ross, 1984)

(8) easier infant temperament (Ross, 1984)

(9) improved reflexes (Barnard and Bee, 1983)

(10) decreased crying and increased alertness (Korner and Grobstein, 1966)

(11) faster speed of information processing and improved visual recognition memory (Rose et al., 1980)

(12) greater rate of parental visitation (Brown et al., 1980)

Procedures employed within such programmes include rocking, visual mobiles, music and handling (Wright, 1971), heartbeat recordings and rocking (Barnard and Bee, 1973), motorized hammocks (Neal, 1968), recordings of the mother's voice (Katz, 1971), as well as tactile, kinaesthetic and proprioceptive stimulation (Rose et al., 1980; Brown et al., 1980; Clark et al., 1977; Appendix 12).

Scarr-Salapatek and Williams (1973) had the mothers of low birthweight infants provide the infants with extra sensory stimulation which included visual mobiles, speaking directly to the infant, rocking and stroking him/her for 30 minutes, 8 times daily from birth until discharge.

This was found to result in improved performance on mental and motor development tests at 1 year, in comparison to their non-stimulated controls. Again, it is difficult to determine whether the results are due to one, a few, or all of the forms of stimulation used together.

In recent years, tactile stimulation has come to be recognised as one of, if not the, most crucial forms of stimulation, especially during the critical period of early life. Nash (1978) advocated that at first in life, tactile stimulation plays a prominent role in providing sensory input, which according to Nash (1978), is consistent with the work of Harlow and others since "*..maturation almost certainly depends in part on feeding by sensory input..*" (p98).

5.6 TACTILE STIMULATION

5.6.1 Introduction

Intervention programmes utilizing tactile stimulation came into existence to fill the "psychological impasse" prevailing in neonatal units, institutions and other places where individuals were being deprived of their "tactile right".

5.6.1.1 Tactile stimulation in early infancy

Taylor (1921) contended that the touch sense was the greatest sense in our body and Shevrin and Toussieng (1965) postulated the existence of a need for tactile stimulation, especially in early infancy when the baby's other means of commumication are very primitive.

Similarly, Clay (1966) believed that the need for peripheral skin stimulation and contact, whilst prevailing throughout life, is especially intense and crucial in the early phase of reflex attachment. Tactile stimulation, Clay (1966) argued, should also be age graded according to the developmental needs of the organism, to have maximal effect.

Halliday (1948), was another who identified close bodily contact as an essential ingredient, in early life, to satisfy the kinaesthetic and muscular requirements (Kulka et al., 1960). The need for skin contact has also been seen as psychologically more crucial than hunger, with personal integrity representing a continued search for and intake of social nourishment through close relationships incorporating tactual experiences (Forer, 1972).

5.6.1.2 Tactile stimulation with preterms

With the somatosensory system being the earliest maturing system (Turkewitz and Kenny, 1985), the provision of supplemental early tactile and kinaesthetic stimulation has thus been presumed to have a maximal effect upon premature infants as it matches the epigenetic sequence of development (Gottlieb, 1971; Hunt, 1979).

This is congruent with Gottlieb's (1971) notion that changes in one system can cause alterations in the rate of development or ultimate perfection of (which relates to the concept of ceiling of capabilities) other systems.

In utero, the fetus is constantly experiencing variations in tactile sensations as well as kinaesthetic and proprioceptive sensations. Preterms and other high-risk infants residing in neonatal units, as they are perceived as being deprived of such essential sensations, are thus the target recipients for supplemental sensory stimulation intervention programmes (Barnard, 1973; Kramer et al., 1975).

5.7 TACTILE INTERVENTION PROGRAMMES

Tactile intervention programmes tend to use palm (White and LaBarba, 1976) or finger stroking (Rausch, 1981), the later of which Scafidi et al., (1986) believe might "*..be experienced as a tickling and thus more arousing stimulation*" (p92). Rubbing, holding and gentling are other forms of tactile stimulation that have been employed within intervention programmes (Appendix 12).

These terms however are often used synonomously and thus the necessity of operational definitions of the tactile stimulation, in any intervention, cannot be overemphasized.

5.7.1 Tactile Intervention Pogrammes with Animals

With infant animals, programmes of tactile and kinaesthetic stimulation (Appendix 12) have employed such procedures as handling (Bernstein, 1952; Weininger, 1956), stroking with a camelhair brush (McClelland, 1956), tossing the animal into the air and catching it again (Ader, 1969) and by shaking the cage in which the animal resides (Levine and Lewis, 1959b).

Tactile stimulation of infant rats has been found to exert numerous beneficial effects, including:

(1) Greater weight gain (Ruegamer et al., 1954; Levine, 1957)

(2) Enhanced learning (Denenberg, 1962; Bernstein, 1952)

(3) Improved conditioned avoidance learning (Levine et al., 1956)

(4) Greater cortical development (Benjamin, 1978)

(5) Improved survival ability (Levine and Otis, 1958; Weininger, 1956)

(6) Greater exploratory ability (Denelsky and Denenberg, 1967)

(7) Decreased emotional response (Levine, 1958; Hunt and Otis, 1955)

(8) Precocious development of eye opening, colouration, synchrony of eeg and emergence from nest (Meier and Stuart, 1959)

(9) Attenuated plasma corticosterone response to novel stimuli (Ader, 1969)

(10) Enhanced neural growth (Greenough, 1976)

(11) Increased curiosty and problem solving skills (Bernstein, 1952)

(12) Less cardiovascular and gastro-intestinal damage and lower acth output following physiological stress (Weininger, 1954)

(13) Increased serum growth hormone and tissue ornithine decarboxylase levels (Schanberg and Field, 1984)

(14) More cholesterol (index of myelinzation in the brain) (Levine and Alpert, 1959).

(15) Preference for more varied and intense stimulation as adults (Denelsky and Denenberg, 1967).

In general, the effects of tactile stimulatiom may be categorized into the following:

5.7.1.1 Physical

5.7.1.2 Cognitive

5.7.1.3 Socio-Emotional

5.7.1.1 Physical Effects

With infant animals, tactile stimulation has been shown to have a wide variety of physical effects. Barron in 1955, found a rise in the oxygen content of the blood, (possibly elevated oxygenation), when kid goats were licked and groomed and an associated hastening in their ability to stand, revealing the physiological importance of certain tactile components of rearing.

Evoniunk et al., (1979), similarly showed this in rat pups. They found that when rat pups were deprived of maternal licking, their levels of ornithine decarboxylase (O.D.C) dropped. However, a compensatory tactile stimulation programme, providing them with stroking using a camelhair brush increased O.D.C. levels back to their "normal" (i.e. non-maternally deprived) rates.

Ornithine decarboxylase (O.D.C.) is the first enzyme involved in the synthesis of polyamines, substances intimately involved in the regulation of protein synthesis (Bacrach, 1973; Raina and Janne, 1970).

Activity of the enzyme is a sensitive index of tissue growth and differentiation in the developing tissue, with growth hormone being one of it's regulators, controlling O.D.C. activity in the brain and peripheral tissues (Rogers et al., 1974). However, supplemental growth hormone given to maternally deprived rats, does not increase O.D.C. levels, rather tactile stimulation is the means through which O.D.C. levels may be elevated again (Kuhn et al., 1979).

Weininger (1954) gentled male rats for 3 weeks after weaning and revealed that at 44 days, gentled rats displayed a mean weight 20 grammes higher plus a greater rectal temperature (suggesting a change in metabolic rate) than their non-gentled controls.

The gentled rats were also less stressed than their controls, who clung more to the walls in an open-field situation.

This suggests that the gentled rats were less vulnerable to cardiovascular and other organic damage incurred from suffering too prolonged or too great acth production, such as when under stress.

Increased brain weight and cholinesterase (Che) activity, smaller increases in Ache activity as well as increased proliferation of glial tissue (containing predominantly Che) compared with neuronal tissue (Rosenzweig et al., 1967) have also all been found following stimulation.

Finally, animals given supplemental tactile stimulation in infancy, have been found to show a more adaptive response to stress (Levine and Lewis, 1959). Rats that had been handled during days 2-5 of their life displayed a significantly greater depletion of adrenal ascorbic acid in response to a severe cold stress at 12 days, compared to their non-handled controls and those handled only after the fifth day of life. This implys the existence of a critical period for this effect.

5.7.1.2 Cognitive Effects

Studies on animals, providing them with supplemental tactile stimulation during early infancy, have established this to enhance many aspects of cognition. Denenberg (1969) handled infant rats prior to weaning and found that such rats, as compared to controls, displayed a greater ability to learn using reinforcers.

Similarly, greater avoidance learning has been found in rats handled in the first 10 days of life compared to their non-handled controls (Denenberg and Morton, 1962). Improved maze learning in adulthood has also been found in rats handled for 10 minutes daily, for 10 days within the first 50 days of life, as compared to non-handled rats (Bernstein, 1952).

Exploratory behaviour, another feature of cognition is also enhanced in rats by handling within the period of early infancy (Levine and Broadhurst, 1963; Denelsky and Denenberg, 1967). Wachs (1974) revealed that rats handled prior to weaning show greater adult visual exploration following pre-exposure to intense auditory stimulation than those handled after weaning.

This is consistent with the experiential buffering hypothesis, suggesting that early handling allows organisms to tolerate more easily the effects of subsequent stimulation, possibly because they come to have higher stimulation thresholds.

Problem-solving behaviour, as assessed by the Hebb-Williams maze test, has not however been found to be effected by handling (Denenberg and Morton, 1962) despite the significant effect on problem solving ability found by Bernstein (1952).

Finally, more rapid dissipation of changes in cholinesterase and acetylcholinesterase activity occured in a study by Brown (1971), following both long and short-term stimulation, enrichment and training in rats.

This physical effect of stimulation has consequences for cognition in that the cholinergic system has been implicated in the direction and selective inhibition of responding (Carlton, 1969; Russell, 1959) as well as in the process of memory coding (Deutsch, 1966).

5.7.1.3 Socio-Emotional Effects

Effects upon animal emotionality have stood out in the field of research on tactile stimulation in early infancy, with an enhanced ability to cope with stress in adulthood being one of the most prevalent and consistently found effects. Emotional responses affected by tactile stimulation early on in life include:

(1) Attenuated plasma corticosterone response to novel stimuli (Ader, 1969)

(2) An earlier ability in responding to cold with a significant depletion in adrenal ascorbic acid (Levine et al., 1958)

(3) A quicker response to stress with a shorter duration of stress effects (Bell et al., 1961)

(4) A less extreme response to novel situations (Levine and Mullins, 1966)

Al of the above may be seen to contribute to an improved capacity to deal with stress as well as resulting in more mature emotionality.

Survival of extreme stressors is also enhanced by tactile stimulation during early life.

An enhanced adaptive response to and survival of operations such as a thyro-parathyroidectomy, (Hammett, 1922), starvation (Bovard, 1958), water depletion for 18 hours and electrical shock (Levine, 1958), have been found to follow on from supplemental (as compared to no supplemental) handling in early infancy.

Tactile stimulation in early life has also been shown to ameliorate the physiological effects of an emotionally stressful experience as illustrated by the Schanberg and Field (1983) study of the effects of stroking on O.D.C. in maternally deprived rats.

5.7.2 Tactile Intervention Programmes with human infants

Tactile stimulation programmes conducted with human infants have demonstated a broad range of improvements including:

(1) Enhanced sucking ability (Macedo, 1984)

(2) Accelerated and increased weight gain (Solkoff et al., 1969)

(3) Improved mental and motor development at 1 year (Field, 1981)

(4) Greater attentiveness to novel stimuli (McNichols, 1974)

(5) Enhanced appetite (White, 1975)

(6) Better habituation and orientation to developmental test items (Field et al., 1987)

(7) Decreased incidence of food regurgitation (Hopper and Pinneau, 1957)

(8) Improved learning (Wright, 1971; Siqueland, 1973)

(9) Decreased crying (Ourth and Brown, 1961)

(10) Increased alertness and active behaviour (Scafidi et al., 1986)

(11) Accelerated development of visual exploration (White and Castle, 1964)

(12) Elevated oxygen levels (Terres, 1979)

(13) Maturer reflexes (Rice, 1977; Macedo, 1984)

(14) Earlier discharge from hospital (Scafidi et al., 1986)

(15) A more stimulating home environment (Solkoff and Matuszak, 1975)

In general, as with the effects of tactile stimulation studies with animals, the effects of such studies with human infants may be categorized into:

5.7.2.1 Physical

5.7.2.2 Cognitive

5.7.2.3 Socio-emotional

5.7.2.1 Physical Effects

In recognition of the physiological impact which tactile stimulation exerts upon neonates.

Freedman (1969) cites the example of a Chicago hospital where handling and swaddling seemed to lead to a greater survival rate than when incubators were introduced and handling diminished. According to Freedman (1969), the arrival of incubators resulted in prolonged periods of relative infant inactivity in conjunction with an absence of external stimulation up to 3 months of age.

A three times daily fifteen minute programme of holding and cuddling conducted by Terres (1979), resulted in increased oxygen levels for over a week and a greater ability to maintain these levels during holding periods in comparison to controls.

Five minutes of stroking every hour for ten days, administered to high-risk infants was found by Solkoff et al., (1969) to result in a quicker regain of birthweight, greater activity, decreased crying and improved health (reflected in growth and motor development) in stroked compared to non-stroked infants.

Rice (1977) was another who established a tactile stimulation programme with preterms once they had been discharged from hospital. Mothers used a massage type sequence of stroking, followed by rocking, for 1 month and overall this was found to result in greater weight in and higher Bayley scores at 4 months, in the stimulated as compared to control infants.

Similarly, Macedo (1984) devised a sequence of patterned, all over the body, stroking movements called "Tac-Tic", which she administered to a sample of premature and low birthweight infants in hospital. In comparison to their controls, these infants displayed better sucking and hand grasp reflexes, a faster regain of birthweight, and higher Bayley scores at 1 year.

Finally, another intervention programme providing preterm infants with tactile stimulation is that of Field et al., (1986). They administered stroking along with passive movements of the limbs for ten days to twenty preterms. The infants were stroked from the top of the head down to the feet in segmented movements for five one minute periods in the prone position.

In the supine position the infant was then given five one minute periods of passive flexion-extension movements lasting approximately ten seconds a piece for each arm then each leg and then both legs together. The stimulated infants showed on average forty-seven per cent greater weight gain per day, were more active and alert during sleep-wake behavioural observations. More mature habituation, concentration, motor and range of state behaviour on the Brazelton was also shown by the stimulated as compared to non-stimulated infants.

5.7.2.2 Cognitive Effects

Cognition, including the spheres of learning, problem-solving, cross-modal transfer and information processing have also been found to benefit from a supplemental tactile stimulation, along with other forms of stimulation in early life.

Enhanced cognitive developmental test (eg. Bayley scales) performance shown by infants who had received supplemental tactile stimulation, as compared to their non-stimulated controls (Field et al., 1986; Powell, 1974; Rice, 1977), may be interpreted as reflecting enhanced cognition, given that such tests assess cognitive, amongst other developmental features.

Similarly, cognitive advance may also be seen to be enhanced by improved attentiveness, responsivity, environmental interest and exploration, all of which have been found to be consequences of programmes of supplemental tactile stimulation in early infancy (Rosenfield, 1980; Brody, 1951; Siqueland, 1969). Improved reflexes, state control and visual exploration (Field et al., 1986; White and Castle, 1964; Rice, 1977) resulting soley from additional tactile stimulation in early infancy, may also be construed as benefiting cognition.

Most studies however, that have examined the effects of tactile stimulation on cognition, have provided such stimulation in conjunction with other form of stimulation, rather than on its own.

Thus, it is difficult to determine whether any benefits to cognition, accrued from such programmes, are due to the tactile or the other forms of stimulation provided or both.

Siqueland (1973) provided supplemental handling during 2 daily feeds to premature infant twins in combination with the provision of contingent visual stimulation upon eye-opening behaviour. At 4 months, the stimulated twins were compared to those not stimulated on a visual conditioning task. This task consisted of 18 minutes of conditioning, whereby visual patterns, varying in complexity and novelty were presented alternately during the first 10 minutes and familiar and novel patterns presented for the final 8 minutes.

Infants who did not receive the additional stimulation tended to fail to display evidence of visual reinforcement control of their sucking behaviour, whilst the stimulated infants exhibited the reverse tendency, even with an auditory rather than a visual reinforcement task.

McNicholl (1975) compared groups of infants given visual enrichment or tactile enrichment or both or simply routine care. No differences were found between these groups on such measures as weight gain, motor strength or muscle tone. However, those infants who received only tactile stimulation scored higher than the others on a test of visual tracking and they displayed habituation to visual stimuli which the infants who received visual stimulation also exhibited.

In a similar study, Groom (1973), provided one group of preterms with visual stimulation (coloured decorations and mobiles) whilst providing another group of infants with tactile stimulation in the form of rubbing and passive limb movements. A third group received both types of stimulation and finally a fourth group were left with just routine care.

On the day prior to discharge, all infants were tested on 2 habituation tasks, a blast of white noise for 2 seconds and visual orientation to a checkerboard target. No differences were found though between the groups on these tasks and no differences were found when infants were tested on conditioned headturning tasks at 42 weeks of age.

Tactile stimulation as a component of a general multi-modal stimulation programme (consisting of massage, vestibular, proprioceptive and auditory stimulation) has been found to contribute towards improved information processing. Preterms given such supplemental stimulation for three 20 minute daily sessions during the first two weeks of life, did not show the deficits in speed of information processing (reflected in cardiac and behavioural responsivity to stimulation) that their controls exhibited (Rose, 1980).

Tactile stimulation, in conjunction with increased mobility and an enriched visual environment in infancy, has been found to result in earlier directed manipulation of objects, which also facilitates cognitive growth (White, 1969, 1971).

5.7.2.3 Socio-Emotional Effects

Tactile contact has long been identified as a critical component of the mother-infant relationship (Ainsworth, 1972; Feher, 1980) as well as being of crucial importance for infant socio-emotional development (Bowlby, 1969; Klaus et al., 1976; Spitz, 1962).

With regard to attachment, Klaus and Kennell (1976) summarized the findings of 8 studies on amount of contact between mothers and their premature newborns and concluded that mothers with early (within 30 minutes of birth) contact of their infants, showed significantly more attachment behaviour than those with later contact. Also, the earlier the mother touched and explored her premature infant, the greater her commitment and confidence were, as well as her stimulation and caretaking skills (Klaus and Kennell, 1976).

Mothers with early contact of their infants (compared to mothers who received later contact with their infant) have also been revealed to spend twice as long feeding their infants at 3 months, as well as engaging in more face to face conversation.

The infants of early contact mothers, have in turn been found to cry less and smile and laugh more than infants of late contact mothers (DeChateau, 1976).

Infants who received supplemental early tactile stimulation, have been found to show better Bayley scale scores at 1 year than their non-stimulated counterparts (Field, 1980). This may be interpreted as reflecting improved socio-emotional state as well, given that assessment with the Bayley scales is a social situation which may be quite stressful for the infant.

Thus, enhanced performance on these scales may indicate better social and emotional (stress-coping) skills rather than simple enhanced cognitive or motor development. Unfortunately, performance on the Infant Behavioral Record section (socio-emotional or personality index) of the Bayley scales tends to be neglected, if used at all. Information on the infant's performances on the specific social and behavioural components of these scales is thus lacking.

Increased parental visiting rates (Rosenfield, 1980) and decreased crying (Ourth and Brown, 1961), both found to follow on from programmes of tactile stimulation, may be seen as reflecting enhanced social and emotional capabilities.

Improvements in attentiveness, responsivity and state control, as a consequence of supplemental tactile stimulation (Rosenfield, 1980; McNichol, 1974; Siqueland, 1969; Field et al., 1987) may also be seen to contribute towards improved social interaction and emotional development and expression, as these are all features of optimal interaction.

5.7.2.4 Conclusion

Overall, intervention programmes appear to prevent, correct or at least ameliorate any developmental delays (accountable for later developmental problems, retardation or non-acquisition of one's optimal state of eg. learning) emanating from prematurity or perinatal illness and associated iatrogenic damage. Much has yet to be achieved however in terms

Early intervention may also assist high-risk infants such as preterms, to surmount the developmental challenges inherent in the neurobehavioural transition stages as advocated by Stratton (1982). However, the actual causal pathways and mediating mechanisms through which intervention programmes, such as those providing tactile stimulation to preterms, exert their beneficial effects yet remain to be unveiled. Speculations regarding such mechanisms are outlined later.

5.8 INFLUENTIAL SUBJECT VARIABLES

The effectiveness of any form of stimulation programme may also depend on various subject variables not discussed earlier including:

5.8.1 Individual behavioural differences

5.8.2 Past experience

5.8.3 State at time of stimulation

5.8.4 Genetic inheritance

5.8.5 Physiological condition

5.8.6 Miscellaneous factors

5.8.1 Individual behavioural differences

What may determine the effectiveness of any stimulation intervention programme for any particular individual is individual differences within such behaviours as:

(1) motor activity (Fries, 1947)

(2) readiness to respond to stimuli (Korner and Grobstein, 1967)

(3) success in shutting out stimulation too intense to cope with (Murphy and Moriarty, 1976)

(4) energy output, motor demeanour, exploitation of the environment to gain information, reaction to stimulation (Gesell and Bates-Aimes, 1937)

(5) reactivity to stimulation in terms of alertness and intensity of response, that cut across both state and modality (Birns, 1965; Korner and Thoman, 1970)

Recognition of the "individual" within each infant was advocated by Gorski et al., (1979), who recognised that routine intervention, no matter how well intentioned may adversely affect some infants while benifiting others. They argued that some infants need regular feeding schedules, sleep and handling whilst others fail to thrive unless care is arranged their demands for feeding and activity. They also saw that infants vary in their toleration of sensory input from the environment.

Those that can tolerate little, they argued, respond with physiological decompensation to overloading stimuli which other, more tolerant, infants may turn to with alerting in request for even more stimulation.

Such physiological decompensation may include regurgitation, gaze aversion, fussiness and increased drowsiness, which Als (1981) construed as signs of overtaxation though some of these may be seen to simply reflect a change of state.

Finally, infants may also have a prefered stimulus modality, responding less well to stimulation of any of the other modalities (Horowitz, 1969; McCall and Melson, 1970).

Individually designed stimulation programmes shaped around the characteristics and preferences of any given infant may thus, as Als (1981) advocated, be the path to follow in order for such programmes to be of maximum benefit.

5.8.2 Past Experience

There are many influential factors in an infant's past experience that impinge upon the effectiveness of any stimulation intervention programme.

5.8.2.1 Maternal heart rate

Smith and Steinschneider (1975), identified high maternal heart rate children as needing more stimulation input postnatally than do low maternal heart rate children, as the former have become accustomed to greater levels of stimulation prenatally. Without sufficient environmental input, high maternal heart rates childrens' arousal levels might rise, according to Smith and Steinschneider (1975), to meet their needs for sensory stimulation and thereby reducing their soothability.

5.8.2.2 Maternal caffeine intake

Another influential factor is the caffeine intake of the mother during pregnancy which has been discovered to positively correlate with number of state changes and startles shown by the infant and is also associated with low muscle tone, low visual orienting, poor orientation, poor eye tracking, less head turning and poor consolability (Jacobson et al., 1984).

Hronsky and Emory (1987), revealed that low level caffeine effects were highly dependant upon environmental stimulation and argued that the effect of caffeine upon infant behaviour may be mediated by environmental contingencies and seems to be stimulus determined.

5.8.2.3 Length of labor/delivery

McGrade et al., (1976) found a relationship between length of labor and the responsiveness of the infant to certain stimulation, with greater fatigue correlating with increased difficulties in delivery. This in turn may hamper the benefits which problem birth infants could experience from a stimulation intervention programme.

Medication administered to the mother during labor and delivery has been identified to lead to more problems during feeding and less infant behaviour during parent-infant interactions (Hollenbeck et al., 1984). Again, this may modulate the effectiveness of any stimulation intervention programme.

5.8.2.4 Amount of stimulation experienced

Green (1962) expounded amount of stimulation to be a factor which effects the stimulation threshold of an individual. Possibly the greater amount of stimulation experienced in the past, the higher the requirement in the future.

Such would coincide with the notions of Hunt (1961) who believed the stimulation experience to be influential in setting ones "optimal stimulation threshold", with a high threshold being postulated as associated with greater intelligence since more input or information is sought to achieve satisfaction.

Hunt's (1961) principle of "the match" between environmental stimulation and an infants already assimilated schemata (innate nervous system programming) is critical possibly in the effectiveness of stimulation programmes, though as Hunt (1961) recognised the matching process is a matter of empirical trial and error. However, habituation and central nervous system measures now render this less of a problem except with the more critically ill high-risk infants whose medical condition hinders accurate assessment.

Similarly, Clarke-Stewart (1973) believed stimulation to be "matched" to an infant's developmental status and asserted that a constant and pronounced relationship existed between amount and variety of toys and materials a child is exposed to and cognitive development.

5.8.3 State at/response to stimulation

5.8.3.1 Effect of state on response to stimulation

With specific regard to tactile stimulation programmes, exteroceptive skin responses show a state dependent pattern different from that of proprioceptive responses.

Even if mild pressure is applied to the skin, responses are virtually absent during state two (rem, active) while being reliably acquirable in state three (quiet wakefulness) (Lenard et al., 1968).

State prior to stimulation was also found to have an impact on an organism's response to such stimulation by Bridger and Riesen (1959). They argued that when prestimulation heart rate is low, stimulation leads to cardiac acceleration and that when prestimulation heart rate is high it results in cardiac deceleration even when the same form of stimulation is used.

Wolff (1959) also reported on state related changes in responsiveness to tactile, vibratory and auditory stimuli and derived a scale of states from his work with unstimulated infants, thereby neglecting to cater for the effects of stimulation on state.

Infants who are quiet tend to be aroused by stimulation and infants who are alert tend to be quietened (Bridger 1965) again illustrates that stimulation can exert changes on an infants, in a direction which depends on that infant's existing state.

According to Birns (1965) these effects apply to several stimulus modalities with stable individual differences existing in such responsivity.

Heart rate responsiveness to stimulation has also been found to vary with state. Cardiac acceleration tends to occur in response to stroking of the face with a nylon filament during sleep, whilst cardiac deceleration occurs when an infant is stroked in an awake state, with a greater magnitude and range of scores occuring during the latter (Lewis et al., 1967).

Lewis et al., (1969) argued that the cardiac acceleration response is associated with the exclusion of information (and is a feature of a defensive reaction, according to Graham and Clifton, 1966), whereas the cardiac deceleration response is linked to the intake of information, implying that the state of wakefulness is more aprropriate for stimulation interventions to take place.

5.8.3.2 Effect of stimulation on state

In 1966 Wolff however, drew attention to the effect of stimulation on state by positing that the infants response was not exclusively a function of state and that the modality (of stimuli) had something to do with the dirction of change in response to stimulation.

The impact of stimulation on state was also noted by Korner and Grobstein (1966), who found reduced crying and increased alertness when infants were picked up and put to the shoulder (thereby receiving visual, vestibular, tactile and proprioceptive stimulation) when crying.

Relevant to this is Brackbill's (1973) contention that continuous stimulation has a pacifying or quieting effect on both the infant's physiology and behaviour, with a more regular respiration rate accompanied by less activity and crying, a reduced heart rate and increased sleep.

Many other factors also affect state including environmental temperature and humidity, ambient noise and light and dressing (Wolff, 1966), which illuminate how susceptible state is to extraneous influence.

5.8.4 Genetic Inheritance

The findings that different strains of rat yield different shock preference curves (Harrington and Kohler, 1966) and that reaction to rearing conditions is in part governed by genetic strain, as well as by degree of inbreeding (Laule, 1969), draw attention to the bearing that genetics may have upon an organism's reaction to stimulation.

Looking specifically at humans, Eysenck (1963) believed that one may inherit a type of nervous system that tends to be overreactive and is especially sensitive eg. to noise and pain.

Otherwise according to Eysenck (1963), one may inherit a passive less sensitive nervous system. From this one could deduce that possibly some infants are more sensitive to stimulation than others and thus stimulation programmes may vary in their "success" according to "nervous system sensitivity" genetic characteristics of their subject sample.

5.8.5 Infant's current condition

5.8.5.1 Emotional state

Wickler (1950) proposed emotional condition to be effective in altering ones stimulation threshold, which may in turn be altered by impinging stimulation.

5.8.5.2 Maternal medication

Orientation behaviour has also been found to be negatively effected by maternal medication, even as late as one month after the administration of such medication (Bowes et al., 1970). Such medication may, thereby inhibit the effectiveness of any stimulation intervention programme, by compromising the infant's orientation behaviour or arousal to the stimulation provided by the programme.

5.8.5.3 Physiological condition

Schaffer (1977) noted how methodologically incorrect it was to arbitrarily heap stimulation upon an infant, for the effectiveness of a given form of stimulation relys upon what is going on at that time within the infant, i.e. his/her physiological organization, and so the timing of a stimulation is all important.

Related to this is his critique of paternalistic stimulation programmes, where stimulation is imposed with no regard for the infants state and condition, willingness at the time to engage in social interaction, ability to determine its nature and the effect produced by any one form of stimulation.

As Schaffer (1977) contended, such a "blob of clay" conception of the infant needs to be abandoned and argued that "*..an infant may need stimulation but its amount, kind and timing must be closely related to his own psychological organization*" (p48-49) at the time.

This is of particular significance to premature infants, who as a consequence of physiological immaturity and/or illness may not benefit from a stimulation intervention programme until a few days, (rather than hours) after their birth.

5.8.6 Miscellaneous factors

There are a wide selection of other factors which are pertinent to the design and running of early intervention programmes.

5.8.6.1 Development of responsiveness

Wolff (1959) for instance, found responsiveness to tactile stimulation to be greater during the first days of life than any other forms of stimulation including auditory and vestibular, thus reinforcing the arguement that tactile stimulation is the most appropriate form of stimulation in early infancy.

5.8.6.2 Right vs left-sided stimulation

Turkewitz et al., (1967) elucidated that neonates are more responsive to right rather than left sided stimulation, possibly due to innate programming or because the infant lies typically with the head prone position where the head is to the right, shielding the right ear and side thereby making the left ear and side more accessible to stimulation.

This however inevitably raises the question of why most infants adopt the right head prone position in the first place.

Applying this to intervention programmes, it is visible that programmes may need to provide more stimulation to the left side of the body to raise it to the same 'threshold' as its more sensitive right side.

5.8.6.3 Sensitivity of different bodily areas

The face and perineum are more sensitive to touch rather than the limbs or trunk, according to Wolff (1959), thus requiring less stimulation than the rest of the body to reach the infants 'optimum threshold for stimulation'.

5.8.6.4 Developmental direction of reponsiveness

Responsiveness to stimulation has also been shown, according to Landreth (1966), to develop in an anterior-posterior direction (i.e from the face to lower limbs) with the greatest sensitivity in the region of the mouth. This may account for the cephalocaudal rhythm so often adopted in tactile stimulation programmes.

5.8.6.5 Weight

A low positive relationship between tactile sensitivity and chubbiness (Rosenblith and DeLucia, 1963; Bell and Costello, 1964) identifies weight to be another subject feature which may have a bearing upon the effectiveness of tactile stimulation programmes. Jacklin et al., (1981) however found the relationship to be applicable to male infants only.

5.8.7 Conclusion

The importance of acknowledging the role that various subject features may have in determining the effectiveness of any stimulation intervention programme, (tactile or otherwise), cannot be overemphasized. By detailing subject features and the intervention employed as well as conducting the same intervention programme with different subject groups, quantified data on the bearing of such features upon the effectiveness of a given intervention programme can be collected.

This data can then be used to draw up more appropriate and effective stimulation interventions with various subject groups.

5.9 OVERALL CONCLUSIONS

Early intervention programmes, specifically those providing supplemental tactile stimulation to preterm infants, can be construed as being a fundamental component of optimal preterm infant care. However, such programmes call for a stringent design and evaluation.

A procedure modifiable according to the infant's unique individual characteristics and condition as well as environmental requirements at the time of stimulation is also called for so that stimulation intervention programmes can achieve maximal effectiveness.

Features which need to be included within future intervention programmes are:

(1) a detailed specification of the stimulation employed

(2) a broad subject sample including infants of various ages and extremes of the critical to stable medical spectrum

(3) an examination of current short term and long-term effects on a variety of physiological, psychological and social measures

(4) calculation of such programmes cost effectiveness in economic, time and psychological terms

Recognition should also be given to the fact as Gray (1974) outlined, that an effective intervention programme, be it ever so good, cannot possibly be promulgated as a form of innoculation whereby the child is immunized forever afterward to the effects of an inadequate home and school, inappropriate to her/his needs.

CHAPTER 6

AN INVESTIGATION INTO THE SHORT AND LONG-TERM EFFECTS OF A PROGRAMME OF TACTILE STIMULATION WITH PREMATURE INFANTS

6.1 INTRODUCTION: Tactile Stimulation Programmes

Concomitant with a recognition of the value of supplemental tactile stimulation in early life for premature infants, increased emphasis has come to be laid upon replicability of the designs of these programmes.

Within tactile stimulation programmes, wide variance and discrepancies among the results, arbitrary selection of parameters eg. duration of stimulation, a lack of precise definition or operationalization of concepts has all contributed to a call for more rigourous, replicable designs to be set down (Fromm-Ross, 1984).

The concepts of "stroking", "rubbing", "gentling" and "handling" have rarely been operationalized and are often used synonymously with each other eg. Solkoff et al. (1969) equated stroking with handling. However, each of these may result in distinct and different sequelae (Macedo, 1984) and thus operationalization of concepts is essential in the designs of tactile stimulation programmes.

Acknowledging this, the tactile\vestibular stimulation programmes of Rice, 1977; Rose et al., 1980; Field et al., 1986; and Macedo, 1984, have all incorporated a design specifying precisely the procedure employed, thereby enabling replication.

6.1.1 Rice (1977)

Rice's (1977) sensorimotor procedure involved a sequential cephalocaudal sequence of stroking, emphasizing the head region, using the palmer and digital surface of the stroker's hand along with finger-tip massage and thumb pressure.

The mother was trained to do the stroking and the infant was placed first in a supine position in the mother's arms and then stroked from head to toes with each stroke being repeated 3 times. This took 15 minutes and was followed by 5 minutes of rocking, holding and cuddling in the "en face" position with visual contact between the stroker (mother) and baby.

This whole procedure was performed 4 times daily for 1 month post-discharge, beginning on the day of discharge with a subject sample consisting of 29 premature infants (<37 weeks gestation and 2.4 kg birthweight, experimental=15, control=14).

The stroked, as compared to non-stroked infants, were found to show significantly:

(1) greater weight gain at 4 months

(2) better Bayley mental scores at 3 months

(3) better reflexes at 4 months.

No differences were found in length, head circumference or Bayley motor scores.

6.1.2 Rose et al. (1980)

The procedure of Rose et al. (1980) consisted of a systematic regimen of massage and rocking performed by the experimenter.

The subject sample consisted of 90 infants, 60 of whom were premature (<2 kg <36 weeks gestation experimental =30 control=30) and the remaining 30 were fullterm controls. Each 20 minute massage session was broken down into 3 phases, with infants receiving the massage sequence while in the prone, supine and sitting positions. Infants were massaged, in a cephalocaudal direction, with the palmer surface and finger tips of one hand and each massaging motion was administered 10-20 times to the torso, (at the rate of approx. 10 strokes in 15 seconds), and 5-10 times to each limb. This sequence was then repeated.

Once an infant was cared for in a cot as compared to incubator, one of the sessions was replaced by rocking in a rocking chair. Direct visual contact and periodic talking to the infant was also conducted during each session and the whole procedure was administered daily, in three 20 minute sessions, 5 days a week, for the first 2 weeks of life. All the infants were tested prior to discharge, 1 hour after the onset of sleep, in cardiac and behavioural responsivity to tactual stimuli (5.46 filaments from Semmes-Weinstein aesthesiometer) placed on the abdomen.

The results revealed that the experimental, in comparison to control infants, exhibited:

(1) a significantly greater cardiac acceleration during active sleep to the stimulus filament (as did fullterms)

(2) behavioural responsivity to the stimulus more akin to that of the fullterms.

6.1.3 Field et al. (1986)

Field et al.'s (1986) procedure involved placing the infant in a prone position and stroking the infant's body in a cephalocaudal sequence, through the incubator portholes for 5 1 minute periods, (12 strokes at approx. 5 seconds per stroking motion), across each of the bodily regions. The infant was then placed in a supine position for kinaesthetic stimulation consisting of five 1 minute segments of 6 passive flexion/extension movements, about 10 seconds a-piece for each arm, then leg and then both legs together. The infant was then placed back in the prone position and received the stroking procedure once more.

The experimenter performed the programme with infants cared for in incubators, as soon as they were declared medically stable, within the special care unit of the hospital. Altogether there were 40 preterms (experimental= 20 control= 20), all of whom were below 36 weeks gestation and 1.5 kg birthweight.

The programme was performed for three 15 minute periods at the beginning of 3 consecutive hours, beginning 30 minutes after the first morning feed, for 10 week days with a non-treatment weekend intervening. The results found that the experimental, in comparison to control infants, showed significantly:

(1) greater weight gain per day

(2) improved Brazelton habituation, orientation, motor and range of state items

(3) more activity during sleep/wake observations

(4) better Bayley mental and motor scores at 6 months

No differences were found in formula intake or number of feeds per day or head circumference or length at 6 months.

6.1.4 Macedo (1984)

Macedo's (1984) Tac-Tic (Touching and Caressing, Tender in Caring) programme involved light, stroking touch and revolved around the principles of G.R.E.C., Gentleness, Rhythm (of stroking movements), Equilibrium (of pressure) and Continuity of stroking (Adamson-Macedo, 1991).

Altogether there were 85 (experimental= 45 control= 40) premature and low birthweight infants (<2.2 kg birthweight) in her study, and these were drawn from three hospitals.

Immediately before performing the Tac-Tic procedure, the stroker's hands and arms were scrubbed and hands warmed by rubbing them together. During this procedure, infants were stroked, in a cephalocaudal sequence, by the experimenter (trained) through the portholes of incubators or in their cots, beginning within the first 3 days of birth until discharge.

Infants were first placed in the prone position and stroked in a patterned sequence of stroking movements (illustrations in Appendix 6.1.4) with each movement being repeated 3 times. Each of these strokes was then repeated once more after which the infant was turned over into the supine position. Another sequence of stroking movements (each repeated 3 times) was then performed, again in a cephalocaudal direction. Each of these strokes was then repeated once more after which the infant was placed in the position s\he was found in before the procedure began. The procedure took 15-20 minutes for each infant and was performed twice daily until day of discharge.

The results found were that the experimental, in comparison to control infants, displayed significantly:

(1) less weight loss in week 1 of life and higher weight gain by day 21

(2) earlier removal from gavage (tube) feeds to all feeds in a day being from a bottle

(3) better sucking and grasp reflexes

(4) earlier removal from care in an incubator to care in a cot

(5) better Dubowitz scores compared with fullterms of same age at 40 weeks

(6) better Bayley at 6 months (n= 20)

No differences were found in food intake per day during hospitalization or habituation to light/sound at 40 weeks.

Adamson-Macedo, Wilson, and de Carvalho (1990) reported also that infants who received the tactile stimulation as compared to those who did not, scored significantly higher on the mental processing composite of the Kaufman Assessment Battery for Children.

The objective of this study was to assess this Tac-Tic programme by replicating the procedure with a sample of premature infants. This programme was selected given its results, the fact that it involves tactile stimulation only and has been the sole known tactile stimulation programme for high-risk infants, that has been designed and tested in Britain.

6.1.5 Study 1

For optimal clarity, this study (study 1) may be sub-divided into 2 sections:

6.1.5.1 Macedo (1984) Replication

A replication of Macedo's (1984) Tac-Tic programme conducted with premature infants and using retrospective controls, looking at the short term developmental measures of:

(1) Age in days at removal from care in an incubator to care in a cot

As a consequence of their large surface area relative to their weight, a deficiency of subcutaneous fat and brown adipose tissue, (which can metabolize rapidly producing heat), preterms display rapid heat loss and become hypothermic very quickly. Apnoeic attacks and hypoxia may follow on from this, compromising respiration, with an overall increase in mortality at either a too high/low a temperature. Preterms are thus cared for within a regulated neutral temperature range in an incubator, minimizing the amount of oxygen they consume which would otherwise be used in respiration, circulation and general homoeostasis (system regulation).

The subsequent move from being cared for in a cot as compared to an incubator is understandably seen as quite a significant step in preterm infant development, indicative of development and stability of their thermoregulatory system (keeps the balance between heat production and loss). No longer do they require a regulated thermal environment but are able to function independently.

(2) Age in days at first suck of all feeds in a day

Sucking is one of the reflexes we are born with and serves as one of the most fundamental activities of the neonate. Through this activity the neonate acquires essential nutrition which promotes his/her health and growth, as well as laying the groundwork of both future physical and psychological development.

As an early psychological experience, sucking acts as a powerful moulding influence of later events and as the first feeding experience it possesses an unquantified investment into later feeding habits.

Sucking is, according to Schaffer (1977), the first essential way in which the baby comes into contact with the outer world with the suck being a highly complex, internally organized response, which is variable in its response to external stimulation. Piaget (1952a) on the other hand, emphasized early sucking and grasping as hereditary patterns of action (reflexes), pre-adapted and ready to function immediately after birth. Whereas Freud (1905), viewed sucking as an activity that stimulates oral instinctual impulses, which the infant strives to gratify, the quality of gratification achieved influencing subsequent psychological development.

Sucking thus can be seen to be a reflexive activity that is significant in both physiological and psychological terms.

Premature, in comparison to fullterm infants though, tend to exhibit very poor and impoverished sucking ability and thus are administered their feed by nasogastric tube, until their sucking ability improves sufficiently such that they can tolerate bottle or breast feeds, i.e retain these feeds with little if any regurgitation, (Hutchison, 1975).

Any improvements in accelerating the onset of all-suck (all the daily feeds being from a bottle/breast) feeding, thus may be seen to assist nutritional intake and/or utilization and the establishment of sucking and feeding as the pleasurable, sensual, in itself gratifying and interactive situation found in healthy infants.

(3) Age in days at discharge

The discharge of a premature infant home is another major step in his/her development reflecting confidence on the part of the consultants in the stability and functioning of the infant's physiological systems. The infant is now seen as coping well independently, with no need for any medical support or observation.

As length of hospitalization has been found to lead to poorer mental and physical development at two years of age (Sanford-Zeskind and Iacino, 1987), a discharge as early as possible, is thus to the infant's advantage.

In each of the aforementioned dependent variables, as well as comparing experimental and control samples, these samples broken down into high-risk and low-risk groups were also compared.

This was done as it has been found that in preterms, the extent of retardation or compromised functioning eg. in information processing, is determined by degree of prematurity or severity of medical complications (Rose et al., 1988; Landry et al., 1985). Preterms have been identified as a very heterogeneous sample, showing immense variation in both the number and severity of medical complications experienced (Fox and Lewis, 1982, 1980).

These have been shown to affect social response (Brachfeld et al. 1980) auditory attention (Swoboda et al., 1976, 1978) and autonomic reactivity (Fox and Lewis, 1983).

It has been previously suggested by Field (1980), that preterms who have experienced more medical complications may benefit more from supplemental tactile stimulation than those who have not suffered such complications. Given that the incidence of these complications is higher the younger the preterm is, in gestational age, and the lighter s\he is, in birthweight, the study set out to investigate whether Tac-Tic had a greater effect on high-risk (low gestational age and low birthweight) or low-risk (high gestational age and high birthweight) preterm infants.

The overall experimental hypotheses of this study were that the experimental in comparison to control infants, would display more developmentally advanced results i.e younger ages, on each of the 3 measures of:

(1) Age in days at removal from care in an incubator to care in a cot

(2) Age in days at first suck of all feeds in a day

(3) Age in days at discharge.

When the experimental and control samples, broken down into high-risk and low-risk groups, are compared on these variables, it was hypothesized that the Tac-Tic stroking would have a greater impact on the high-risk than the low-risk group of infants. In operational terms it was thus hypothesized that:

(4) the high-risk group in the experimental sample would show significantly earlier ages on the above variables than the high-risk group of the control sample and that the liklihood of a significant difference between these groups would be greater than between the low-risk groups.

6.1.5.2 Extension of the Replication study with Prospective controls and long-term follow-up

The second section of the study involves:

(A) an extension of the Replication study with a larger subject sample and with prospective instead of retrospective controls, looking again at the effects of Tac-Tic on the short-term developmental measures of:

(1) Age in days at removal from care in an incubator to care in a cot

(2) Age in days at first suck of all feeds in a day

(3) Age in days at discharge

The experimental hypotheses here were the same as in Section 6.1.5.1.

(B) a long-term follow-up (15 months) using the:

(1) Bayley Scales (Bayley, 1969) to determine developmental status of the experimental and control infants.

This was employed, as a number of other stimulation programmes, notably those of Rice, 1977; Field et al., 1986, have used these assessment scales thereby enabling a comparison of long-term effects.

(2) Self Perceptions of the Parental Role questionnaire (S.P.P.R.; McPhee et al., 1986) to assess maternal attitudes towards the parental role.

The S.P.P.R. was employed since a number of studies have established that many mothers of preterms have difficulties in adjusting to being a parent of such an infant, exhibited in maltreatment (Hunter et al., 1978), child abuse (Klein and Stern, 1971) and failure to thrive (O'Callaghan and Hull, 1978).

Mothers of high-risk infants have also been found to report higher levels of emotional distress and depressive symptomatology, more concerns about themselves and their baby, more difficulty in expressing affection towards their baby and greater dissatisfaction with their social support (Bennett and Slade, 1991). All of these factors detract from a positive adjustment to the parental role and thus optimal parenting (McPhee et al., 1986; Bennett and Slade, 1991).

(3) HOME Inventory (Caldwell and Bradley, 1984) to measure stimulation in the home

Stimulation in the home has been found to correlate positively with cognitive development (Elardo and Bradley, 1981; Bradley, 1982), and be higher in homes of preterms who have participated in a tactile stimulation programme (Solkoff and Matuszak, 1975). As a consequence, the HOME Inventory (Caldwell and Bradley, 1984) was employed in this study to control for the effect of stimulation in the home, using co-variate analyses with the cognitive and motor developmental measures.

The experimental hypotheses for the long-term follow-up were that:

1. The experimental in comparison to control infants, would display more developmentally advanced scores on the Bayley Scales of Infant Development (Bayley, 1969) at 15 months.

2. The mothers of the experimental infants would display more optimal scores in their feelings of being a parent in comparison to control mothers.

3. There would be no differences in the amount of stimulation in the homes of experimental as compared to control infants at 15 months.

In all of the above variables, the high-risk and low-risk groups of the experimental and control samples were also compared (see Section 6.1.5.1).

6.2 METHOD

For the pupose of clarity, there are 2 method sections in this study, divided according to the sections in the introduction:

Method 6.2.1: Macedo (1984) replication study (introduction section 6.1.5.1)

Method 6.2.2: Extension of the Macedo (1984) replication study with Prospective controls and a long-term follow-up (introduction section 6.1.5.2)

6.2.1 Method: Macedo (1984) replication study

6.2.1.1 Design

The objectives of this study were to assess the effects of one such stimulation programme, Tac-Tic (Macedo 1984), on premature infant health and development.

An independent samples design was employed but experimental and control samples were matched (see Appendix 6.2.1.1) as far as possible on the variables of:

(a) Birthweight

(b) Gestation

(c) Apgars

(d) Gender

This was done to ensure that any effects found were not due to the better health status and prognosis associated with infants of larger birthweights, older gestational ages and greater Apgars or to an unequal proportion of the sexes, as female infants are known to be less vulnerable to insult in early life than their male counterparts and also are more sensitive to tactile stimulation, which could have an influence on the effectiveness of a tactile stimulation programme (Maccoby and Jacklin, 1974; Bell and Costello, 1964).

Measures of infant health and development employed were:

(a) Age in days at first suck of all feeds in a day

(b) Age in days at removal from care in an incubator to care in a cot

(c) Age in days at discharge.

These measures were chosen as they are the criteria used, by medical personnel, in the determination and prognosis of infant health and development, within the neonatal unit setting.

Although the experimental and control infants were matched, independent as well as matched subjects t-tests were performed given the diificulty of accounting for extraneous variables in the sample used, such as infant drug intake.

As a consequence of past studies which have shown programmes of tactile stimulation to benefit and never compromise, preterm infant sucking and thermoregulation (Macedo, 1984; Jay 1982) and accelerate their discharge from hospital (Field et al., 1986), 1-tailed t-tests were conducted.

6.2.1.2 Subjects

The subjects were 24 premature infants, 16 male and 8 females, recruited from the Queen Mother's Maternity hospital, Yorkhill, Glasgow. All the infants were born before 37 weeks gestation with a birthweight below 2.6 kg and none suffered from any debilitating medical condition eg. congenital heart defect, cerebral palsy, other than jaundice.

For later referal, subject characteristics, broken down into high and low-risk, for the reasons mentioned in section 6.1.5.1, are detailed in the tables below and overleaf (high- risk = at/below 33 weeks gestation and then only if birthweight = 2.0 or less, this threshold conveniently divides groups into near equal numbers).

Table 6.2.1.2.1BIRTHWEIGHT (kg): Replication Study

	MEAN	S.D.	RANGE	N
Entire Population:	1.75	0.31	1.11 - 2.54	24
Experimental 8m 4f	1.74	0.25	1.23 - 2.23	12
High Risk:	1.64	0.22	1.23 - 1.89	8
Low Risk:	1.94	0.21	1.70 - 2.23	4
Control 8m 4f:	1.77	0.38	1.11 - 2.54	12
High Risk:	1.56	0.35	1.11 - 1.92	6
Low Risk:	1.97	0.30	1.68 - 2.54	6

Table 6.2.1.2.2 GESTATION: Replication Study

	MEAN	S.D.	RANGE	N
Entire Population:	32.83	1.94	28 - 36	24
Experimental:	32.75	1.71	29 - 36	12
High Risk:	32.25	1.58	29 - 34	8
Low Risk:	33.75	1.70	33 - 36	4
Control:	32.91	2.23	28 - 36	12
High Risk:	31.33	1.86	28 - 33	6
Low Risk:	34.50	1.22	33 - 36	6

Table 6.2.1.2.3 APGAR AT 1 MINUTE: Replication Study

	MEAN	S.D.	RANGE	N
Entire Population	7.29	2.21	1 - 9	24
Experimental:	7.83	2.36	1 - 9	12
High Risk:	7.37	2.82	1 - 9	8
Low Risk:	8.75	0.50	8 - 9	4
Control:	6.75	2.00	4 - 9	12
High Risk:	5.66	1.96	4 - 8	6
Low Risk:	7.83	1.47	6 - 9	6

Table 6.2.1.2.4 APGAR AT 5 MINUTES: Replication Study

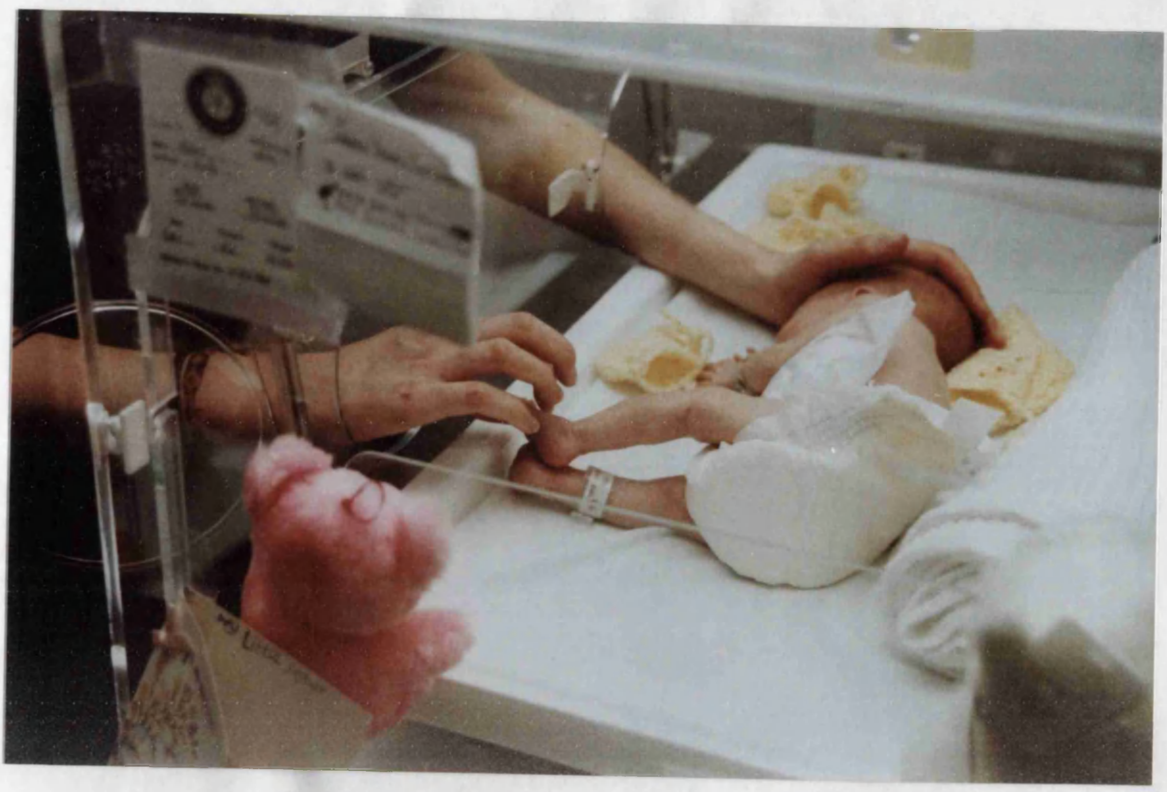
	MEAN	S.D.	RANGE	N
Entire Population:	8.70	1.04	4 - 9	24
Experimental:	9.00	0.00	9 - 9	12
High Risk:	9.00	0.00	9 - 9	8
Low Risk:	9.00	0.00	9 - 9	4
Control:	8.41	1.44	4 - 9	12
High Risk:	8.00	2.00	4 - 9	6
Low Risk:	8.83	0.40	8 - 9	6

6.2.1.3 Stimulation

The programme of stimulation employed was Tac-Tic (Touching and Caressing, Tender in Caring; Macedo, 1984), a systematic sequence of stroking movements, covering the whole of the body (see Figures 6.2.1.3.1 and 6.2.1.3.2; Appendix 6.1.4), with gentleness, rhythm, equilibrium and continuity of touch being its foremost priciples (Macedo, 1984).

Figure 6.2.1.3.1 Palm Stroke

Figure 6.2.1.3.2 Toe Stroke



6.2.1.4 Procedure/Equipment

All of the experimental infants received the Tac-Tic progamme of supplemental tactile stimulation from the experimenter (outlined in full in Appendix 6.1.4), once daily (approx. duration of stimulation = 20 mins), from the third day after birth until day of discharge from the hospital (mean duration = 17 days). Parents of the experimental infants were also shown and encouraged to stroke their baby using the Tac-Tic procedure.

Experimenter hands and arms were scrubbed, warmed and disinfected immediately before conducting the procedure and hats and other items of clothing were removed from the infant, along with the nappy being loosened, before s/he was stroked.

Control infants were selected retrospectively (see Appendix 6.2.1.1) from the past 6 months from hospital records. Hospital records were also used to obtain information on age at removal from an incubator into a cot, age at first suck of all feeds over a day and age at discharge.

6.2.2 METHOD: Extension Study

6.2.2.1 Design

This was an extension of the previous study, (see Section 6.2.1.1), with prospective rather than retrospective matched controls being employed. All infants recruited were firstly assigned to the experimental group and thereafter subjects were assigned to the control group if they matched experimental infants on the characteristics outlined in Section 6.2.1.1.

The objectives were to investigate whether, when the sample is extended from 24 infants to 42 infants (21 experimental, 21 control) overall and with prospective rather than retrospective controls, the tactile stimulation programme of Tac-Tic (Macedo, 1984) exerted the same significant accelerating effects on:

(1) age (in days) when all feeds in a day were first sucked (SUCK)

(2) age (in days) at removal from care within an incubator to care in a cot (COT)

(3) age in days at discharge (DISCHARGE)

As with the previous study, independent and matched subjects 1-tailed t-tests were employed when analyzing these variables for the reasons mentioned previously (see section 6.2.1.1).

Long-term assessment

Whether there were any long-term effects of the Tac-Tic procedure, being administered to the experimental infants during the neonatal period, on:

(4) Infant development - assessed using the Bayley scales (Bayley, 1969)

(5) Maternal feelings on being a parent - assessed using the Self Perceptions of the Parental Role questionnaire (S.P.P.R.; McPhee et al., 1986; Appendix 6.2.2.1.1).

Stimulation in the home environment was assessed using the HOME Inventory (Caldwell and Bradley, 1984; Appendix 6.2.2.1.2) and incorporated within co-variate analyses during data analysis to control for its effects.

The HOME Inventory was chosen as it represents a more accurate and informative measure of the influence of socio-economic status (S.E.S) upon the child's development than S.E.S itself.

6.2.2.2 Subjects

The subjects were 42 premature infants, 30 male and 12 females, recruited from the Queen Mother's Maternity hospital, Yorkhill, Glasgow.

All the infants were born before 37 weeks gestation with a birthweight below 2.5 kg and none suffered from any debilitating medical condition eg. congenital heart defect, cerebral palsy, other than jaundice.

Subject characteristics, broken down into high and low-risk (high-risk = at/below 33 weeks gestation and then only if birthweight = 2.2 kg or less, this threshold selected as it conveniently divides groups into a near equal number), for reference to in the results section, are detailed in the tables overleaf (Tables 6.2.2.2.1-6.2.2.2.4).

Table 6.2.2.2.1 BIRTHWEIGHT (kg): Extension Study

	MEAN	S.D.	RANGE	N
Entire Population 30m 12f:	1.88	0.30	1.2-2.5	42
Experimental 15M 6F:	1.91	0.34	1.2-2.5	21
High Risk:	1.84	0.37	1.2-2.3	11
Low Risk:	1.98	0.31	1.5-2.5	10
Control 15M 6F:	1.85	0.26	1.3-2.2	21
High Risk:	1.75	0.29	1.3-2.1	11
Low Risk:	1.96	0.20	1.5-2.2	10
Overall High Risk:	1.80	0.33	1.2-2.3	22
Overall Low Risk:	1.97	0.25	1.5-2.5	20

Table 6.2.2.2.2 GESTATION: Extension Study

	MEAN	S.D.	RANGE	N
Entire Population:	33.23	1.88	28-36	42
Experimental:	33.23	1.57	29-36	21
High Risk:	32.18	1.32	29-33	11
Low Risk:	34.40	0.84	34-36	10
Control:	33.23	2.18	28-36	21
High Risk:	31.63	1.74	28-33	11
Low Risk:	35.00	0.81	34-36	10
Overall High Risk:	31.90	1.54	28-33	22
Overall Low Risk:	34.70	0.86	34-36	20

Table 6.2.2.2.3 APGAR AT 1 MINUTE: Extension Study

	MEAN	S.D.	RANGE	N
Entire Population:	7.95	1.83	1-9	42
Experimental:	7.76	2.14	1-9	21
High Risk:	7.36	2.61	1-9	11
Low Risk:	8.20	1.47	5-9	10
Control:	8.14	1.49	4-9	21
High Risk:	7.90	1.44	5-9	11
Low Risk:	8.40	1.57	4-9	10
Overall High Risk:	7.63	2.08	1-9	22
Overall Low Risk:	8.30	1.49	4-9	20

Table 6.2.2.2.4 APGAR AT 5 MINUTES: Extension Study

	MEAN	S.D.	RANGE	N
Entire Population:	8.92	0.40	8-10	42
Experimental:	8.90	0.43	8-10	21
High Risk:	8.81	0.40	8-9	11
Low Risk:	9.00	0.47	8-10	10
Control:	8.95	0.38	8-10	21
High Risk:	8.81	0.40	8-9	11
Low Risk:	9.10	0.31	9-10	10
Overall High Risk:	8.81	0.39	8-9	22
Overall Low Risk:	9.05	0.39	8-10	20

6.2.2.2.1 Long-term subjects

Out of the original 42 subjects only 26 (18 males 8 females) were assessed at 15 months uncorrected age. Change of residence (n = 5), emigration (n = 2) and adoption (n = 1), accounted for the attrition in the experimental sample and their matched controls were consequently dropped from the control sample. No loss of control subjects occured other than those whose experimental matches were lost. Holidays and inconvenience of testing for the parents accounted for the range of age at assessment.

Data on the missing subjects, indicating their similarity to those tested, is included in Tables 6.2.2.2.1.1-6.2.2.2.1.4.

Table 6.2.2.2.1.1 BIRTHWEIGHT (kg): Missing Long-terms

	Mean	S.D.	N
Overall Population	1.87	0.31	16
Experimental	1.89	0.33	8
Control	1.86	0.31	8

Table 6.2.2.2.1.2 GESTATION: Missing Long-terms

	Mean	S.D.	N
Overall Population 12M:4F	33.12	1.74	16
Experimental 6M:2F	33.62	1.18	8
Controls 6M:2F	32.62	2.13	8

Table 6.2.2.2.1.3 APGAR AT 1 MINUTE: Missing Long-terms

	Mean	S.D.	N
Overall Population	7.62	1.82	16
Experimental	7.62	1.92	8
Control	7.62	1.84	8

Table 6.2.2.2.1.4 APGAR AT 5 MINUTES: Missing Long-terms

	Mean	S.D.	N
Overall Population	8.93	0.44	16
Experimental	8.87	0.64	8
Control	9.00	0.00	8

The experimental and control infants who participated in the long-term assessment, were matched, as far as possible, in their overall distributions of:

(1) gender

(2) birthweight

(3) gestation

(4) Apgars at 1 and 5 minutes

detailed in Tables 6.2.2.2.1.5 to 6.2.2.2.1.8 overleaf.

The overall mean age at long-term assessment was 15 months and 4 days (s.d. = 0.9 range = 14 months - 18 months).

For the experimentals alone this was 15 months and 5 days (s.d. = 0.9 range = 14 months - 17 months 18 days). For the controls this was 15 months and 2 days (s.d. = 1.06, range = 14 months - 18 months).

Table 6.2.2.2.1.5 BIRTHWEIGHT: Long-term Study

	MEAN	S.D.	RANGE	N
Entire Population 18m 8f:	1.89	0.33	1.2-2.5	26
Experimental 9m 4F:	1.92	0.36	1.2-2.5	13
High Risk:	1.65	0.23	1.2-1.8	7
Low Risk:	2.23	0.21	1.9-2.5	6
Control 9m 4f:	1.86	0.31	1.3-2.3	13
High Risk:	1.62	0.25	1.3-1.9	6
Low Risk:	2.07	0.16	1.8-2.3	7
Overall High Risk:	1.63	0.23	1.2-1.9	13
Overall Low Risk:	2.14	1.99	1.8-2.5	13

Table 6.2.2.2.1.6 GESTATION: Long-term Study

	MEAN	S.D.	RANGE	N
Entire Population:	33.1	2.10	28-36	26
Experimental:	32.8	1.77	29-36	13
High Risk:	32.1	1.60	29-34	7
Low Risk:	33.6	1.63	31-36	6
Control:	33.3	2.43	28-36	13
High Risk:	31.8	2.48	28-35	6
Low Risk:	34.7	1.50	32-36	7
Overall High Risk:	32.0	2.00	28-35	13
Overall Low Risk:	34.2	1.59	31-36	13

Table 6.2.2.2.1.7 APGAR AT 1 MINUTE: Long-term Study

	MEAN	S.D.	RANGE	N
Entire Population:	8.07	1.74	1-9	26
Experimental:	7.69	2.32	1-9	13
High Risk:	7.14	2.17	1-9	7
Low Risk:	8.33	1.21	6-9	6
Control:	8.46	0.77	7-9	13
High Risk:	8.67	0.82	7-9	6
Low Risk:	8.29	0.76	7-9	7
Overall High Risk:	7.85	2.50	1-9	13
Overall Low Risk:	8.31	0.92	6-9	13

Table 6.2.2.2.1.8 APGAR AT 5 MINUTES: Long-term Study

	MEAN	S.D.	RANGE	N
Entire Population:	8.92	0.39	8-10	26
Experimental:	8.92	0.27	8-9	13
High Risk:	9.00	0.00	9	7
Low Risk:	8.83	0.41	8-9	6
Control:	8.92	0.49	8-10	13
High Risk:	8.83	0.41	8-9	6
Low Risk:	9.00	0.58	8-10	7
Overall High Risk:	8.92	0.28	8-9	13
Overall Low Risk:	8.92	0.49	8-10	13

6.2.2.3 Stimulation

see Section 6.2.1.3

6.2.2.4 Procedure/Equipment

The same procedure and equipment referred to in Section 6.2.1.4 is used here, except in this sample the mean duration of hospital stay was 22 days and the controls were selected prospectively.

6.2.2.4.1 Long-term assessment

Letters (see Appendices 6.2.2.4.1.1 to 6.2.2.4.1.2) were sent out to all the families before each infant was 14 months requesting to see both the mother and her infant in their home at a convenient date and time once the infant had reached 15 months of age. After this the mothers were phoned to remind them of the up-coming visit.

Infants were assessed in their homes, each assessment taking approx. 3 hours to conduct, using the Bayley Scales of Infant Development (B.S.I.D.; Bayley, 1969) with the walking board and stairs items not being included due to operational difficulties.

Stimulation in the home was measured using the HOME Inventory (Caldwell and Bradley, 1984) and mothers were given the Self Perceptions of the Parental Role questionnaire (S.P.P.R.; McPhee et al., 1986) to determine how they feel about being a parent.

6.2.2.5 Data Analysis

6.2.2.5.1 Mental Measures

The Bayley Scales of Infant Development (B.S.I.D) manual (Bayley, 1969) was used to calculate the M.D.I. (Mental Development Index) to investigate if cognitive benefits were shown by the stroked infants.

The Kohen-Raz (1967) scale was used to answer the question of whether stroked/non-stroked infants differed within specific areas of cognitive development (defined by clusters of items from the Bayley mental scale).

Ross's (1985) Mental Fullterm Differentiation factor structure was incorporated into the data analysis as it identifies those cognitive items most prone to compromization as a consequence of prematurity.

6.2.2.5.2 Motor Measures

The B.S.I.D. manual (Bayley, 1969) was used to calculate the P.D.I. (Motor Development Index) to determine whether motor benefits were shown by the stroked infants.

Ross's (1985) Motor Fullterm Differentiation factor structure was employed within the data analysis since it identifies motor items which are the most vulnerable to compromization as a consequence of prematurity.

6.2.2.5.3 Behavioural Measures

As the I.B.R. (Infant Behaviour Record) does not provide a single summary score, Meisels et al.'s (1987) I.B.R. factor structure was employed. This is based on the I.B.R. factor structure of Matheny (1980) but pertains both to premature and fullterm infants, whereas that of Matheny (1980) just applys to fullterms. Both factor structures are gender and age invariant.

Meisels et al.'s (1987) I.B.R. factor structure enables the question of whether differences occured between stroked and non-stroked infants within the various domains of cognitive test-taking behaviour tapped by the I.B.R.

6.2.2.5.4 Home Measures

The HOME Inventories were scored using the technical manual for the instrument (Caldwell and Bradley, 1984) yielding a summary score for each subject.

6.2.2.5.5 The S.P.P.R

These questionnaires were scored using the S.P.P.R standardized rating structure (McPhee et al., 1986) yielding a summary total score plus 4 sub-section score of:

1. Integration
2. Competence
3. Investment
4. Satisfaction.

6.3 RESULTS

For the purpose of clarity, there are 2 results sections, divided according to the sections in the introduction and method:

Results 6.3.1: Macedo (1984) replication study (Introduction section 6.1.5.1, Method section 6.2.1)

Results 6.3.2: Extension of the Macedo (1984) replication study with Prospective controls and a long-term follow-up (Introduction section 6.1.5.2, Method section 6.2.2)

6.3.1 RESULTS: Macedo (1984) Replication Study

6.3.1.1 Descriptive Statistics

As hypothesized, the raw data (see Tables 6.3.1.1.1 to 6.3.1.1.3 and Figures 6.3.1.1.1 to 6.3.1.1.3) reveal that infants who received the Tac-Tic stroking display benefits in the 3 dependent variables:

(1) age (in days) when all feeds in a day were first sucked (SUCK)

(2) age (in days) at removal from care within an incubator to care in a cot (COT)

(3) age in days at discharge (DISCHARGE)

in terms of earlier ages in comparison to their non-stimulated matched controls.

Table 6.3.1.1.1 AGE (IN DAYS) WHEN ALL FEEDS IN A DAY WERE FIRST SUCKED: REPLICATION STUDY

	MEAN	S.D.	N
Entire Population:	19.45	7.13	22
Experimental:	17.00	3.79	11
High Risk:	17.85	3.23	7
Low Risk:	15.50	4.72	4
Control:	21.90	8.90	11
High Risk:	27.50	5.61	6
Low Risk:	15.20	7.46	5
Overall High Risk:	22.25	7.00	12
Overall Low Risk:	16.10	5.98	10

Figure 6.3.1.1.1 AGE (IN DAYS) WHEN ALL FEEDS IN A DAY WERE FIRST SUCKED: REPLICATION STUDY

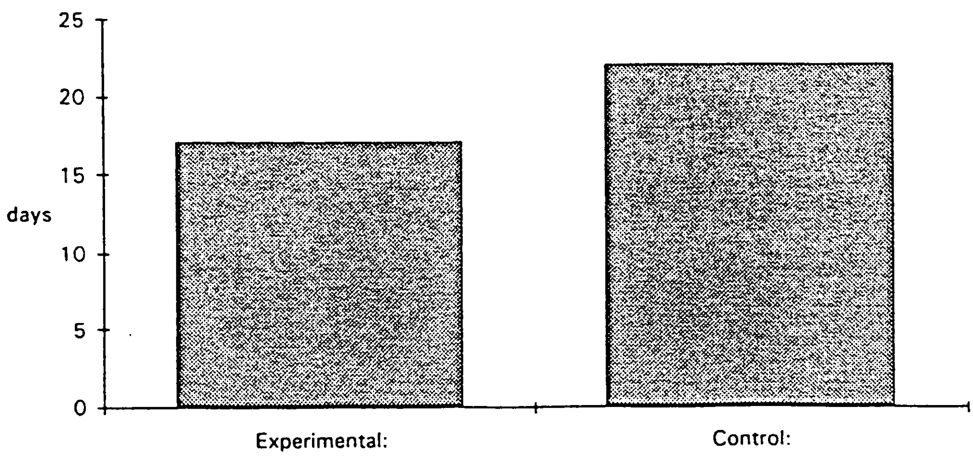


Figure 6.3.1.1.2 AGE (IN DAYS) AT REMOVAL FROM CARE IN INCUBATOR TO CARE IN COT: REPLICATION STUDY

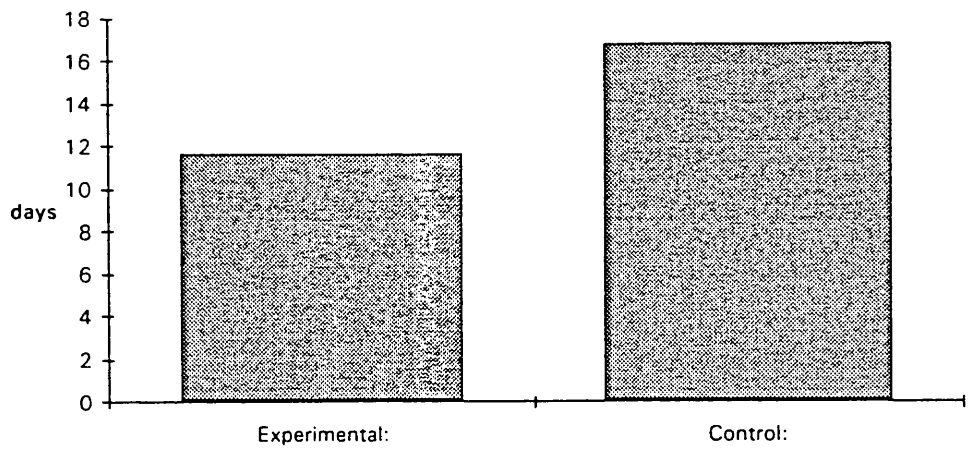


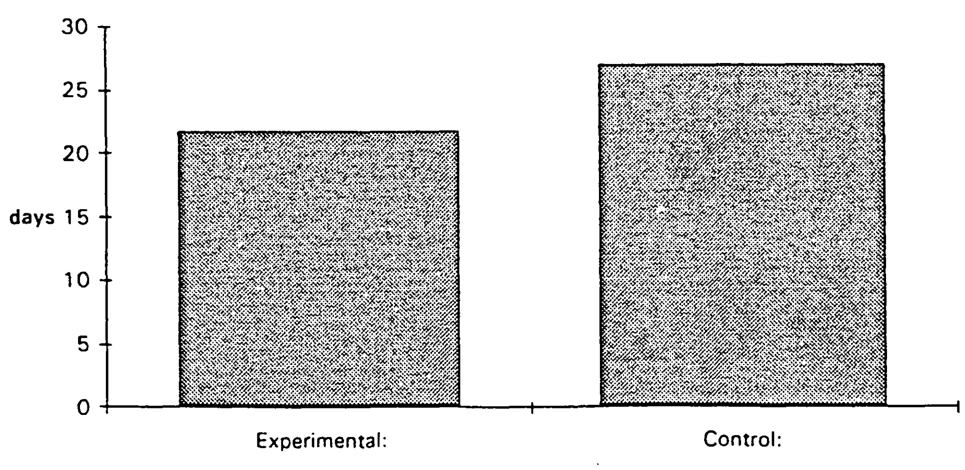
Table 6.3.1.1.2 AGE (IN DAYS) AT REMOVAL FROM CARE IN INCUBATOR TO CARE IN COT: REPLICATION STUDY

	MEAN	S.D.	N
Entire Population:	14.25	7.76	24
Experimental:	11.66	7.78	12
High Risk:	14.12	7.84	8
Low Risk:	6.75	5.50	4
Control:	16.83	7.13	12
High Risk:	21.16	7.11	6
Low Risk:	12.50	4.03	6
Overall High Risk:	16.46	8.46	13
Overall Low Risk:	11.63	6.23	11

Table 6.3.1.1.3 **AGE IN DAYS AT DISCHARGE FROM HOSPITAL: REPLICATION STUDY**

	MEAN	S.D.	N
Entire Population:	24.25	7.89	24
Experimental:	21.66	5.31	12
High Risk:	22.87	4.38	8
Low Risk:	19.25	6.84	4
Control:	26.83	9.35	12
High Risk:	32.66	9.41	6
Low Risk:	21.00	4.73	6
Overall High Risk:	27.23	8.67	13
Overall Low Risk:	20.72	5.29	11

Figure 6.3.1.1.3 **AGE IN DAYS AT DISCHARGE FROM HOSPITAL: REPLICATION STUDY**



6.3.1.2 t-tests / Manova

To determine the statistical significance of this data, a-priori independent and matched subjects t-tests were performed between the experimental and control groups, with Tac-Tic stroking being the between-subjects variable.

The independent t-test analyses revealed differences between the experimental (stroked) and control infants (non-stroked) which closely approached significance on all of the 3 measures of suck ($t = 1.68$, $df = 20$, $p < 0.054$, 1 tailed), cot ($t = 1.70$, $df = 22$, $p < 0.052$, 1 tailed) and discharge ($t = 1.66$, $df = 22$, $p < 0.055$, 1 tailed), with the experimental infants showing the developmentally more advanced results.

There was missing data on the suck data of two subjects due to these infants sucking all their feeds from birth.

On the matched subjects t-tests however, the experimental as compared to control sample showed significantly earlier ages on the variables of cot ($t = 3.63$, $df = 11$, $p < 0.002$ 1 tailed) and discharge ($t = 2.15$, $df = 11$, $p < 0.024$ 1 tailed). No significant difference was found between the samples on suck ($t = 0.32$, $df = 10$, $p < 0.312$).

It can thus be concluded from these analyses that the experimental sample show significant benefits in terms of speed of removal from an incubator to a cot and speed of discharge home.

Converting the mean differences between experimental and controls into percentages of the controls data, the experimental infants were found to show a:

(1) 19.04 % benefit in time from gavage to all suck feeds

(2) 30.07 % benefit in time in removal from care in an incubator to care in a cot

(3) 19.26 % benefit in speed of discharge from the hospital

By combining these three variables together, a meta-analysis, a multi-variate analysis of variance (MANOVA), was performed to determine whether the experimental, as compared to control, sample showed a significantly larger overall benefit.

MANOVA: Experimental vs Control Subjects on the 3 variable combination

Tests of Between-Subjects Effects.

Tests of Significance for T1 using UNIQUE sums of squares

Source of Var	SS	DF	MS	F	Sig.F
WITHIN CELLS	2756.85	20	137.84		
CONSTANT	25370.24	1	25370.24	184.05	.000
Exp/Contro	448.24	1	448.24	3.25	.086

EFFECT ..Exp/Control BY ALLVAR (All the variables combined together).
Multivariate Tests of Significance (S = 1, M = 0, N = 8 1/2)

Test Name	Value	Approx.F	Hyp. DF	Error DF	Sig.F
Pillais	.0231	.2254	2.0	19.0	.80
Hotellings	.0237	.2254	2.0	19.0	.80
Wilks	.9768	.2254	2.0	19.0	.80
Roys	.0231				

Tests involving 'ALLVAR' Within-Subject Effect.

AVERAGED Tests of Significance for MEAS.1 using UNIQUE sums of squares

Source of Var.	SS	DF	MS	F	Sig.F
WITHIN CELLS	520.4	40	13.0		
ALLVAR	1022.2	2	511.1	39.2	.00
Exp/Control BY ALLVAR	4.0	2	2.02	.15	.85

No significant difference was found between the experimental and control samples when all three variables were combined together.

6.3.1.3 CORRELATIONS

Pearson correlations were performed on the data and as expected, suck, cot and discharge all correlate significantly with each other as does birthweight with cot, discharge and gestation (see Table 6.3.1.3.1). Correlations were not conducted with the groups dealt with below, as they all belonged to the population on which the following correlations were calculated.

Suck= age (in days) when all feeds in a day were first sucked

Cot= age (in days) at removal from care within an incubator to care in a cot

Disch= age in days at discharge

Bwgt = Birthweight

Gest = Gestational age

Table 6.3.1.3.1 CORRELATIONS: REPLICATION STUDY

	Suck	Cot	Disch	Bwgt	Gest
Suck	-	0.70*	0.87*	non-sig	non-sig
Cot	0.70*	-	0.79*	0.70*	0.64*
Disch	0.87*	0.79*	-	0.63*	0.66*
Bwgt	non-sig	0.70*	0.63*	-	0.68*
Gest	non-sig	0.64*	0.66*	0.68*	-

* Significant at -0.001

6.3.1.4 High/Low risk groups

It can be seen from Tables 6.3.1.1.1 to 6.3.1.1.3 and Figures 6.3.1.4.1 to 6.3.1.4.3, the high-risk experimental as compared to high-risk control infants showed much lower ages than low-risk experimental as compared to control infants on the variables:

(1) age when all feeds in a day were first sucked

(2) age at discharge.

However, on the second variable, age at removal from care in an incubator to care in a cot, the comparison differences were quite similar.

Within the experimental and control samples, on the variables:

(1) age when all feeds in a day were first sucked

(2) age at discharge

the difference between the high-risk and low-risk groups is much greater within the control, as compared to experimental sample. On age at removal from care in an incubator to care in a cot, little difference exists between the high-risk and low-risk groups within the experimental as compared to control samples.

These results and the results of all the risk- group analyses, do however have to be interpreted cautiously because of their low cell numbers.

Figure 6.3.1.4.1 AGE WHEN ALL FEEDS IN A DAY WERE FIRST SUCKED: RISK GROUPS

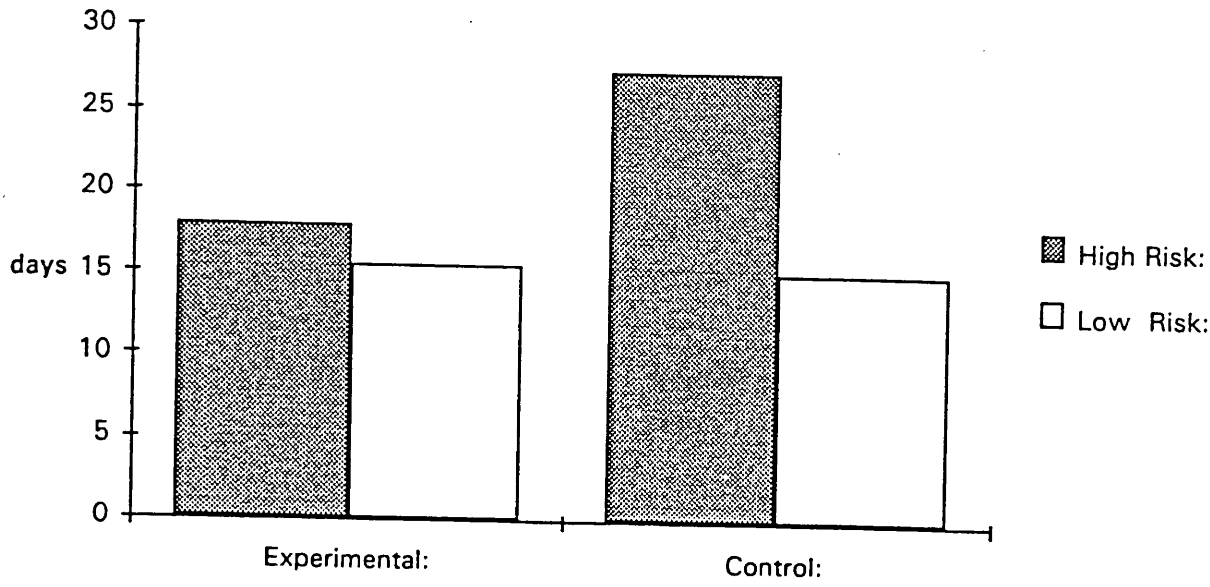


Figure 6.3.1.4.2 AGE AT REMOVAL FROM CARE IN INCUBATOR TO CARE IN COT: RISK GROUPS

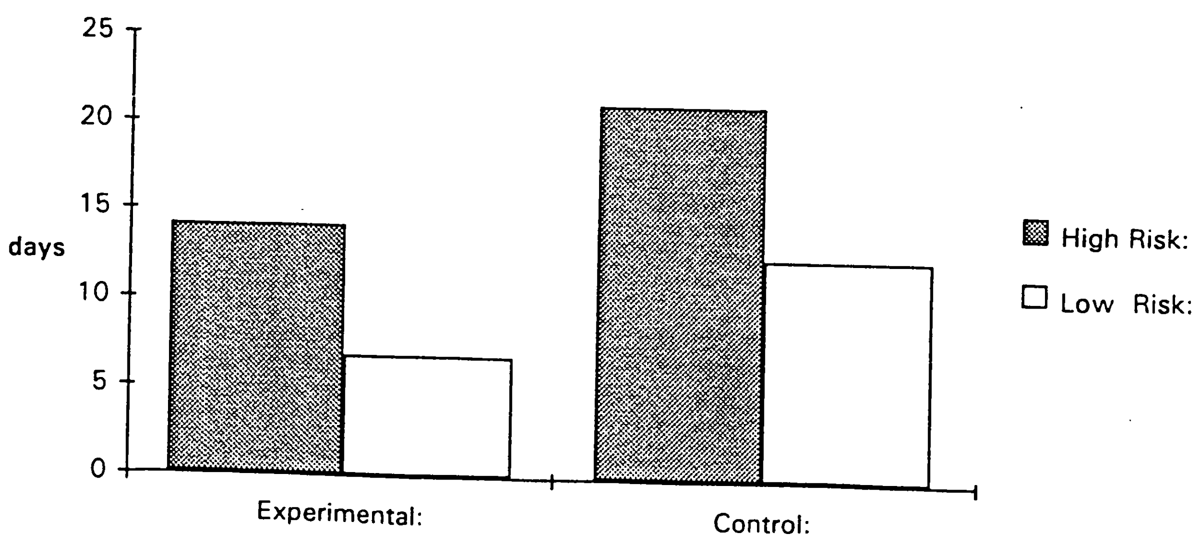
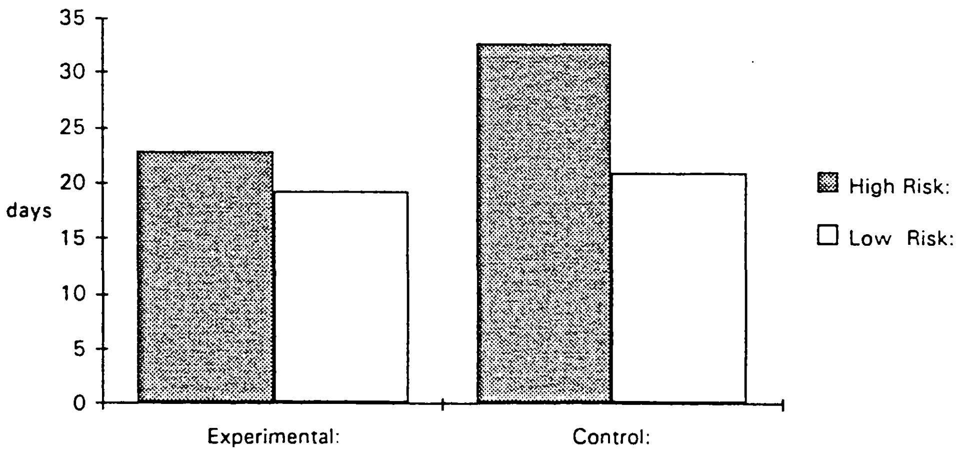


Figure 6.3.1.4.3 AGE IN DAYS AT DISCHARGE FROM HOSPITAL: RISK GROUPS



Oneway ANOVAs and post-hoc Scheffe t-tests, were conducted to examine the differences between the high-risk and low-risk groups of the experimental and control samples. The control high-risk group was found to be:

(1) significantly ($p< 0.05$) older than all the other groups, when they first sucked all their feeds in a day (SUCK; Section 6.3.2.1)

(2) significantly older ($p< 0.05$) than the experimental low-risk group, when moved from an incubator into a cot (COT; Section 6.3.2.2)

(3) significantly older ($p < 0.05$) than all the other groups when discharged home (DISCHARGE; Section 6.3.2.3)

6.3.1.4.1 SUCK

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Grps	3	648.38	216.12	9.23	.000
Within Grps	18	421.06	23.39		
Total	21	1069.45			

The value actually compared with Mean(J)-Mean(I)

is 3.4200 * Range * Sqrt(1/N(I) + 1/N(J)).

6.3.1.4.2 COT

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Grps	3	531.41	177.13	4.14	.019
Within Groups	20	855.08	42.75		
Total	23	1386.50			

The value actually compared with Mean(J)-Mean(I)

is 4.6235 * Range * Sqrt(1/N(I) + 1/N(J)).

6.3.1.4.3 DISCHARGE

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Grps	3	802.95	267.65	8.47	.000
Within Grps	20	631.54	31.57		
Total	23	1434.50			

The value actually compared with Mean(J)-Mean(I)

is 3.9735 * Range * Sqrt(1/N(I) + 1/N(J)).

6.3.1.5 Conclusions

To summarise, the results revealed that the stroked, as compared to non-stroked infants, displayed significant benefits, on two of the three dependent variables in terms of a significantly earlier age:

(1) at removal from care within an incubator to care in a cot (COT)

(2) at discharge (DISCHARGE).

No significant difference was found between the experimental and control samples on:

(1) age when all feeds in a day were first sucked (SUCK)

(2) the three variables when combined together in meta-analysis.

However the experimental sample showed the more developmentally advanced result on both suck and the meta-analysis.

The differences between the experimental and control samples appeared to occur particularly with the high-risk (low gestational age and birthweight) infants as:

(1) no significant differences were found between low-risk experimental and low-risk control samples on any of the variables, suggesting that the stroking programme had no effect on the low-risk infants in the variables examined.

On both age at first all feed sucking and discharge however, high-risk experimental (along with the low-risk experimental and control samples) infants were found to be significantly younger than the control high-risk sample.

(2) within the control but not experimental sample, the high-risk as compared to low-risk infants were found to show significant differences on age at first all feed sucking and discharge.

This suggests that the experimental but not control high-risk infants had in some way gained, becoming more similar to those of low-risk in their ages on the variables examined.

6.3.2 RESULTS: Extension of the Macedo (1984) replication study with Prospective controls and a long-term follow-up

The data of the extended replication study is dealt with first from Section 6.3.2.1 to 6.3.2.3. The long-term data is then covered in the Section 6.3.2.4.

6.3.2.1 Descriptive Statistics

The averaged data (Tables 6.3.2.1.1 to 6.3.2.1.3) as expected, shows that the stroked infants exhibit the more developmentally more advanced results (in terms of earlier ages) on the dependent variables of:

(1) age (in days) when all feeds in a day were first sucked (SUCK)

(2) age (in days) at removal from care within an incubator to care in a cot (COT)

(3) age in days at discharge (DISCHARGE)

Table 6.3.2.1.1 AGE WHEN ALL FEEDS IN A DAY WERE FIRST SUCKED: EXTENSION STUDY

	MEAN	S.D.	N
Entire Population:	17.90	13.26	40
Experimental:	14.10	7.09	20
High Risk:	16.60	6.22	10
Low Risk:	11.60	7.32	10
Control:	21.70	16.74	20
High Risk:	28.72	16.69	11
Low Risk:	13.11	12.91	9
Overall High Risk:	22.95	13.97	21
Overall Low Risk:	12.31	10.07	19

Table 6.3.2.1.2 AGE (IN DAYS) AT REMOVAL FROM CARE IN INCUBATOR TO CARE IN COT: EXTENSION STUDY

	MEAN	S.D.	N
Entire Population:	9.61	9.10	42
Experimental:	9.28	7.99	21
High Risk:	10.72	8.01	11
Low Risk:	7.70	8.08	10
Control:	9.95	10.28	21
High Risk:	14.09	10.69	11
Low Risk:	5.40	8.01	10
Overall High Risk:	12.40	9.37	22
Overall Low Risk:	6.55	7.92	20

Table 6.3.2.1.3 AGE IN DAYS AT DISCHARGE HOME: EXTENSION STUDY

	MEAN	S.D.	N
Entire Population:	22.47	14.38	42
Experimental:	19.85	8.69	21
High Risk:	23.27	8.46	11
Low Risk:	16.10	7.63	10
Control:	25.09	18.28	21
High Risk:	33.36	18.88	11
Low Risk:	16.00	13.08	10
Overall High Risk:	28.31	15.18	22
Overall Low Risk:	16.05	10.42	20

6.3.2.2 t-tests / Manova

The statistical significance of this data was calculated using a-prori independent and matched subjects t-tests with the Tac-Tic stroking being the between-subjects variable.

Both the independent and matched 1 tailed t-test analyses revealed statistically, significant differences between the experimental (stroked) and control (non-stroked) infants on suck, i.e. age in days when all feeds in a day were first sucked ($t= 1.87$, $df= 25.6$, separate var., $p< 0.030$; $t= 1.88$, $df= 18$, $p< 0.035$) but not cot ($t= 0.23$, $df= 40$, $p< 0.40$; $t=0.20$, $df= 20$, $p< 0.42$) or discharge ($t= 1.19$, $df= 28.6$, separate var., $p< 0.12$; $t= 1.18$, $df=20$ $p< 0.12$).

There was suck data missing for two subjects since they had sucked all their feeds from birth.

Converting the mean differences between experimental and control subjects into percentages of the control data, the experimental infants displayed a:

(1) 35.02 % benefit in acceleration in time from gavage to sucking of all daily feeds.

(2) 6.73 % benefit in acceleration in time in removal from care in an incubator to care in a cot

(3) 20.88 % benefit in speed of discharge home

By combining these three variables together, a meta-analysis, a multi-variate analysis of variance (MANOVA), was performed to determine whether the experimental, as compared to control, sample showed a significantly larger overall benefit.

Tests of Between-Subjects Effects.

Tests of Significance for T1 using UNIQUE sums of squares

Source of Var.	SS	DF	MS	F	Sig. F
WITHIN CELLS	16028.08	37	433.19		
CONSTANT	33205.73	1	33205.73	76.65	.001
Exp/Control	691.07	1	691.07	1.60	.214

EFFECT .. Exp/Control BY ALLVAR (All the variables combined together).
Multivariate Tests of Significance (S = 1, M = 0, N = 17)

Test Name	Value	Approx.F	Hyp. DF	Error DF	Sig.F
Pillais	.2304	5.38	2.0	36.0	.009
Hotellings	.2994	5.38	2.0	36.0	.009
Wilks	.7695	5.38	2.0	36.0	.009
Roys	.2304				

Tests involving 'ALLVAR' Within-Subject Effect.

AVERAGED Tests of Significance for MEAS.1 using UNIQUE sums of squares

Source of Var.	SS	DF	M	F	Sig.F
WITHIN CELLS	1493.5	74	20.1		
ALLVAR	3386.0	2	1693.0	83.8	.001
Exp/Control BY ALLVAR	243.9	2	121.9	6.0	.004

The experimental as compared to control sample was found to display a significantly more developmentally advanced result overall when the three variables of suck, cot and discharge were combined together ($f = 6$, $p < 0.004$).

6.3.2.3 Correlations

Pearson correlations were performed on the data and as expected, suck, cot, discharge, birthweight and gestation all correlated significantly with one another. Apgar at 1 minute score also correlated significantly with both birthweight and gestation and Apgar score at 5 minutes correlates significantly with discharge.

Correlations were not conducted with the risk groups dealt with below, as they all belonged to the population with which the aforementioned correlations were conducted on.

Table 6.3.2.3.1 CORRELATIONS

	Suck	Cot	Disch	Gest.	Bwgt	Ap1	Ap5
Suck	-	0.82*	0.97*	-0.56*	-0.66*	ns	ns
Cot	0.82*	-	0.86*	-0.42*	-0.83*	ns	ns
Disch	0.97	0.86*	-	-0.61*	-0.70*	ns	-0.37~
Gest	-0.56*	-0.42*	-0.61*	-	0.40*	ns	ns
Bwgt	-0.66*	-0.83*	-0.70*	0.40*	-	ns	ns

* Significant at 0.001 ~ Significant at 0.01

6.3.2.4 High and Low-risk groups

The experimental and control samples broken down into high-risk and low-risk groups in Tables 6.3.2.1.1 to 6.3.2.1.3 show again as in the previous study that high-risk experimental as compared to high-risk control infants showed much lower ages than low-risk experimental compared to low-risk control infants on the variables:

(1) age when all feeds in a day were first sucked

(2) age at discharge.

On the second variable though, age at removal from care within an incubator to care in a cot, the comparison differences between the high-risk and low-risk groups, across the experimental and control samples, were quite similar.

In this variable, in contrast to the previous study, the low-risk control, as compared to the low-risk experimental group, showed the younger mean age.

Analyses of the results were performed using oneway ANOVAs and post-hoc Scheffe t-tests to examine the differences between the high and low-risk groups of the experimental and control samples (Sections 6.2.3.4.1 to 6.2.3.4.3).

Both the high-risk experimental and high-risk control samples were found to be:

(1) significantly ($p < 0.05$) older than the low-risk experimental and control samples when they first sucked all their feeds in a day (SUCK)

(2) significantly ($p < 0.05$) older than the low-risk experimental and control samples when they were discharged (DISCHARGE).

The high-risk control sample was also found to be:

(1) significantly ($p < 0.05$) older than both the control and experimental low-risk samples when they were moved from care in an incubator to care in a cot (COT).

6.3.2.4.1 SUCK

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Grps	3	7337.47	2445.82	12.35	.000
Within Grps	36	7127.30	197.98		
Total	39	14464.77			

The value actually compared with Mean(J)-Mean(I)

is 9.9494 * Range * Sqrt(1/N(I) + 1/N(J))

6.3.2.4.2 COT

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Grps	3	6291.81	2097.27	5.95	.002
Within Groups	29	10219.52	352.39		
Total	32	16511.33			

The value actually compared with Mean(J)-Mean(I)

is 13.2740 * Range * Sqrt(1/N(I) + 1/N(J)).

6.3.2.4.3 DISCHARGE

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Grps	3	9724.34	3241.44	11.57	.000
Within Grps	36	10082.05	280.05		
Total	39	19806.40			

The value actually compared with Mean(J)-Mean(I)

is 11.8334 * Range * Sqrt(1/N(I) + 1/N(J)).

6.3.2.4 Long-term data

Analysis of the results of the

(1) Bayley Scales

(2) HOME Inventory

(3) S.P.P.R

was conducted using a-priori t-tests, one way ANOVAs and post-hoc Scheffe t-tests. Influence of stimulation in the home upon the results of the Bayley scales and the S.P.P.R. was examined using a co-variate analysis of variance.

6.3.2.4.1 Bayley Scales

A. Cognitive Measures

For each infant, the Bayley Mental Scale was scored using the Bayley Scales manual (1969), to yield an:

(1) M.D.I. (Mental Development Index) Score

The Ross (1985) Mental Fullterm Differentiation item, (composed of items 89, 95, 98, 100, 106, 107 from the Bayley Mental Scale which differentiate preterms from fullterms), was also employed yielding a:

(2) Mental Fullterm Differentiation Score

The Kohen-Raz (1967) subscales of the Bayley Mental Scale were also employed to analyze the Bayley mental scale yielding 5 scores on:

1. Eye-hand Co-ordination
2. Manipulation
3. Object-Relations
4. Imitation-Comprehension
5. Vocalization-Social Contact-Active Vocabulary

(3) Eye-hand Co-ordination

This subscale measures the co-ordination of prehension and vision which Piaget (1952) saw as underlying his third stage of mental development.

(4) Manipulation

This subscale taps well-aimed motor coordination and motor activity for its own sake which Piaget (1952) saw as underlying his third stage of mental development.

(5) Object-Relations

This subscale pertains to activities intended to come into touch with objects out of reach or sight and such activities are seen by Piaget (1952) to be basic processes underlying his fourth and fifth stages of mental development.

(6) Imitation-Comprehension

This subscale measures verbal understanding and graphic imitation with the premise that the understanding of spoken language is related to imitatory motor activity (Kohen-Raz, 1967).

(7) Vocalization-Social Contact-Active Vocabulary

Expressive movements and verbal utterances are measured by this scale with the premise that the expression of emotional needs by gestures and verbal utterances is a fundamental precedent for intentional and more objective language use (Kohen-Raz, 1967).

A.1 Descriptive Statistics

As can be seen from Tables 6.3.2.4.1.1. to 6.3.2.4.1.7 and Figures 6.3.2.4.1.1 and 6.3.2.4.1.2, there was a general tendency for the experimental group to score higher than the control group in all of the 7 cognitive measures.

Interestingly, within the experimental sample, those of high as compared to low-risk, tended to score the highest on the measures whereas within the control sample the reverse was true i.e those of low as compared to high-risk tended to score the highest across the measures. Looking between the experimental and control samples it can be seen that the high-risk groups differed more than the low-risk groups.

On Imitation-Comprehension and vocalization-social-contact, however the differences between the high-risk groups and the low-risk groups, across the experimental and control samples were very similar.

Table 6.3.2.4.1.1 MENTAL DEVELOPMENT INDEX (MDI)

	MEAN	S.D.	N
Entire Population:	96.15	18.96	26
Experimental:	104.30	15.73	13
High Risk:	112.83	18.51	6
Low Risk:	97.00	8.64	7
Control:	88.00	18.90	13
High Risk:	82.00	18.47	6
Low Risk:	93.14	19.07	7
Overall High Risk:	97.41	23.88	12
Overall Low Risk:	95.07	14.36	14

Figure 6.3.2.4.1.1 MENTAL DEVELOPMENT INDEX (MDI)

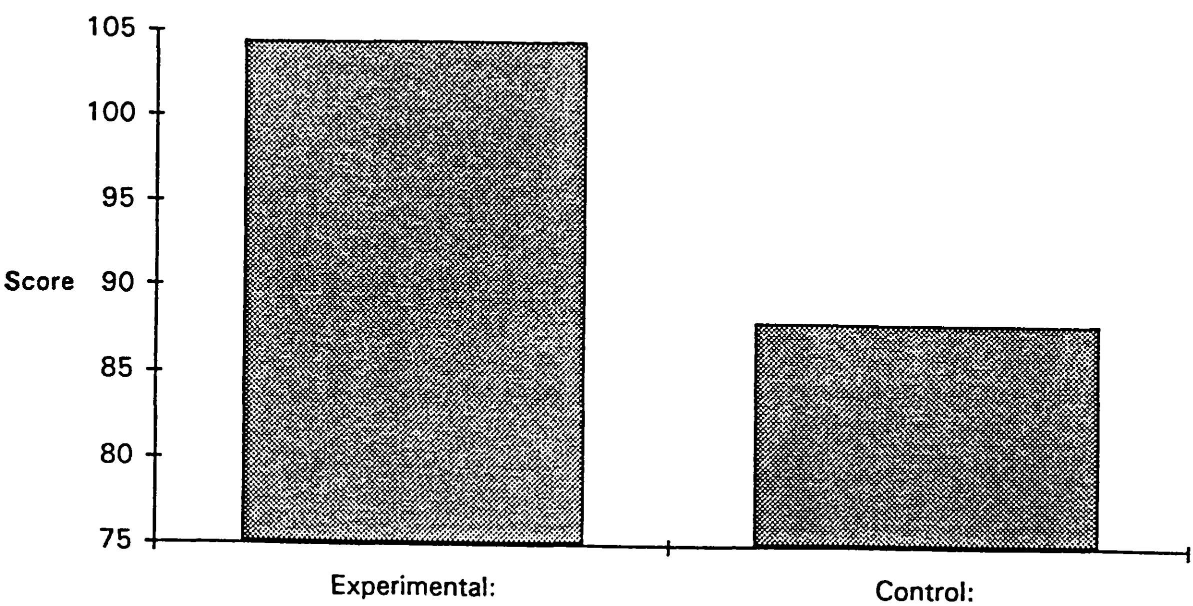


Table 6.3.2.4.1.2 MENTAL FULLTERM DIFFERENTIATION

	MEAN	S.D.	N
Entire Population:	3.96	1.18	26
Experimental:	4.23	1.36	13
High Risk:	4.33	1.63	6
Low Risk:	4.14	1.21	7
Control:	3.69	0.94	13
High Risk:	3.66	0.81	6
Low Risk:	3.71	1.11	7
Overall High Risk:	4.00	1.27	12
Overall Low Risk:	3.92	1.14	14

Table 6.3.2.4.1.3 EYE-HAND CO-ORDINATION

	MEAN	S.D.	N
Entire Population:	5.38	0.94	26
Experimental:	5.53	1.05	13
High Risk:	6.16	0.98	6
Low Risk:	5.00	0.81	7
Control:	5.23	0.83	13
High Risk:	5.50	0.83	6
Low Risk:	5.00	0.81	7
Overall High Risk:	5.83	0.93	12
Overall Low Risk:	5.00	0.78	14

Table 6.3.2.4.1.4 MANIPULATION

	MEAN	S.D.	N
Entire Population:	2.61	0.49	26
Experimental:	2.69	0.48	13
High Risk:	2.66	0.51	6
Low Risk:	2.71	0.48	7
Control:	2.53	0.51	13
High Risk:	2.33	0.51	6
Low Risk:	2.71	0.48	7
Overall High Risk:	2.50	0.52	12
Overall Low Risk:	2.71	0.46	14

Table 6.3.2.4.1.5 OBJECT-RELATIONS

	MEAN	S.D.	N
Entire Population:	4.69	0.54	26
Experimental:	4.76	0.43	13
High Risk:	4.83	0.40	6
Low Risk:	4.71	0.48	7
Control:	4.61	0.65	13
High Risk:	4.66	0.81	6
Low Risk:	4.57	0.53	7
Overall High Risk:	4.75	0.62	12
Overall Low Risk:	4.64	0.49	14

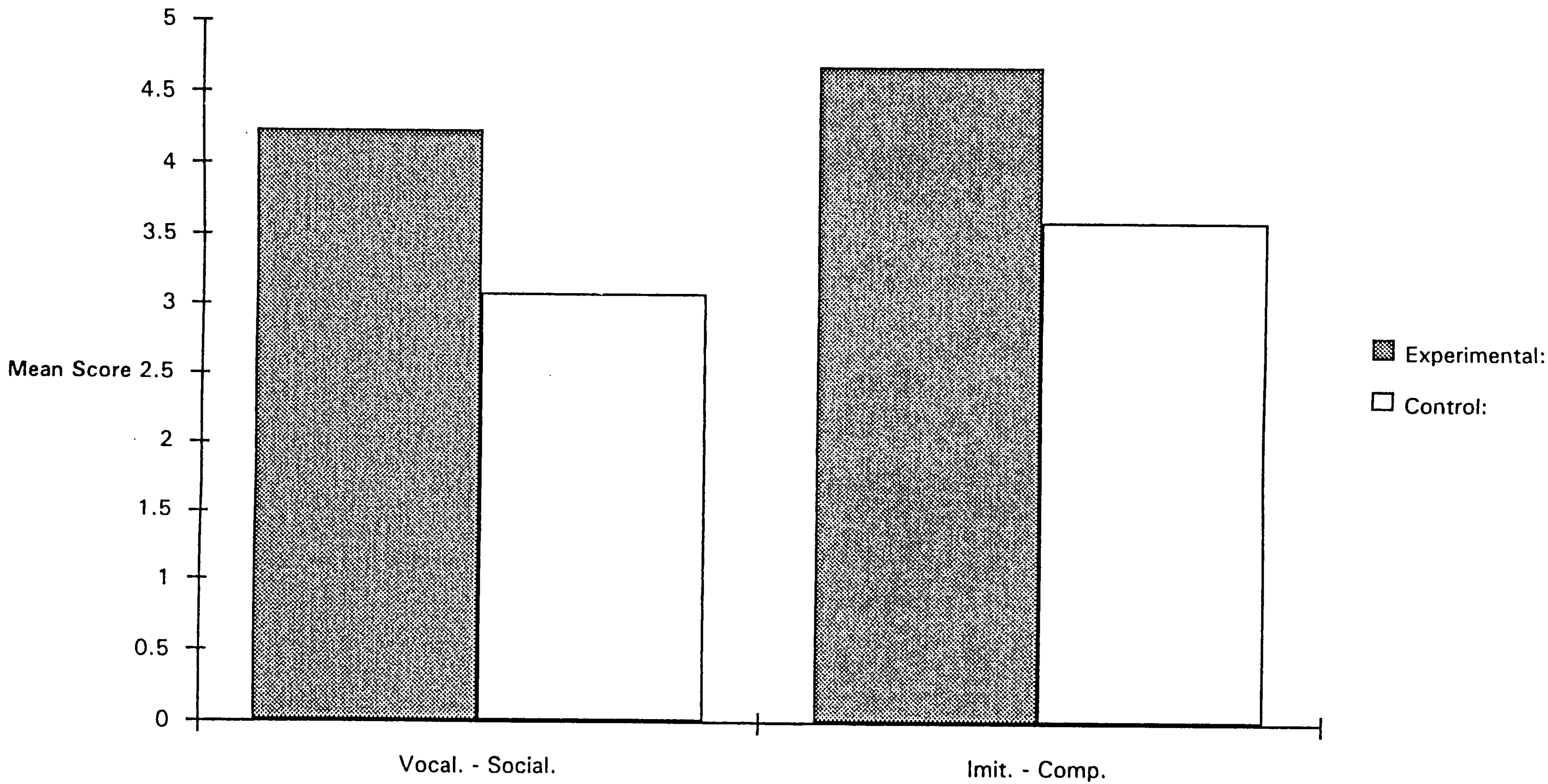
Table 6.3.2.4.1.6 IMITATION-COMPREHENSION

	MEAN	S.D.	N
Entire Population:	4.15	1.31	26
Experimental:	4.69	1.10	13
High Risk:	5.33	0.81	6
Low Risk:	4.14	1.06	7
Control:	3.61	1.32	13
High Risk:	3.33	1.03	6
Low Risk:	3.85	1.57	7
Overall High Risk:	4.33	1.37	12
Overall Low Risk:	4.00	1.30	14

Table 6.3.2.4.1.7 VOCALIZATION-SOCIAL-CONTACT

	MEAN	S.D.	N
Entire Population:	3.65	1.41	26
Experimental:	4.23	1.42	13
High Risk:	4.50	1.64	6
Low Risk:	4.00	1.29	7
Control:	3.07	1.18	13
High Risk:	3.33	1.50	6
Low Risk:	2.85	0.89	7
Overall High Risk:	3.91	1.62	12
Overall Low Risk:	3.42	1.22	14

Fig. 6.3.2.4.1.2 Vocalisation - Socialisation and Imitation - Comprehension Mean Scores



A.2 Co-variate Analyses

Stimulation in the home, as measured by the HOME Inventory, was not found to have a significant impact upon any of the 7 cognitive measures, by the co-variate analyses performed (Table 6.3.2.4.1.8).

A.3 Experimental vs Control t-tests

From the a-priori, independent t-tests in Table 6.3.2.4.1.9 and Figures 6.3.2.4.1.1, 6.3.2.4.1.6 and 6.3.2.4.1.7, it can be seen that significant differences, between the experimental and control infants, occurred in the cognitive measures of:

(1) Imitation-Comprehension

(2) Vocalization-Socialization-Active Vocabulary

(3) Mental Development (M.D.I).

Table 6.3.2.4.1.8 CO-VARIATE ANALYSES WITH HOME INVENTORY SCORES

Var	B	Beta	Sd.Er.	t	Sig.t	Lower	Upper
MDI	2.3	0.35	1.26	1.82	.081	-.30	4.9
MENT	0.09	0.21	0.08	1.05	.303	-.09	0.27
EYEH	0.02	0.06	0.07	0.31	.755	-.12	0.17
MANIP	0.05	0.27	0.03	1.35	.190	-.02	0.12
OBJREL	0.01	0.08	0.04	0.40	.689	-.07	0.10
IMITCO	0.15	0.33	0.09	1.70	.102	-.03	0.33
VOCSOC	0.02	0.05	0.10	0.27	.784	-.18	0.23

MDI = Mental Development Index

MENT = Mental Differentiation Score

EYEH = Eye-Hand Co-ordination

MANIP = Manipulation

OBJREL= Object-Relations

IMITCO= Imitation-Comprehension

VOCSOC= Vocalization-Social Contact

Table 6.3.2.4.1.9 EXPERIMENTAL VS CONTROL T-TEST RESULTS

variable	t	var	df	1 tailed p<
MDI	2.39	pooled	24	.01
MENT	1.17	pooled	24	.12
EYEH	.83	pooled	24	.41
MANIP	.78	pooled	24	.44
OBJREL	0.71	pooled	24	.48
IMITCOMP	2.25	pooled	24	.03
VOCSOC	2.24	pooled	24	.03

A.3 High-risk and Low-risk groups

Oneway ANOVAs and post-hoc Scheffe t-tests were performed to examine the differences between the high and low risk groups of the experimental and control samples. Comparing these groups, none of them differed significantly with each other on any of the 7 cognitive variables at the $p < 0.05$ level.

(1) Mental Development Index: Anova

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Grps	3	2134.86	711.62	2.28	.107
Within Grps	22	6856.52	311.660		
Total	25	8991.38			

The value actually compared with Mean(J)-Mean(I) is 12.4832 * Range * Sqrt(1/N(I) + 1/N(J)). No two groups are significantly different at the $p < 0.05$ level.

(2) Mental Full-Term Differentiation Score Anova

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Grps	3	3.53	1.17	.824	.494
Within Grps	22	31.42	1.42		
Total	25	34.96			

The value actually compared with Mean(J)-Mean(I) is 0.8452 * Range * Sqrt(1/N(I) + 1/N(J)). No two groups are significantly different at the $p < 0.05$ level.

(3) Eye-Hand Co-ordination: Anova

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Grps	3	4.65	1.55	1.95	.151
Within Grps	22	17.50	.795		
Total	25	22.15			

The value actually compared with Mean(J)-Mean(I) is 0.6307 * Range * Sqrt(1/N(I) + 1/N(J)). No two groups are significantly different at the p< 0.05 level.

(4) Manipulation: Anova

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Grps	3	.3919	.1306	.498	.686
Within Grps	22	5.7619	.2619		
Total	25	6.1538			

The value actually compared with Mean(J)-Mean(I) is 0.3619 * Range * Sqrt(1/N(I) + 1/N(J)). No two groups are significantly different at the p< 0.05 level.

(5) Object-Relations: Anova

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Grps	3	1.919	.6398	2.50	.085
Within Grps	22	5.619	.2554		
Total	25	7.538			

The value actually compared with Mean(J)-Mean(I) is 0.3574 * Range * Sqrt(1/N(I) + 1/N(J)).No groups are significantly different at the p< 0.05 level.

(6) Imitation-Comprehension: Anova

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Grps	3	12.908	4.302	3.10	.047
Within Grps	22	30.476	1.385		
Total	25	43.384			

The value actually compared with Mean(J)-Mean(I) is 0.8323 * Range * Sqrt(1/N(I) + 1/N(J)). No two groups are significantly different at the p< 0.05 level.

(7) Vocalization-Socialization Anova

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Grps	3	12.40	4.136	2.42	.092
Within Grps	22	37.47	1.703		
Total	25	49.88			

The value actually compared with Mean(J)-Mean(I) is 0.9229 * Range * Sqrt(1/N(I) + 1/N(J)).No two groups are significantly different at the p< 0.05 level.

(B) Motor Measures

For each of the subjects, the P.D.I (Motor Development Index) was calculated, using the B.S.I.D. manual (Bayley, 1969), yielding a:

(1) P.D.I Score

The Ross (1985) Motor Fullterm Differentiation item, composed of items 41, 45,46 and 47 from the Bayley Mental Scale, which differentiates preterms from full-terms, was also employed yielding a:

(2) Motor Full-term Differentiation Score.

B.1 Descriptive Statistics

From the tables (Tables 6.3.2.4.1.10 and 6.3.2.4.1.11) it is clear that though the experimentals scored slightly higher than the controls on P.D.I, the reverse holds true in Motor Fullterm Differentiation, both of which are measures of motor development.

While within the experimental sample, those of high-risk as compared to low-risk again show the higher scores, in the control sample those of low risk again show the higher scores on both P.D.I. score and Motor Fullterm Differentiation score.

Table 6.3.2.4.1.10 MOTOR DEVELOPMENT INDEX (PDI)

	MEAN	S.D.	N
Entire Population:	100.46	14.31	26
Experimental:	101.07	13.23	13
High Risk:	111.66	5.71	6
Low Risk:	92.00	10.70	7
Control:	99.84	15.85	13
High Risk:	92.00	17.77	6
Low Risk:	106.57	11.17	7
Overall High Risk:	101.83	16.24	12
Overall Low Risk:	99.28	12.95	14

Table 6.3.2.4.1.11 MOTOR FULLTERM DIFFERENTIATION SCORES

	MEAN	S.D.	N
Entire Population:	3.38	0.80	26
Experimental:	3.15	0.89	13
High Risk:	3.50	0.83	6
Low Risk:	2.85	0.89	7
Control:	3.61	0.65	13
High Risk:	3.50	0.83	6
Low Risk:	3.71	0.48	7
Overall High Risk:	3.50	0.79	12
Overall Low Risk:	3.28	0.82	14

Co-variate analyses with Home Inventory score

Var	B	Beta	Sd.Er.	t	Sig.t	Lower	Upper
PDI	1.24	0.22	1.10	1.12	.273	-1.04	3.53
MOTOR	0.08	0.29	0.05	1.48	.152	-0.03	0.20

B.2. Co-variate Analyses

Stimulation in the home, as assessed by the Home Inventory (Caldwell and Bradley, 1984), was not found to exert a significant impact upon either P.D.I or Motor Fullterm Differentiation scores.

B.3. Experimental vs Control samples

No significant differences were found by independent a-priori t-tests between experimental and control infants on the 2 measures of motor development PDI ($t= 0.21$, $df= 24$, $p< 0.41$, 1 tailed) and Motor Fullterm Differentaition ($t= 1.5$, $df= 24$, $p< 0.07$, 1 tailed).

B.4 High-risk and Low-risk groups

Looking between the experimental and control samples it can be seen that the high-risk groups differed more than the low-risk groups on the motor development index factor only. In both variables, the high-risk (as compared to low-risk) infants obtained the highest mean score in the experimental sample, while the low-risk group had the higher score in the control sample.

Oneway ANOVAs and post-hoc Scheffe t-tests were performed to examine the differences between the high and low-risk sub-groups of the experimental and control samples.

No significant differences between the groups were found on the 2 motor development variables at the $p< 0.05$ level.

(1) Motor Development Index (PDI): Anova

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Grps	3	1063.27	354.42	1.91	.156
Within Grps	22	4063.19	184.69		
Total	25	5126.46			

The value actually compared with Mean(J)-Mean(I)

is 9.6096 * Range * Sqrt(1/N(I) + 1/N(J))

No two groups are significantly different at the

p< 0.05 level.

(2) Motor Full-Term Differentiation Score: Anova

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Grps	3	4.55	1.51	2.88	.058
Within Grps	22	11.59	.527		
Total	25	16.15			

The value actually compared with Mean(J)-Mean(I)

is 0.5133 * Range * Sqrt(1/N(I) + 1/N(J))

No two groups are significantly different at the

p< 0.05 level.

(C) Infant Behavioural Record Measures

Analysis of the I.B.R's of the Bayley Scales was conducted using Meisels et al.'s (1987) factor structure (based on that of Matheny, 1980) yielding 6 factors (composed of items from the I.B.R.).

(1) Test Affect-Extraversion (T-A-E)

This is a measure of how outgoing, positive and involved the infant was in the social give and take of the test situation. Many of the behavioural characteristics defined by Bayley et al. (1964) as constituting their extraversion-introversion dimension and accounting for much variance of mental and motor performance, were found by Matheny (1980) to belong to this factor.

(2) Activity (ACTIV)

This factor measures overall activity or body motion and energy level exhibited by the infant during the course of assessment and is a useful factor to assess, given that activity has been consistently established as a component of temperament or personality at any age (Thomas and Chess, 1977).

(3) Task Orientation (TASK-O)

This factor refers to the infant's general involvement with testing as a task, which according to Piaget (1952) is a fundamental cognitive attitude that necessarily links mental activities with the directed objective of those activities (Matheny, 1980).

(4) Auditory-Visual Awareness (A-V-A)

This factor pertains to degree of awareness of the general stimulus flux, threshold of responsiveness and distractability (Matheny, 1980).

(5) Motor Co-Ordination (MOTORCOR)

This factor measures degree of motor co-ordination with higher scores reflecting poorer co-ordination.

(6) Social-Orientation (SOCIAL-O)

This refers to the infant's general interest or involvement with other persons (Meisels et al., 1987).

C.1. Descriptive Statistics

Experimental as compared to control infants were found to have higher Test-Affect-Extraversion, Activity, Task-Orientation, Auditory-Visual-Awareness and Social-Orientation mean scores, in comparison to control infants. Control infants were though found to show a higher motor co-ordination mean score than experimental infants.

Within the experimental sample, in general, high- risk as compared to low-risk infants tend to show the higher mean scores on the various behavioural measures. This is not true of the control infant sample though as high-risk and low-risk control infants tend to show relatively varied mean scores in comparison to each other on each of the behavioural measures (Tables 6.3.2.4.1.12 to 6.3.2.4.1.17). Comparing across the experimental and control samples, the differences between the high-risk groups and the low-risk groups, were very similar.

Table 6.3.2.4.1.12 TEST-AFFECT-EXTRAVERSION

	MEAN	S.D.	N
Entire Population:	39.34	5.37	26
Experimental:	41.76	5.81	13
High Risk:	44.16	3.25	6
Low Risk:	39.71	6.94	7
Control:	36.92	3.68	13
High Risk:	36.83	4.91	6
Low Risk:	37.00	2.64	7
Overall High Risk:	40.50	5.51	12
Overall Low Risk:	38.35	5.24	14

Table 6.3.2.4.1.13 ACTIVITY

	MEAN	S.D.	N
Entire Population:	16.46	1.96	26
Experimental:	17.76	1.42	13
High Risk:	17.33	1.75	6
Low Risk:	18.14	1.06	7
Control:	15.15	1.51	13
High Risk:	15.16	0.98	6
Low Risk:	15.14	1.95	7
Overall High Risk:	16.25	1.76	12
Overall Low Risk:	16.64	2.17	14

Table 6.2.3.4.1.14 TASK ORIENTATION

	MEAN	S.D.	N
Entire Population:	22.23	3.31	26
Experimental:	22.69	2.86	13
High Risk:	23.50	2.34	6
Low Risk:	22.00	3.26	7
Control:	21.76	3.76	13
High Risk:	22.16	4.16	6
Low Risk:	21.42	3.69	7
Overall High Risk:	22.83	3.29	12
Overall Low Risk:	21.71	3.36	14

Table 6.3.2.4.1.15 AUDITORY-VISUAL AWARENESS

	MEAN	S.D.	N
Entire Population:	23.73	2.82	26
Experimental:	25.92	1.80	13
High Risk:	26.16	1.83	6
Low Risk:	25.71	1.88	7
Control:	21.53	1.71	13
High Risk:	21.33	2.25	6
Low Risk:	21.71	1.25	7
Overall High Risk:	23.75	3.19	12
Overall Low Risk:	23.71	2.58	14

Table 6.3.2.4.1.16 MOTOR CO-ORDINATION

	MEAN	S.D.	N
Entire Population:	11.15	2.01	26
Experimental:	10.92	2.32	13
High Risk:	12.33	0.81	6
Low Risk:	9.71	2.56	7
Control:	11.38	1.70	13
High Risk:	11.16	1.16	6
Low Risk:	11.57	2.14	7
Overall High Risk:	11.75	1.13	12
Overall Low Risk:	10.64	2.46	14

Table 6.3.2.4.1.17 SOCIAL ORIENTATION

	MEAN	S.D.	N
Entire Population:	12.38	2.80	26
Experimental:	14.00	2.16	13
High Risk:	14.16	2.13	6
Low Risk:	13.85	2.34	7
Control:	10.76	2.45	13
High Risk:	9.83	1.32	6
Low Risk:	11.57	2.99	7
Overall High Risk:	12.00	2.82	12
Overall Low Risk:	12.71	2.84	14

Table 6.3.2.4.1.18 CO-VARIATE ANALYSES WITH HOME INVENTORY SCORES

Var	B	Beta	Sd.Er.	t	Sig.t	Lower*	Upper
T-A-E	0.33	0.18	0.37	0.89	.38	-0.43	1.10
ACTIV	-0.27	-0.50	0.09	-2.76	.01	-0.48	-0.07
TASKO	0.57	0.45	0.23	2.46	.02	0.09	1.05
A-V-A	-0.12	-0.18	0.13	-0.90	.37	-0.40	0.15
MCOR	0.33	0.44	0.14	2.36	.02	0.04	0.63
SOCO	0.03	0.03	0.18	0.17	.86	-0.34	0.40

Table 6.3.2.4.1.19 EXPERIMENTAL VS CONTROL T-TEST RESULTS

variable	t	var	df	1 tailed p<
T-A-E	2.54	pooled	24	.00
ACTIVITY	4.53	pooled	24	.00
TASK-O	0.70	pooled	24	.24
A-V-A	6.36	pooled	24	.00
MCOR	0.58	pooled	24	.23
SOCO	3.56	pooled	24	.00

C.2. Behavioural Co-variate Analyses

Stimulation in the home, as assessed by the Home Inventory (Bradley and Caldwell, 1984), was found (Table 6.3.2.4.1.18) to have a significant impact upon the 3 behavioural measures of:

(1) Activity

(2) Task-Orientation

(3) Motor Co-ordination.

C.3. Experimental vs Control t-tests

Experimental as compared to the control infants, showed significantly higher scores on:

(1) Test-Affect-Extraversion

(2) Activity

(3) Auditory-Visual-Awareness

(4) Social Orientation

as indicated by the a-priori independent t-tests in Table 6.3.2.4.1.19.

C.4 High-risk and Low-risk groups

Oneway ANOVAs and post-hoc Scheffe t-tests were performed to examine the differences between the high-risk and low-risk groups of the experimental and control samples.

A number of significant ($p < 0.05$) differences were found including:

(a) experimental low-risk infants scored higher than the control high-risk or low-risk groups in activity

(b) experimental high-risk and low-risk groups both scored higher than control high-risk and low-risk groups in auditory-visual-awareness

(c) experimental high-risk and low-risk groups both scored higher than the control high-risk groups in social orientation.

(1) Test Affect-Extraversion: Anova

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Grps	3	238.19	79.39	3.61	.029
Within Grps	22	483.69	21.98		
Total	25	721.88			

The value actually compared with Mean(J)-Mean(I) is 3.3156 * Range * Sqrt(1/N(I) + 1/N(J)).No two groups are significantly different at the p< 0.05 level.

(2) Activity: Anova

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Grps	3	46.48	15.49	6.82	.002
Within Grps	22	49.97	2.27		
Total	25	96.46			

The value actually compared with Mean(J)-Mean(I) is 1.0657 * Range * Sqrt(1/N(I) + 1/N(J)).

(3) Task-Orientation: Anova

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Grps	3	33.99	11.33	1.036	.396
Within Groups	22	240.619	10.93		
Total	25	274.615			

The value actually compared with Mean(J)-Mean(I) is 2.3385 * Range * Sqrt(1/N(I) + 1/N(J)). No two groups are significantly different at the p< 0.05 level.

(4) Auditory-Visual Awareness: Anova

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Grps	3	128.25	42.75	13.27	.000
Within Grps	22	70.85	3.22		
Total	25	199.11			

The value actually compared with Mean(J)-Mean(I)
is 1.2690 * Range * Sqrt(1/N(I) + 1/N(J))

(5) Motor Co-ordination: Anova

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Grps	3	14.64	4.88	1.23	.319
Within Grps	22	86.73	3.94		
Total	25	101.38			

The value actually compared with Mean(J)-Mean(I)
is 1.4040 * Range * Sqrt(1/N(I) + 1/N(J)). No two groups are significantly different at the $p < 0.05$ level.

(6) Social Orientation: Anova

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Grps	3	77.60	25.86	4.80	.010
Within Grps	22	118.54	5.38		
Total	25	196.15			

The value actually compared with Mean(J)-Mean(I)
is 1.6414 * Range * Sqrt(1/N(I) + 1/N(J)).

6.3.2.4.2 HOME Measure

Stimulation in the home was assessed using the Home Inventory (Caldwell and Bradley, 1984) yielding a HOME Inventory Score.

A. Descriptive Statistics

Control as compared to experimental infants were found to show the higher HOME Inventory (stimulation) mean score. Within the experimental sample those of high-risk, as compared to low-risk displayed the higher mean score with the reverse being true of the control sample (Table 6.3.2.4.1.20).

Comparing across the samples, the difference between the high-risk groups as compared to that between the low-risk groups is quite similar.

Table 6.3.2.4.1.20 HOME INVENTORY SCORES

	MEAN	S.D.	N
Entire Population:	39.34	2.85	26
Experimental:	38.23	2.61	13
High Risk:	39.66	2.80	6
Low Risk:	37.00	1.82	7
Control:	40.46	2.72	13
High Risk:	40.00	3.68	6
Low Risk:	40.85	1.77	7
Overall High Risk:	39.83	3.12	12
Overall Low Risk:	38.92	2.64	14

B. Experimental vs Control t-tests

Though no difference was hypothesized to occur between the experimental as compared to the control sample on stimulation in the home, control as compared to experimental infants, were found, by an a-priori, independent t-test, to have homes significantly higher in their stimulation content ($t= 2.13$, $df= 24$, $p< 0.04$, 2 tailed).

C. High and Low-risk groups

A oneway ANOVA and post-hoc Scheffe t-tests were conducted to examine the differences between the high and low-risk groups of the experimental and control samples. Comparing these groups, none were found to differ significantly at the $p< 0.05$ level.

Analysis of Variance

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Grps	3	45.14	15.04	2.08	.131
Within Grps	22	158.73	7.21		
Total	25	203.88			

The value actually compared with Mean(J)-Mean(I) is 1.8994 * Range * Sqrt(1/N(I) + 1/N(J)). No two groups are significantly different at the $p < 0.05$ level.

Table 6.3.2.4.1.21 S.P.P.R. TOTAL SCORES

	MEAN	**S.D.**	**N**
Entire Population:	83.26	8.87	23
Experimental:	82.58	8.18	12
High Risk:	85.16	10.92	6
Low Risk:	80.00	3.46	6
Control:	84.00	9.91	11
High Risk:			
Low Risk:	81.00	12.86	6
Overall High Risk:	86.27	8.06	11
Overall Low Risk:	80.50	9.00	12

6.3.2.4.3 PARENTAL S.P.P.R. MEASURE

A. Descriptive Statistics

Analysis of the S.P.P.R's yielded five scores, one total score (S.P.P.R) and four S.P.P.R section scores:

(1) S.P.P.R

(2) Investment

(3) Competence

(4) Integration

(5) Satisfaction

On total S.P.P.R, control as compared to experimental parents, showed the higher means, with those with high-risk infants, within both samples (and overall) showing the higher mean scores in comparison to those parents with low- risk infants (Table 6.3.2.4.1.21).

A.1 Sub-sections

A.1.1.Investment

In Investment, the experimental and control parents showed virtually no difference in their mean score, with those with low-risk as compared to high-risk infants, within the experimental sample and those with high-risk as compared to low-risk infants in the control sample, showing the higher mean scores (Table 6.3.2.4.1.22).

A.1.2 Competence

In competence, control as compared to experimental parents, displayed the higher mean, with those with high-risk as compared to low-risk infants, within the experimental sample and those with low-risk as compared to high-risk infants in the control sample showing the higher means (Table 6.3.2.4.1.23).

A.1.3 Integration

Control as compared to experimental parents were found to show a higher Integration mean score. Within the experimental sample, those parents with low-risk, as compared to high-risk infants, displayed the higher mean score, with the reverse being true of the control sample (Table 6.3.2.4.1.24).

A.1.4 Satisfaction

Experimental as compared to control parents were found to have a higher Satisfaction mean score. Within the experimental parents, those with high-risk, as compared to low-risk infants displayed the higher mean score whereas the reverse was true within the control sample (Table 6.3.2.4.1.25).

B. Experimental vs Control t-tests

The only significant difference found between the experimental and control parents, using a-priori, independent t-tests was on satisfaction, with the experimental sample scoring the higher total (Table 6.3.2.4.1.26).

Table 6.3.2.4.1.22 INVESTMENT

	MEAN	S.D.	N
Entire Population:	13.76	3.94	25
Experimental:	13.75	2.98	12
High Risk:	13.00	3.67	5
Low Risk:	14.28	2.56	7
Control:	13.76	4.78	13
High Risk:	14.00	6.32	6
Low Risk:	13.57	3.50	7
Overall High Risk:	13.54	5.06	11
Overall Low Risk:	13.92	2.97	14

Table 6.3.2.4.1.23 COMPETENCE

	MEAN	S.D.	N
Entire Population:	22.39	4.16	23
Experimental:	21.83	3.66	12
High Risk:	23.00	5.61	5
Low Risk:	21.00	1.29	7
Control:	23.00	4.75	11
High Risk:	22.33	5.92	6
Low Risk:	23.80	3.34	5
Overall High Risk:	22.63	5.50	11
Overall Low Risk:	22.16	2.65	12

Table 6.3.2.4.1.24 INTEGRATION

	MEAN	S.D.	N
Entire Population:	23.26	4.47	23
Experimental:	22.33	3.17	12
High Risk:	22.00	3.46	5
Low Risk:	22.57	3.20	7
Control:	24.27	5.55	11
High Risk:	24.33	6.77	6
Low Risk:	24.20	4.43	5
Overall High Risk:	23.27	5.40	11
Overall Low Risk:	23.25	3.67	12

Table 6.3.2.4.1.25 SATISFACTION

	MEAN	S.D.	N
Entire Population:	22.86	2.43	23
Experimental:	23.83	1.11	12
High Risk:	24.00	1.00	5
Low Risk:	23.71	1.25	7
Control:	21.81	3.06	11
High Risk:	21.66	2.80	6
Low Risk:	22.00	3.67	5
Overall High Risk:	22.72	2.41	11
Overall Low Risk:	23.00	2.55	12

Table 6.3.2.4.1.26 Experimental vs Control S.P.P.R t-tests

variable	t	variance	df	1 tailed p<
SPPR Total	0.37	pooled	21	.35
INVESTMENT	0.01	pooled	23	.49
COMPETENCE	0.66	pooled	21	.25
INTEGRATION	1.04	pooled	21	.15
SATISFACTION	2.06	separate	12.4	.03

C. High and Low-risk groups

Oneway ANOVAs with post-hoc Scheffe t-tests were performed to examine the differences between the high and low risk groups of the experimental and control samples. No significant differences were found between any of the groups either in total score or in any of the sub-section scores.

(1) Self Perceptions of the Parental Role (S.P.P.R.) total: Anova

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Grps	3	210.40	70.13	.875	.471
Within Grps	19	1522.03	80.10		
Total	22	1732.43			

The value actually compared with Mean(J)-Mean(I) is 6.3288 * Range * Sqrt(1/N(I) + 1/N(J)). No two groups are significantly different at the p< 0.05 level.

(2) Investment: Anova

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Grps	3	1.56	.520	.029	.993
Within Grps	21	371.00	17.666		
Total	24	372.56			

The value actually compared with Mean(J)-Mean(I) is 2.9721 * Range * Sqrt(1/N(I) + 1/N(J)). No two groups are significantly different at the p< 0.05 level.

(3) Competence: Anova

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Grps	3	20.17	6.72	.353	.787
Within Grps	19	361.30	19.01		
Total	22	381.47			

The value actually compared with Mean(J)-Mean(I) is 3.0835 * Range * Sqrt(1/N(I) + 1/N(J)). No two groups are significantly different at the p< 0.05 level.

(4) Integration: Anova

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Grps	3	83.13	27.71	1.47	.253
Within Grps	19	357.30	18.80		
Total	22	440.43			

The value actually compared with Mean(J)-Mean(I) is 3.0664 * Range * Sqrt(1/N(I) + 1/N(J)). No two groups are significantly different at the p< 0.05 level.

(5) Satisfaction: Anova

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Grps	3	26.40	8.80	1.605	.221
Within Grps	19	104.20	5.48		
Total	22	130.60			

The value actually compared with Mean(J)-Mean(I) is 1.6559 * Range * Sqrt(1/N(I) + 1/N(J)).

No two groups are significantly different at the p< 0.05 level.

D. CORRELATIONS

D.1 Cognitive/Motor Variables

GEST = Gestational age BWGT = Birthweight

MDI = Mental Development Index Score

PDI = Motor Development Index Score

HOME = Home Inventory Total

MENT = Mental Fullterm Differentiation Score

IMITC = Imitation-Comprehension Score

VOCSOC= Vocalization-Socialization Score

Table D.1 CORRELATIONS: Cognitive/Motor

	GEST	BWGT	MDI	PDI	HOME
GEST	-	0.50*	0.05	0.34	-0.2
BWGT	0.5*	-	0.64	0.01	-0.29
MDI	0.05	0.64	-	0.50*	-0.03
PDI	0.34	0.01	0.50*	-	0.07
HOME	-0.2	-0.29	-0.03	0.07	-

	MDI	PDI	MENT
MENT	0.60*	-0.12	-
MOTOR	0.17	0.45	0.00
IMITC	0.75*	0.39	0.69*
VOCSOC	0.28	-0.22	0.66*

* Sig corr. 0.01 1 tailed

None of these variables correlated significantly with Gestation or Birthweight. None of the other M.D.I factors (Eye-Hand Coordination, Manipulation or Object-Relations) showed any significant correlations with gestational age or birthweight.

D.2 I.B.R. Variables: I.B.R.

TAE = Test-Affect-Extraversion

ACT = Activity TASK = Task-Orientation

AVA = Auditory-Visual-Awareness

MCOR = Motor Co-ordination

SOCO = Social Orientation

Table D.2 CORRELATIONS

	TAE	ACT	TASK	AVA	MCOR	SOCO
TAE	-	0.25	0.36	0.55*	-0.33	0.68*
ACT	0.25	-	-0.2	0.70*	-0.43	0.49*
TASK	0.36	-0.2	-	-0.01	0.27	-0.00
AVA	0.55*	0.70*	-0.01	-	-0.29	0.62*
MCOR	-0.33	-0.43	0.27	-0.29	-	-0.58*
SOCO	0.68*	0.49*	-0.00	0.62*	-0.58*	-

Given that some of these factors shared the same items it is understandable that they would correlate with each other. None of these correlated significantly though with the M.D.I. or Home Inventory (HOME) and only Motor Coordination (MCOR) correlated significantly with P.D.I. (0.54*), as expected given that they both reflect motor development. None of these variables either correlated significantly with Gestation or Birthweight.

6.3.3 CONCLUSIONS

Overall the long-term developmental assessment showed that:

1. Experimental infants showed benefits in physical, cognitive and social development as compared to their controls.

2. Such benefits did not appear to be maximal when the infant is of high-risk (i.e low gestation and birthweight) status.

   This was shown by:

   a. Both the high-risk experimental and high-risk control samples being significantly older than the low-risk experimental and control samples when they first sucked all their feeds in a day and were discharged.

   b. The lack of any significant differences between the risk groups in the cognitive, motor and parental attitude measures.

   c. The findings that the (1) experimental low-risk as well as high-risk groups scored significantly higher than the control risk groups in the I.B.R. measure auditory-visual-awareness and than the high-risk control group alone on social orientation.

(2) experimental low-risk group only scored significantly higher on the I.B.R. measure activity than the control risk groups.

3. Stimulation in the home did not contribute to such differences as indicated by co-variate analyses.

4. The experimental infants were significantly lower in HOME Inventory total (i.e. stimulation in the home) than their controls.

5. No motor benefits were shown by the experimental infants.

6. Satisfaction with the parental role was the only measure of the S.P.P.R enhanced in mothers of experimental infants.

6.4 DISCUSSION

For the pupose of clarity, there are 2 parts to this discussion, divided according to the sections used in the introduction, method and results:

Discussion 6.4.1: Macedo (1984) replication study (Introduction section 6.1.5.1, Method section 6.2.1, Results section 6.3.1)

Discussion 6.4.2: Extension of the Macedo (1984) replication study with prospective controls and a long-term follow-up (Introduction section 6.1.5.2, Method section 6.2.2, Results section 6.3.2)

These results, akin to those of Macedo (1984), suggest that supplemental tactile stimulation, in the form of Tac-Tic, is an important ingredient for the optimal development of premature infants cared for within neonatal units, significantly facilitating thermoregulation and general prognosis (discharge home), both of which reflect improved physiological functioning.

Unlike the Macedo (1984) study however no significant benefit was found in the move from tube to all suck feeding, though a difference approaching significance was found.

6.4.1 Macedo (1984) Replication Study

6.4.1.1 Improved Thermoregulation

The move from being cared for in a cot as compared to an incubator has already been identified as a significant step in preterm infant development, reflecting development and stability of the thermoregulatory system and a diminished risk of ventilation assistance in the future (Whitelaw et al., 1980).

(1) enhanced survival

As a consequence of this improved thermoregulation, physiologically, the infant is better able to adapt to the environment and so has an enhanced survival capability.

(2) increased interaction and exercise

The psychological benefits of improved thermoregulation for the infant include enhanced ability to interact with his/her environment, exercise sensori-motor schemata and reflexes (Freidman and Sigman, 1981) and increased availability to the parents.

This is in terms of reduced contact separation as there is no longer an incubator perspex wall between the parents and their infant. This is of significance in that early maternal separation has been argued, (Field, 1977a), to contribute more to later mother-premature infant interactive failures than specific early behavioural deficits of preterms, such as difficulties in feeding (Klaus and Faranoff, 1973).

Such increased infant-environment interaction and responding, resulting from a diminished amount of time spent in an incubator is also of pertinence for cognitive development. It has been noted by Finkelstein and Ramey (1977) that incubators preclude instrumental responding by an infant to environmental stimuli, thereby impeding early learning experience, which plays a significant role in cognitive development.

(3) enhanced parental expectations

Along with this, parental expectations of their infant's survival and development are probably also enhanced as soon as their infant no longer requires care within a regulated thermal environment for survival.

(4) reduced risk of emotional disturbance

Reduced stay in an incubator may also diminish the risk of emotional disturbance in later childhood. Incubator induced isolation has previously been suggested as the causal factor underlying the higher prevalence of emotional disturbances amongst children who were born as prematurely compared to those born at term (Rothschild, 1966).

(5) reduced risk of hearing impairment

The risk of noise induced hearing loss is also reduced as a consequence of removal from incubator into cot care.

Incubators have been found to produce continuous noise levels between 50-86 db, on the A weighted scale (Bell et al., 1979), which in adults, even for a short time could produce hearing loss (American Academy of Pediatrics, 1974). The incidence of sensory hearing loss has been established to be higher in premature and low birthweight infants as compared to fullterms (Schulman-Galambus and Galambus, 1975, Gottfried, 1985) with increased length of care in an incubator being associated with greater risk of hearing loss (Douek et al., 1976).

Interestingly, few other supplemental tactile stimulation programmes with premature or low birthweight infants have shown benefits in this variable. For example, using four 12 minute daily periods of tactile contact with a sample of mechanically ventilated preterms (n= 26, experimental= 13 control= 13), for 10 days, Jay (1982) found no significant difference between the experimental and control infants on temperature stability.

In the present study, what may account for the significant result in this variable, is the significant improvement in sucking mentioned below, since a significant positive correlation was between these two variables (as well as with age at discharge). The move to all-oral feeding from nasogastric feeding requires improved homoeostasis of physiological functions to enable the infant to cope more successfully with the feeding situation. Thus, the improvement in speed of removal to care in a cot from care in an incubator could be a side effect of the improvement in sucking ability (or alternatively may underlie sucking improvement).

Another point to consider is that, since other studies have found improved sucking without any improvement in thermoregulation, this finding could thus be a consequence of the stroking technique applied (i.e Tac-Tic), which has only been employed once before, where thermoregulation was also benefited in the stroked sample. Further investigation thus needs to be conducted into the differential effects of this programme of tactile stimulation in comparison to others eg. that of Rice (1977).

Looking lastly at the significant positive correlation found between move into cot care and age at discharge, this is to be expected given that consultants use control/stability of temperature regulation as one of their criteria for infant discharge.

6.4.1.2 Improved Prognosis

As can be seen from the results, the experimental infants were found to be discharged significantly earlier than their controls. The benefits that this earlier discharge entails cannot be over-emphasized.

Shorter length of hospitalization has been found to be reliably related to higher mental and physical development measures (Bayley Scales M.D.I and P.D.I) at 24 months (Sanford- Zeskind and Iacino, 1987). Given the environment and diminished amount of "normal caretaking and other experiences" (eg. contingent stimulation) within the neonatal unit as compared to the home, this is an understandable finding.

Goldberger (1990) proposed a number of problems experienced by preterm/low birthweight infants during their hospitalization within a neonatal unit which include:

(1) a lack of co-ordinated multi-sensory events (eg. many sounds are out of sight and thus the infant is unable to co-ordinate sounds with their source)

(2) a lack of control over or contingency of events

(3) fragmented sensory experiences

(4) an inability to turn away from aversive stimulation

All of these, over time, may compromise infant development or "ceiling" of cognitive and motor ability achieved or even achievable.

The longer an infant is hospitalized, the longer s/he is separated from her/his parents, in early life and this may compromise bonding and attachment (Klaus and Kennell, 1970; Ainsworth, 1972). Duration of hospitalization was found by Bennett and Slade (1991) to be associated with delayed attachment and though Richards (1986) and Jackson and Gorman (1988) found that early separation itself does not lead to long-term attachment problems, studies such as that of Bennett and Slade (1991) do indicate the possibility of short-term difficulties.

Though number of post-natal complications could be expected to determine length of hospitalization, the study by Sanford-Zeskind and Iacino (1987) did not find this. This factor may though have played a role in the present study but this seems unlikely given that all the infants in the study suffered no medical complication other than jaundice.

The significant positive correlation between the three variables however suggests that move into cot care and the move from nasogastric to all-suck (oral) feeding, may account for the significant age at discharge result, given that consultants use control and stability of temperature regulation as well as toleration of oral feeds as criteria for discharging infants.

Finally, few other supplemental tactile stimulation programmes employed this as a dependent variable and though the tactile intervention performed by Jay (1982), found it to be significantly earlier in their experimental infants, they chose to disregard it as invalid. This step was undertaken due to the confounding variables of:

(1) severe illness (bronchopulmonary displasia) in some of the controls

(2) parental hesitancy in taking the infant home mentioned by medical notes

Though none of the infants in the present study suffered from any medical complaint other than jaundice, parental hesitancy in taking their infant home could have exerted an influence on the discharge variable.

This factor was not written in medical notes referred to in the present study and thus its presence was not measured.

The lack of a significant difference between the experimental and control groups may have accounted for the overall lack of a significant difference between the groups when the three variables were combined together in the multi-variate analysis of variance. Equally the samll numbers in both groups may have contributed to this.

6.4.1.4 High vs Low-Risk groups

Though the cell numbers are very small when the experimental and control groups are each sub-divided into high-risk and low-risk, a pattern suggesting that the supplemental tactile stimulation has more of a beneficial effect on high-risk infants emerges. This was concluded since:

(1) no significant differences were found between low-risk experimental and low-risk control samples on any of the variables, suggesting that the stimulation did not benefit these infants.

On both age at first all feed sucking and discharge however, high-risk experimental (along with low-risk experimental and control samples) infants were found to be significantly younger than the control high-risk sample. It would be expected that both of the low-risk groups would have significantly younger ages on these variables due to their greater physiological maturity.

The fact that the high-risk experimental group shows a significant earlier age on these variables than their control counterparts suggests that the stimulation did indeed benefit them.

(2) within the control but not experimental sample, the high as compared to low-risk infants were found to show significant differences on age at first all feed sucking and discharge.

This suggests that within the experimental sample, those of high-risk had "caught up" with those of low-risk status in their sample on physiological viability.

This adds gain to the argument that the tactile stimulation had its greatest benefits on the youngest and weakest (in gestational age and birthweight) infants.

A very early sensitive period may thus exist for tactile stimulation to exert particular benefits. This would be in agreement with the notion of the importance of tactile/kinaesthetic stimulation inutero for optimal development. Possibly, beyond a certain gestational age, tactile stimulation does not have as significant an effect, or exerts different effects, on infant development. This has yet to be determined.

6.4.1.5 Overall Conclusions

Supplemental tactile stimulation, in the form of Tac-Tic can thus be seen to facilitate preterm infant thermoregulation, sucking and discharge home, and in so doing improve their long-term prognosis.

However, the question of how such benefits actually come about, through what mediating mechanism(s) tactile stimulation exerts its effects remains to be answered.

Equally, another question that remains to be answered is whether tactile stimulation is more effective with infants of a higher risk (lower gestational age and birthweight) as compared to a lower risk (higher gestational age and birthweight) status and if so why. Intervention programmes providing tactile stimulation to infants of various degrees of prematurity, within particular time periods post-birth would help to answer this.

In conclusion, the practical implications of this study are that supplemental tactile stimulation, in the form of Tac-Tic, is a cost-effective means of assisting premature infant development as well as reducing hospital neonatal unit costs in terms of a reduction in infant medical equipment use (incubators) and hospital stay.

6.4.2 Extension of the Macedo (1984) replication study with prospective controls and a long-term follow-up

6.4.2.1 Short-term variables

The only significant difference between the stroked and non-stroked infants, on the 3 dependent variables was, in contrast to the previous study, on age in days at first suck of all feeds in a day i.e toleration of oral feeding (the implications of which are discussed in the previous discussion section 6.4.1).

However, on the other two dependent variables of age in days at removal from care in an incubator to care in a cot and age in days at discharge, the experimental, in comparison to control, infants do show the more developmentally advanced results.

Equally, on the multi-variate analysis of variance combining all the variables together, the experimental as compared to control sample was found to show significantly more developmentally advanced scores overall.

Why no significance was obtained on the two variables of cot and discharge (unlike the previous study) however, is debatable.

It could be due to:

(1) A subtle, undetected variable which modulates tactile stimulation eg. tactile sensitivity, which, with the extended sample of infants in this study, has diminished the significance of these variables.

(2) A change in criteria for moving infants from incubators to cots and discharging them from the hospital, since when the experimental infants were in the hospital.

(3) Tactile stimulation having no effect on thermoregulation or speed of discharge.

Given that no other tactile intervention with preterms has found benefited thermoregulation (White and LaBarba, 1976; Jay, 1982), this also suggests that the significant finding on this measure in the previous study may be due to some unidentified variable.

6.4.2.1.1 Enhanced Sucking Development

The increase in subject number may have accounted for the significantly earlier sucking shown by the experimental, as compared to control sample, in this study, in contrast to the previous study. This accleration in all suck feeding has many implications.

The move from nasogastric to oral feeding is a fundamental and essential step for optimal infant growth and development. The sooner this step is achieved, the earlier the infant experiences "normal feeding" and engages in its' associated interaction sequences, thereby extending his/her behavioural repertoire and exploration of the environment. It is also more comforting for the parents to know that their infant can now cope with "normal" feeding (Gandy and Roberton, 1987).

The significant acceleration in toleration of oral feeding in the experimental infants found in this study, is similar to the results of other tactile intervention programmes with preterm/low birthweight infants (Macedo, 1984; Tryowski, 1979), though has been failed to be shown to be accelerated by other studies (Jay, 1982).

Many programmes however, have shown benefited feeding behaviour in various ways (Rice, 1977; Field et al., 1986; Rausch, 1981; White, 1975) all of which point towards a possible tactile-sucking-feeding mediating mechanism, through which tactile stimulation programmes exert their effects.

Such a link between touch and feeding has been noted previously. Preyer as far back as 1881, referred to sucking, (and chewing, licking, biting and tooth grinding) as an instinctual act and emphasized the role of touch as a stimulus for sucking.

Ribble (1943) also identified sucking as having a tactile component. She argued that the mouth was fundamentally an organ of touch and that sucking was the tactile nucleus around which early perception is organized, forming a base for sensory process development and through these a foundation for the development of muscular activity.

She also viewed sucking as an inherent need (for at least two hours sucking a day in the term baby, with preterms requiring a great deal more), an infant panacea for tension states and a component of speech development by drawing an enhanced blood supply to the face and head, contributing to the progressive development of facial muscles and probably also to the brain itself.

Similarly Dunn (1977), found measures of affectionate maternal behaviour such as tactile contact, to be associated with differences in the baby's sucking rate eg. greater tactile contact being associated with greater and smoother feeding and sucking rate.

Increased body movement and sucking initiation in infants receiving light cheek stimulation during pauses when compared to the same stimulation during active sucking has also been demonstrated by Wolf and Simmons (1967).

With specific regard as to how simple tactile stimulation accelerates sucking, further research is needed to address the question of "..*whether or not there is a demonstratable reflex action between tactile stimulation and sucking action on the one hand and tactile stimulation and nutrient absorption on the other*? " (Macedo, 1984, p180).

6.4.2.1.2 High/Low-risk groups

When the experimental and control samples are sub-divided into high-risk and low-risk, the pattern of the previous study, i.e high-risk infants appearing to benefit more from the supplemental tactile stimulation than those of a low-risk status, did not emerge.

This was concluded since the high-risk experimental and high-risk control samples both were significantly older than the low-risk experimental and control samples when they first sucked all their feeds in a day and when they were discharged. This implies that the high-risk experimental in comparison to control group, did not "catch up", (in term of physical viability) with those of low-risk status.

6.4.2.2 Long-term variables

A. Cognitive Measures

As revealed by many other tactile intervention programmes, (Field et al., 1986; Rice, 1977; Powell, 1974; Solkoff et al., 1969), enhanced long term mental development, (i.e greater M.D.I's), was found in stroked as compared to non-stroked preterms.

In agreement with this finding, stroked preterms in this study, were also found to score higher than their controls on the Mental Fullterm Differentiation factor (Ross, 1985), indicating that stroked preterms performed significantly better than their controls on those items of the Bayley Mental Scale (Bayley, 1969), which best differentiate preterm from term infants.

This suggests that, in mental development, the stroked preterms appear to be "catching up" with term born counterparts better than their non-stroked controls.

Enhanced mental development in the stroked, as compared to non-stroked, preterms was further supported by the finding that the experimental, as compared to control, infants, exhibited significantly higher scores on two of the four, Kohen-Raz (1967) subscales of the Bayley Mental Scale, namely:

(1) Imitation-Comprehension

(2) Vocalization-Social Contact-Active Vocabulary

Accelerated verbal understanding, expressive movements and verbal utterances within the experimental sample suggests improved imitation ability and intentional, more objective language use (Kohen-Raz, 1967), both of which play prominent roles in cognitive and social development (Piaget, 1952).

It could be argued that these two scales incorporate items of a more interpersonal nature than those items in the scales where no significant difference was found between the experimental and control infants (Eye-Hand and Object-Relations scales).

This could be interpreted as suggesting that parent-infant interaction in some way, (eg. through increased sensitivity and/or elevated expectations), modulated the long term cognitive benefits of stroking.

While amount of maternal stimulation has been found to be unrelated to cognitive development (as measured by M.D.I.), maternal responsivity, sensitivity and interactive measures have been found to be significantly and positively related to infant M.D.I. at 3 months (Lewis and Coates, 1980).

Hawthorne and placebo effects could also have contributed to the results since the study did select out a sample of subjects for special treatment, thereby attributing them with a "special" status in the eyes of themselves or others.

Parents of infants in the experimental group may thus have had higher expectations of their infants development than parents of infants in the control sample and this in-turn may have contributed to the results found.

Related to this is the finding of Widmayer and Field (1981). They found that even simply showing mothers of preterms, the Brazelton assessment (Brazelton, 1973) being performed on their infants, raises their expectations of their infants future performance and development. It could be that the same process occurs when the parents view Tac-Tic being performed on their infants.

As a result of this intervention, the parents of the experimental infants may have elevated the expectations they had of their infants' development and altered their interaction behaviour accordingly, culminating in what is known as the "self-fulfilling prophecy" (Rosenthal 1966).

Given that the control parents were only approached once before discharge, and then only to ask permission to visit them and see their child in 15 months, the contribution of the aforementioned variable in accelerating the development of experimental infants, cannot be underemphasized.

The possible role of unconcious experimenter bias also cannot be ignored. However, as the experimental sample was not found to score significantly higher than the control sample on the Bayley Motor Scale (Bayley, 1969), which would have been expected as well if such bias was in operation, it seems unlikely that such bias had a significant impact on the results.

As stimulation in the home was found to be higher in the control, it is unlikely that the advanced cognitive development scores found in the experimental sample are due to a greater provision of stimulation. The finding that stimulation in the home (as measured by the HOME Inventory) did not have a significant impact on any of the dependent variables examined adds to this.

Additional stimulation though may have been provided in the experimental sample, through a medium not assessed adequately by the HOME Inventory, for example, tactual parent-infant interaction.

It is conceivable that, as a consequence of the Tac-Tic programme, parents of the experimental infants tactually interacted with their infants more than the parents of the controls. Through this, parent-infant behaviour later on could have been affected, culminating in improved mental development in the infants.

Mothers who experienced more contact with their infant within 3 days post-birth, have been found to initiate more teaching behaviour, provide more productive feedback language to and speak to their infants with a verbal output showing greater variety and elaboration than the routine contact mothers at two years (Ringler et al., 1975).

Equally, it could be that infant behaviour during dyadic interaction is being enhanced, thereby facilitating cognitive advance.

Tactile interventions conducted with small-for gestational-age infants have found increased levels of parent-infant interaction at three months (Watt, 1986, 1990) and significantly lower rates of state change at two months (Watt, 1986). Watt (1990) concluded from these two studies that the tactile intervention facilitated state organization and behavioural stability, thereby helping infants to participate more effectively in dyadic interaction.

The lack of significant findings on the other Kohen-Raz (1967) Bayley Mental Scale subscales may be due to such factors as:

(1) Tactile stimulation having no influence on these areas of mental development tapped by these scales.

(2) The intervention not being conducted during the appropriate sensitive periods for such areas of mental development.

A.1 High-risk and Low-risk groups

As no significant differences were found between any of the risk groups, those of high-risk were not significantly delayed or debilitated in cognitve development in comparison to those of low-risk status. This is interesting in that very-low-birthweight, i.e. high-risk, preterms have been found to be more susceptible to longterm, cognitive, developmental delays than heavier preterms or fullterms (Barrera et al., 1986).

The findings may be due to parents of high-risk, as compared to low-risk or fullterm, infants providing much more intense, (detrimental if too excessive), stimulation to their infants. This has been argued (Wasserman et al., 1980) to be an attempt on the parent's part, (often unconscious), to assist their infant in catching up with his/her counterparts.

However, as no significant differences were found between the risk groups in the HOME measure of stimulation, extra stimulation in the high-risk groups may not be seen to account for the cognitive development scores being similar for all the risk groups.

Stimulation during mother-infant activities though is not measured by the HOME Inventory and this may be where the high-risk infants receive some additional stimulation.

In sum, as both experimental and control high-risk groups, rather than just the latter, were not found to be significantly poorer in thier cognitive development scores, it cannot be concluded that the Tac-Tic stimulation benefited the high-risk experimental group more than the low-risk experimental group.

A.2 Conclusions

To conclude, future research on the cognitive effects of early supplemental tactile stimulation, needs to look at more specific measures of cognitive advance (eg. learning, information processing) across time and with groups of preterms varying in their degree of prematurity. From this, one could then determine which cognitive spheres such an intervention benefits most.

B. Motor Measures

As no significant differences were found between the experimental and control samples on the two measures of motor development, it appears that supplemental Tac-Tic stimulation does not exert any effect on long-term motor development.

Previous tactile intervention studies have been inconclusive in their findings regarding the effects of such interventions upon measures of motor development, with some studies revealing benefits (Kramer et al., 1975; Field et al., 1986) and others not (Rice, 1977; Groom, 1973).

Campbell (1982), in her review of intervention programmes concluded that the lack of solid support for the effects of such programmes upon motor development could be due to a number of factors. Such programmes, according to Campbell (1982), are not tailored to affect motor development, as they do not sufficiently stimulate active motor responses.

Equally, the Bayley's motor development scale, used by many intervention programmes to assess motor development, may be insufficiently sensitive to measure differences in motor performance. Large age differences between items are typical of the Bayley motor scale (Bayley, 1969) which may render it insensitive to small but significant differences in developmental advance.

Possible variations in strength, co-ordination and endurance are also not reflected in the Bayley motor scale assessment (Bayley, 1969) unless they effect achievement of gross motor milestones.

Motor development itself could also be more dependent upon pre-programmed maturation of the neuromuscular system than on the environment and thus less susceptible than eg. cognitive development to environmental influences (Campbell, 1982).

As with mental development, stimulation in the home, assessed using the HOME Inventory (Caldwell and Bradley, 1984), was not found to have a significant impact upon either P.D.I or Motor Fullterm Differentiation scores.

B.1 High-risk and Low-risk groups

When the experimental and control groups were each sub-divided into high-risk and low-risk, no significant differences were found between the risk groups on either of the motor measures.

This suggests that those of high-risk were not significantly delayed or debilitated in motor development in comparison to those of low-risk and that Tac-Tic had no greater effect on the motor development of high as compared to low-risk infants. The has just been previously discussed in the context of cognitive development (Sub-Section A.1).

However, the intervention may have only effected "ceiling" motor abilities (i.e more advanced abilities that are just emerging). These were not assessed in this study as both the stairs and walking board items (used with fullterm age ranges 12-23 months and 13-26 months respectively), were not incorporated in the motor assessment, due to operational difficulties.

B.2 Conclusions

In sum, the tactile intervention was not found to effect long-term motor development and this result was did not vary according to risk status.

C Infant Behavioural Record Measures

Using the I.B.R. subscales designed by Meisels et al., (1987) the experimental as compared to the control sample, showed significantly higher scores on Test Affect-Extraversion, Activity, Auditory-Visual-Awareness and Social Orientation.

This suggests that the experimental infants were more outgoing, active, aware of what was going on and interested in other persons than the control infants.

It also supports Rosenfield (1980) who inferred that stroking of the body contributes to later improved temperament and manageability.

These characteristics could also have contributed towards the improved cognitive performance in the experimental as compared to control sample, though no significant correlations were found between these and the cognitive performance measures.

In comparison to fullterms, preterms have generally been found to be poorer in neurological regulation (Howard et al., 1976), more distractable (Brachfield et al., 1980), perform less optimally on developmental assessments (Siegel, 1982). Perhaps tactile stimulation, acting upon these features and through the I.B.R. behavioural improvements shown, rather than cognitive abilities per se, resulted in the higher experimental as compared to control, M.D.I. scores.

With regard to how the I.B.R. behavioural differences between the experimental and control infants arouse, it is quite feasible that, as mentioned in sub-section A, elevated expectations and the "Hawthorne effect", through altering parent-infant behaviour, could have produced such differences.

Given that such measures are all elements of cognitive and behavioural organization (Meisels et al., 1987), and as sub-scales of the I.B.R., have a bearing upon cognitive test-taking performance (Bayley, 1968; Meisels et al., 1987), the implications of these findings are broad and varied for long-term cognitive development and school performance.

C.1 High and Low-risk groups

The finding that the:

(1) experimental low as well as high-risk groups scored significantly higher than the control risk groups in the I.B.R. measure of auditory-visual-awareness suggests that the experimental as compared to the group may be more sensitive to auditory-visual stimulation.

This may be due to the experimental group receiving more of this kind of stimulation (and this not being picked up by the HOME measure) or due to a general better sensory awareness than their control counterparts.

It has been argued before that the provision of extra stimulation to one sense may benefit the development of the other senses and/or better the integration among (Greenough, 1984) but whether and how this actually occurs have yet to be established.

The findings that the

(2) experimental low as well as high-risk groups scored significantly higher than the control high-risk group on social orientation

(3) experimental low-risk group scored significantly higher on the I.B.R. measure activity than the control risk groups are difficult to explain, but the latter may be due to the effect of greater stimulation in the homes of the experimental low-risk group since stimulation was found by the HOME Inventory (Caldwell and Bradley, 1978) to have had a significant impact upon:

(1) Activity

(2) Task-Orientation

(3) Motor Co-ordination.

D. Home Measure

The finding that the control as compared to the experimental infants, have homes significantly higher in their stimulation content was unexpected. The result could have been due to such factors as:

(1) socio-economic status

(2) parental education

both of which have been found to be related to stimulation provision in the home (Caldwell et al., 1984) and which were not examined in this study.

This finding was in variance to the study of Solkoff et al. (1978) which conducted a tactile intervention programme with infants and found more stimulating homes in the experimental sample at 18 months. However, their study made assessments of the home environment in a very subjective fashion, consisting of interviews with the mother and observations of arrangements in the home. The HOME Inventory was not employed in their study.

D.1 High-risk and Low-risk groups

Homes of very-low-birthweight and very-ill preterms have been found to be less responsive and stimulating than those of high-birthweight and healthier preterms and fullterms, which has been interpreted as reflecting greater parental difficulties in the first sample (Barrera et al., 1987; Field et al., 1979; Minde et al., 1978). It was thus surprising that no significant differences occurred in HOME scores between the risk groups in this study. However, this may be due to the small risk group cell numbers.

E. Parental S.P.P.R. Measures

Satisfaction, (with the parental role),was the only measure of the S.P.P.R that showed a significant between groups difference with the experimentals scoring the higher result.

The Tac-Tic intervention could have contributed to this result, through encouraging in the mother a greater awareness of her infant's developmental achievements, an enhanced sensitivity to his/her cues or reduced anxiety about him/her being a preterm.

Through improved attachment Tac-Tic could also have accounted for this result as, according to Freud (1905), stroking, cuddling and soothing libidinized the infant's body and assists in establishing a healthy body image and ego and promotes the development of object love by cementing the mother-child bond.

No between groups differences were found on parental perceptions of:

(1) their competence in the parental role (Competence)

(2) the importance of the parental role (Investment)

(3) their integration of friend, career, spouse and parent roles (Integration)

or in their

(4) total adjustment to the parental role (S.P.P.R.)

indicating that overall, experimental and control parents were equally adjusted to the parental role.

As McPhee et al., (1986) found feelings of maternal competence are related to their ability to manage interactions with their children, and since we found no between groups difference on this, it is thus feasible to deduce that no difference between the groups occurs either in this feature.

E.1 High-risk and Low-risk groups

No significant differences were found between the risk groups in any of the S.P.P.R. measures. However, the instrument used (the S.P.P.R) was not designed particularly for parents of high-risk infants, and thus may not have been sensitive enough to detect subtle difficulties in adjustment to the parental role they may experience as a result of eg. perceiving their infant as "vulnerable" and in need of "special care".

Instruments pertaining more to the effects of the intervention upon parental parameters in the long term thus need to be developed.

F. Conclusions

Overall the long-term developmental assessment showed that:

1. Experimental infants displayed benefits in cognitive and social development as compared to their controls.

2. Such benefits do not appear to be maximal when the infant is of high-risk (i.e low gestation and birthweight) status.

3. No significant motor benefit was shown by the experimental infants.

4. The experimental infants showed significantly lower total HOME Inventory scores than their controls.

5. Satisfaction with the parental role was the only measure of the S.P.P.R enhanced in mothers of experimental infants.

6. Stimulation in the home did not contribute to any significant difference between experimental and control groups.

CHAPTER 7

THE IMMEDIATE, PHYSIOLOGICAL EFFECTS OF A PROGRAMME OF TACTILE STIMULATION ON VENTILATED, PREMATURE INFANTS.

7.1 INTRODUCTION: Intervention Programmes and Ventilated, Very Low-Gestation Infants

Despite the number of tactile intervention programmes that have been conducted with premature and low birthweight infants, and the consequent benefits in infant development brought about by such programmes, most programmes have worked with healthy preterms, who do not or no longer require ventilator assistance, who tend to possess a gestational age above 30 weeks and whose prognosis is quite good.

Critical preterms, such as those suffering from serious respiratory, cardiac or congenital ailments and at risk for loss of life and compromise of their functions and abilities, have rarely received any form of tactile intervention programme during their critical state. This occurs even though infants in intensive care receive most of their tactile contacts during medical procedures, while infants in post-intensive or special care receive most of their contacts during the more "positive", less stressing periods of touching, holding and burping (Marton et al., 1979).

Such a population may thus be considered to be of greater "need" for supplemental tactile stimulation than their healthier counterparts, given their greater immaturity, less positive tactile contact, more compromised medical state and lengthier hospital stay.

Reluctance on the part of hospital ethical committees though to grant permission for tactile intervention programmes to take place with such infants is a major factor contributing to this.

Scepticism still pervades medical consciousness regarding the effects of "touching" and "handling" in general, upon such infants and a "minimal handling policy" (applying to both staff and parents) is thus still recommended for and common in many units (Gandy and Roberton, 1987) preventing any tactile intervention programmes from being conducted with critical/high-risk infants.

General "handling" of high-risk infants, such as nappy changing, has been established as compromising infant health, increasing heart rate and decreasing po2 (oxygenation) (Long et al., 1980; Murdoch and Darlow, 1984; Gaiter, 1980).

In a twenty hour observation of preterm infants in a neonatal unit, over 41 minutes of hyperoxemia occurred, as revealed by tcpo2 measures, and as much as 75 % of this adverse time occurred during handling procedures (eg. sheet change, nappy change) (Long et al., 1980).

Social or "positive" touching though, as a consequence of been seen as within the domain of general handling, has been automatically rendered also as a harmful or "compromising" experience for the high-risk infant.

General experience and past research however (Autton, 1989; Jay, 1982; Murdoch and Darlow, 1984), has disputed this, but in order that tactile intervention programmes come to be performed with such infants, there is a need for research to establish first that such programmes do not, in any way, harm such infants (Campbell, 1982).

Once this is shown, research may then move on to determine in what form such programmes best promote infant development.

The value of studying the effects of tactile stimulation upon such physiological measures as heart rate, respiration and oxygenation, upon which infant prognosis is made, thus cannot be over-emphasized. These physiological measures are all indicators of infant distress, with increased heart rate and respiration (or a very extreme fall in these) and decreased oxygenation been seen to compromise medical state, resulting in a need for extra ventilator or cardiac assistance (Gandy and Roberton, 1987).

Looking at these measures separately, tactile stimulation may be seen to bear a significant relationship to each.

7.1.1 Heart Rate

Heart rate is a peripheral manifestation of C.N.S. functioning and also is closely tied to neurological development. It is acknowledged as an index of infant potential to react in an adaptive way to stimulation and is also seen to reflect homoeostatic mechanisms, mediated by brain system structures (Izard et al., 1991).

The development of cardiac nerve innervation of the parasympathetic nervous system develops during the last trimester of pregnancy (Stave, 1978).

As a consequence of their early removal from the womb during this time preterms are thus more at risk for cardiac disequilibrium.

7.1.1.1 Prematurity and Heart Rate

Preterms, as a population do exhibit a higher and more variable heart rate than fullterms, indicating that they expend more energy in taking care of internal needs, and thus are less able to take care of external needs (Parmelee and Sigman, 1976). They also exhibit higher heart rates than term infants in response to cuddling, caretaking activities and to an intense auditory stimulus (Garcia-Coll, 1990) and often display a disorganized pattern of a dissociation between cardiac activity and behaviour, indicating that cardiac measures are showing a defensive pattern of response that is not seen in overt behaviour (Field et al., 1979).

Preterm, as compared to term infants have also been found to show less heart rate deceleration when attention responses are elicited suggesting that they are less able to attend to and process environmental input then their term counterparts (Lester et al., 1990).

In general, preterm infant heart rate is around 140 bpm and within a normal range of 120-160 bpm, though it is prone to extremes in both directions (Gandy and Roberton, 1987). Bradycardia, the more common extreme, refers to a slowing of heart rate is deemed to occur when heart rate falls below 100 bpm and is indicative of hypoxia/apnoea (i.e insufficient oxygen) and general C.N.S. malfunction.

Tachycardia, is the reverse condition when heart rate increases above 180 bpm and this condition reflects fluid overload, heart failure, sepsis or can be a consequence of drug overdose. Both conditions are potentially harmful, resulting in such sequelae as brain damage and/or heart failure (Gandy and Roberton, 1987). Stability in heart rate around the standard 140 bpm is thus seen as the most optimal state for infant health and prognosis.

7.1.1.2 Early Heart Rate and Long-Term Development

As well as early heart rate regulation being associated with a better medical prognosis, it is also associated with several other developmental outcomes such as cognitive development at eight and twelve months (Fox and Porges, 1985).

Higher heart rate variability early on (three months), has also been found to be associated both with higher attachment insecurity at nine months (Izard et al., 1991) and higher behavioural reactivity to distressing situations i.e more maladaptive responding (DiPietro et al., 1987).

7.1.1.3 Heart Rate and Stimulation

Looking at the relationship between heart rate and stimulation in general, heart rate deceleration is generally seen as an orienting or attentive response that facilitates environmental interaction, while heart rate acceleration is seen to generally index a defensive reaction that precludes environmental interaction (Graham and Clifton, 1966; Porges, 1974; Pomerleau and Malcuit, 1981).

Akin to this Lacey et al. (1963), contended that heart rate deceleration reflects sensory intake or processing while heart rate accelerations reflects rejection of stimulation and general distress.

Heart rate responsivity though, has been found to vary according to state as well as type of stimulus used (Adkinson and Berg, 1976; Clarkson and Berg, 1977). Generally, when asleep, heart rate acceleration occurs to stimuli such as those of the tactile and vestibular kind while when awake, prior to feeding, heart rate decelerates to such stimuli. When awake after feeding, no reliable heart rate response has been found to such stimuli (Lewis et al., 1969; Pomerleau-Malcuit and Clifton, 1973).

Using cardiac responsivity as a dependent variable, Segall (1972), found that an early intervention programme with preterms, providing auditory stimulation (tape recordings of mothers voice) for 30 minutes daily, lead to more adaptive responses in the treated as compared to control infants.

7.1.1.4 Heart Rate and Tactile Stimulation

With unconscious adult patients, Lynch et al. (1974) found that when nurses hands were simply lain upon them, heart rate deceleration occurred. Interestingly, analogous cadio-vascular effects have been found to be associated with human social touch in animals. Newton and Gantt (1968) found that in both dogs and horses, human tactile contact produced gross changes in heart rate, blood pressure and coronary flow.

With preterm infants, Gorski et al.'s (1990) study examined the effects of touch, in terms of amount and type (medical or social) on heart rate, specifically incidence of bradycardia. With a sample size of n=18, they found no significant difference in the amount of touch that occurred 5 minutes prior to a bradycardia as compared to 5 minutes of baseline (non-bradycardia) time.

Looking just at those infants (n=10) who experienced touch associated with bradycardia episodes, during the pre-bradycardia phase (5 minutes), the proportion of medical to social touch was 63% medical:37% social.

Interestingly, in those infants (n=8) who did not exhibit touch associated with bradycardia episodes, the opposite pattern occurred, with a ratio of 7% medical touch to 93% social touch, during a 5 minute baseline time period. They concluded that tactile stimulation did not lead to cardiac instability, although medical forms of tactile stimulation appeared to be more aversive or destabilizing than social forms of tactile stimulation.

White-Traut and Carrier-Goldman (1988) compared the effects of the RISS (Rice Infant Sensori-motor Stimulation; Rice, 1977) technique on heart rate at 8 minutes during RISS and 15 and 20 minutes after RISS, in experimental preterms (n=17), as compared to matched times in a control period with control infants (n=16). They found a significant increase in heart rate at 8 minutes (i.e during RISS), in the experimental as compared to control preterms.

No significant differences in heart rate were found between the groups at the 15 and 20 minute time points, suggesting that after the RISS procedure heart rate stabilized again quite quickly.

Finally, in Jay's (1982) study of the effects of tactile stimulation on high-risk ventilated preterm infants, the experimenter placed her hands on the heads and abdomens of the experimental infants, for 12 minutes four times a day for 10 days while controls received routine care. No significant difference was found in the incidence of bradycardia between experimental and control infants.

Overall, these studies suggest that, in terms of cardiac stability, social tactile stimulation (in the forms provided) does not harm premature infants, even those of extreme high risk status as in Jay's (1982) study.

In fact, as Rose et al. (1980) showed, tactile stimulation may facilitate preterm cardiac system in terms of its response to stimuli. They found that 20 minute daily sessions of massage in combination with vestibular and proprioceptive stimulation resulted in cardiac and behavioural responses to stimuli which more closely approximated those of healthy fullterms than preterm controls.

7.1.2 Respiration

Respiration, the exchange of gas between the cells of the organism and the external environment, is one of the fundamental physiological processes of survival. Regularity of respiration is acknowledged as "*one of the most reliable state criteria*" in fullterms (Berg and Berg, 1987, p247) and is generally constant in amplitude and rate during quiet awake/sleep states though slightly more variable during active awake/sleep states (Elliott et al., 1988).

Respiratory problems however, constitute as much as 75% of illness in neonates, particularly preterms who tend to display very irregular respiration (Gandy and Roberton, 1987).

7.1.2.1 Prematurity and Respiration

Premature infants exhibit a higher rate of respiration (from 35-40 breaths per min. to 50-60 bpm (breaths per minute)) than their fullterm counterparts (35-40 bpm) and thus are more at risk for tachypnoea (>60 bpm). This condition is indicative of an immature C.N.S. (and thus poor physiological organization), heart failure and pulmonary pathology.

Preterms are also more at risk than fullterms for the other respiratory extreme of apnoea (cessation of respiration > 20 seconds), which is indicative of an immature C.N.S., sepsis, metabolic disturbance or lung disease. This condition is inversely related to gestational age and recurrent apnoea attacks, believed to be due to C.N.S. immaturity, are common in preterms (Gandy and Roberton, 1987).

Tactile stimulation is the generally accepted remedy for an apnoeic attack in infants as such attacks are usually ceased by a light "flick" to the hand or foot of an infant. Medications such as caffeine or theophylline derivatives are also used as they reduce the frequency of apnoea by providing a slight "stretch" stimulation (during cutaneous or tactile stimulation infants also often display stretching movements) to the infant's lungs by giving air at raised pressure.

However, prolonged attacks of either tachypnoea or apnoea can, as a consequence of inadequate oxygenation, seriously compromise health and thus need to be prevented. These are also symptoms of "respiratory distress syndrome" (RDS), which has its aetiology in a deficiency of surfactant.

This is a lipoprotein which reduces surface tension within the lungs, facilitating expansion during inspiration and preventing atelectasis (absorption collapse of the lungs) during expiration (Reynolds et al., 1968).

RDS, which is inversely related to gestational age, is the most common cause of respiratory distress and its complications, such as apnoea mentioned above and inadequate oxygenation and metabolic acidosis discussed below (under oxygenation), are the leading cause of death during the neonatal period (Gandy and Roberton, 1987). Early identification and proper management and treatment are thus essential to minimize the risk of loss of life.

7.1.2.2 Early Respiration and Long-Term Development

Though research is sparse on the precise relationship between early quality of respiration and long-term development, early postnatal complications in preterms, such as those of a respiratory nature eg. apnoea, tachypnoea, have been found to be related to poorer Bayley (Bayley, 1969) motor development scores at 2 years (Sanford-Zeskind and Iacino, 1987).

Learning has also been found to be effected by RDS. Fox and Lewis (1983) found that preterms who had suffered RDS, unlike samples of fullterms and non-RDS preterms, did not exhibit habituation to an auditory stimulus at three months.

Looking at visual or auditory tracking in ventilated preterms from 33 to 41 weeks postconceptual age, Daum et al. (1980) found no evidence of a significant increase in such tracking. Preterms with no respiratory problems however, exhibited linear development in visual and auditory tracking and showed higher developmental scores on the Bayley Scales of Infant Development (Bayley, 1969) than the ventilated preterms (Daum et al., 1980).

As a consequence of such findings, general stability of respiration during the neonatal period is commonly acknowledged as more conducive to long-term health and development than irregular, unstable respiration.

7.1.2.3 Respiration and Stimulation

The regulating effect of rhythmic stimulation upon respiration is illustrated by the oscillating waterbed intervention programmes of Korner et al. (1975, 1978).

They placed preterms and apnoeic preterms on oscillating waterbeds for days at a time and found a significantly reduced incidence of apnoea in both treated groups as compared to their controls.

Akin to this, Elliott et al. (1988), rocked 42-56 day old infants in a motorized carriage for 4 minutes at 40 rocks per minute, for another 4 minutes at 57 rocks per minute, (or vice-versa) and after each rocking period there was a control period of non-rocking for 4 minutes. Infants were found to have less variable respiration during the rocking as compared to control period and respiration entrained to the rocking rhythm, thereby supporting Lester's (1985) contention that exogenous rhythms entrain endogenous timing mechanisms and thus assist physiological organization and regulation.

Lee (1954) also found head to foot oscillations to aid respiration regulation, while Condon and Sander (1974) found that certain forms of rhythmic, auditory stimulation, including the human voice, can similarly induce or entrain an infant to respond with sympathetic synchronous whole body movements.

Such entrainment may be a factor or a mediating mechanism through which regulated, rhythmic stimulation, intervention programmes bring about physical benefits, though this entrainment has yet to be established in intervention programmes with preterms.

7.1.2.4 Respiration and Tactile Stimulation

The relationship between tactile stimulation and respiration has been long established. As far back as 1881, Preyer asserted that there was a "*relationship between cutaneous stimulation and the onset of breathing*" (p245). In support of this Snyder and Rosenfeld (1937) found rhythmic respiratory movements to be initiated in the cat, rabbit, guinea pig and man in utero, where the movement of amniotic fluid provides continuous cutaneous stimulation for the fetus.

It is possible thus, that in the absence of cutaneous stimulation, as would normally be provided by the amniotic fluid and uterine walls, the premature infant shows respiratory difficulties which are alleviated and indeed respiration may be enhanced through the provision of tactile stimulation.

In agreement with this, Runge (1895) argued that pulmonary respiration is initiated by intense cutaneous stimulation and/or that breathing is precipitated by a critical concentration of carbon dioxide acting on the respiratory centre.

Similarly, Fernandez (1918) perceived a link between cutaneous stimulation and respiration.

According to Fernandez (1918), two major theories have been advanced to account for the initiation of pulmonary respiration, one which postulates that respiration is initiated by external stimuli and the other theory being that respiration is brought about by a critical concentration of carbon dioxide in the blood stream.

With regard to the first of these theories, cutaneous stimuli are seen as bringing about an innervation of the musculature of the thorax while atmospheric pressure inflates the lungs. Relaxation of the muscles then produces exhalation and the process is repeated with succeeding inhalations brought about by neural discharges proceeding from the respiratory centre.

In support of this theory of the excitatory role of cutaneous stimuli, Fernandez (1918) indicated that the attending physician employs still more intense cutaneous stimuli if the infant has not begun to breathe after birth.

The second theory asserts that pulmonary respiration is started when the carbon dioxide content of the blood attains the critical concentration which acts directly upon the respiratory centre to arouse it to activity. The birth process, by disturbing the circulatory relations between the maternal organism and the child increases the carbon dioxide content of the child's blood stream and breathing starts as soon as the respiratory centre is activated and this is seen to account for Ahlfeld's breathing movements of the fetus.

Premature infants, however are often deprived of the "normal" birth process, thus, for them the first theory may be more relevant.

On top of this, they miss out on much positive tactile stimulation, especially from their mother, as a consequence of their stay in a neonatal unit.

It has been contended that the infant responds to the mother's touch in a respiratory way, with the mother's handling of the infant, initiating and establishing deeper inspiration (Ribble, 1943). From being held, fondled, allowed to suck freely and frequently, Ribble (1943), argued that the infant received reflex stimulation which primes the respiratory mechanisms into action and enables the whole process to become organized under the control of the central nervous system.

As tactile stimulation results in deeper inhalation and thus greater oxygen intake, Ribble believed that infant brain cells are also benefited and hence mental functioning improved.

Freeman (1967) believed it is thus possible that the respiratory difficulties in the preterm are not only due to the physiological immaturity of the respiratory system but also due to inadequate tactile stimulation and its associate respiratory stimulation.

With regard to the effects of tactile stimulation programmes, especially those conducted with preterm infants, upon respiration, programmes have focused on the effects on the respiratory process of oxygenation, rather than respiration.

The tactile stimulation programme (RISS), conducted by White-Traut and Carrier-Goldman (1988) though did use respiration as one of its dependent variables and found a significant increase in respiratory rate at 8 minutes into the RISS procedure (approx. halfway), in the experimental as compared to control (non RISS) preterms.

No significant differences in respiration rate were found though between the groups at the 15 and 20 minute time points. This suggests that after the RISS procedure respiration rate stabilized again quite quickly and thus that the procedure may have activated an autonomic nervous system (A.N.S.) response, though this response was minor and within an acceptable range to be considered non-harmful (White-Traut and Carrier-Goldman, 1988).

7.1.4 Oxygenation

Oxygenation refers to oxygen concentration with an arterial oxygen tension (Po2) of 6-8 kilopascals (kPa), (45-60 mmHg), being optimal, as when oxygen concentration falls below this, hypoxia and possible brain damage ensues while above this concentration hyperoxaemia and an associated risk retinopathy of prematurity occurs.

It is commonly monitored using heated skin electrodes, the resulting measure being transcutaneous Po2 (tcpo2), and is extremely sensitive in high-risk preterms or sick infants, dropping dramatically during such procedures as nappy changing (Long et al., 1980).

Tcpo2 has been established as a valid measure of oxygen tension (Duc et al., 1975, Fenner et al., 1975, Hashke et al., 1976, Mieth et al., 1976) and correlates significantly (r= 0.93-0.97) with arterial oxygen tension (Rooth, 1975; Eberhard and Mindt, 1976; Huch and Huch, 1976). A stable oxygen concentration within the normal range (6-8 kPa) is essential for optimal biochemical functioning and general bodily functions eg. thermoregulation.

7.1.3.1 Prematurity and Oxygenation

Preterms are especially prone to respiratory acidosis which occurs as a result of insufficient oxygenation (and thus a high concentration of carbon dioxide i.e high Pco2) and this is associated with metabolic acidosis and inadequate ventilation (Hutchison, 1975).

This necessitates the provision of supplemental oxygen via (in increasing order of severity), a head box, intermittent positive pressure ventilation (IPPV) or continuous positive airway pressure (CPAP). Pulmonary damage however from such ventilation therapy is common, particulary in those displaying respiratory distress syndrome (discussed earlier in B.1), and thus the faster an infant is weaned off ventilation the better (Gandy and Roberton, 1987).

Broncho-pulmonary dysplasia (BPD) is one example of such iatrogenic pulmonary damage.

Its aetiology lies in:

1. Infection with long-term IPPV

2. Interference of lung ciliary action and mucous clearance by an endotracheal tube

3. Mechanical distortion of airways during IPPV therapy

Treatment of this condition involves using low ventilator pressures as much as possible and prescribing Dexamethasone.

7.1.3.2 Oxygenation and Long-Term Development

The detrimental effects of respiratory distress syndrome, of which insufficient oxygenation is the primary symptom, in the long-term was revealed in a study by Fox and Lewis (1983). They found, as stated previously that at 3 months, preterms that had suffered RDS, as compared to those who did not, failed to habituate to repeated presentations of, or respond differentially to a novel stimulus.

Another of their findings was that length of time on a ventilator was negatively and linearly related to composite measures of visual recognition memory and cross-modal transfer (Fox and Lewis, 1983).

In comparison to preterms who suffered Broncho-pulmonary dysplasia (BPD) though, those with RDS only have been found to display significantly higher mental (MDI) and motor (PDI) development scores in the Bayley scales (Bayley, 1964), at 6 and 12 months (Landry et al., 1984).

Along with this, infants with BPD hospitalized for more than 4, as compared to less than 4 months, showed significantly poorer mental and motor development scores at 6, 12 and 24 months (Landry et al., 1984). This ties in with Sanford-Zeskind and Iacino's (1987) finding of length of hospitalization being reliably related to poorer mental and physical development at 2 years.

Early oxygenation problems thus can be seen to have long-term cognitive and motor sequelae, with increased severity of these problems being associated poorer cognitive and motor status.

7.1.3.3 Oxygenation and Stimulation

Very little research with infants has examined this relationship though non-nutritive sucking was found by Burroughs et al. (1978) to be a form of stimulation that increases oxygenation in premature infants. Sudden loud noises though, such as those occurring in neonatal units, have been found to lead to a decrease in tcpo2 followed by a rise in intracranial pressure, in infants cared for in such units (Long et al., 1980).

Speidel (1978) investigated the effects of routine medical and care-taking procedures on high risk preterm Po2 and found sharp falls in Po2 occurred as a consequence of, for example:

1. Changes of incubator sheet

2. X-rays

3. Blood samples

and though no investigation of the effects of social tactile stimulation on Po2 was conducted, Speidel (1978), as a result of his study, concluded that this further supported the practice of a "hands-off" approach to high-risk preterms in the neonatal unit.

7.1.3.4 Oxygenation and Tactile Stimulation

Gorski et al. (1990) examined the effects of touch on preterm Po2 (a measure of oxygenation) and found that touch (as compared to non-touch) did not significantly lower Po2. Touching the infant when s\he was already physiologically compromised (i.e with low Po2), as compared to non-compromised, did lower Po2 (approached significance). This reinforces the notion of not providing tactile stimulation to preterm infants when they appear to be in a particular poor state.

However, a rhythmic sequence of social touch, as in tactile stimulation programmes, might not have the same effects on Po2 as general (including medical) touch. A tactile stimulation programme performed by Terres (1979), found that 15 minutes of holding and cuddling three times daily resulted in increased oxygen levels over a week and greater ability to maintain oxygen levels during holding periods in comparison to controls.

In a pilot study of just one ventilated preterm, oxygenation levels, as measured by tcpo2, were found to be higher after as opposed to before Tac-Tic stimulation (Adamson-Macedo, 1991).

Similarly, Jay's (1982) tactile stimulation programme also found benefits in oxygenation in the experimental infants. These were high risk ventilated preterm infants, upon whose heads and abdomens the experimenter placed her hands on for 12 minutes four times a day, for 10 days while the controls received routine care. Experimental as compared to control infants in this study were found to:

1. require significantly less mechanical ventilation (oxygen) from day 4-10
2. show significantly higher hematocrit levels i.e higher % of total blood volume occupied by blood cells
3. require significantly less blood transfusions which is probably due to the higher hematocrit levels, according to Jay (1982).

The later two findings may be seen to reflect improved oxygenation since erythrocyte cells constitute the vast majority of all blood cells (Vander et al., 1980) and hemoglobin accounts for one third of erythrocyte cell weight.

Hemoglobin is a protein which binds and transports most of the oxygen in the blood and thus any increase in hematocrit levels, may reflect increased hemoglobin levels, especially when this is accompanied by a diminished need for mechanical ventilation, as it is in this study.

Furthermore a study conducted by Krieger (1975) already showed increased hemoglobin levels to human touch as compared to non-touch periods of time.

Jay's (1982) study, also showed that a programme of social (i.e non-medical), tactile stimulation did not have any harmful or negative but rather positive effects with high risk ventilated preterms, thereby disputing the "hands off" policy, (propounded by Speidel (1978) amongst others), in terms of social touch with such infants.

7.1.4 Conclusion

It was concluded from past research that:

(1) social tactile stimulation does not harm, but may even benefit high risk ventilated preterms (Jay, 1982; Gorski et al., 1990)

(2) the physiological indices of heart rate, respiration and tcpo2 provide immediate and valid measures of how such stimulation is experienced (i.e in a positive, orienting, healthy way or in a negative, defensive and unhealthy way)

(3) few tactile stimulation programmes have worked with high-risk preterms to investigate these physiological indices.

Accordingly, this study was conducted with the following objectives:

(A) to examine the immediate effects of a patternedsequence of stroking (Tac-Tic) upon the physiological measures of:

1. Heart Rate
2. Respiration Rate
3. Tcpo2

in high-risk ventilated preterm infants, with the experimental hypothesis being that these measures will show trends characteristic of improved infant viability (i.e stable or decreased heart and respiratory rates and stable or increased tcpo2).

(B) to compare the immediate effects of maternal touching and experimenter Tac-Tic on the physiological measures of:

1. Heart Rate
2. Respiration Rate
3. Tcpo2

in high-risk ventilated preterm infants with the experimental hypothesis being that, maternal touching as compared to experimenter Tac-Tic, will induce a greater deterioration on these three measures (i.e heart and respiratory rate will increase more during maternal touching as compared to experimenter Tac-Tic and tcpo2 will decrease more during maternal touching as compared to experimenter Tac-Tic).

This study was based upon a suggestion for future research proposed by Jay (1982), to examine the physiological effects of extra human touch as compared to maternal/nursing touch.

7.2 METHOD

7.2.1 Design

This study set out to investigate the immediate effects (picked up by computer monitoring) of the Tac-Tic stimulation programme itself and of normal maternal touching, upon the physiological measures of:

(a) Heart rate (Hr)

(b) Respiratory rate (Rr)

(c) Tcpo2

in high risk, ventilated premature infants.

These dependent varables were chosen as they are the primary parameters of physiological health status and were, along with blood pressure and core/rectal temperature, the only measures being computer monitored. Tcpo2, blood pressure and temperature were computer monitored on a variable schedule, and since there was insufficent data on the later two, these were not included in the as dependent variables in the study.

All the subjects were attached to computer monitors which recorded and stored physiological data such as the aforementioned measures collected through transcutaneous sensors, across time. Information on the nature and timing of various interventions conducted with the infants, was superimposed onto the physiological data and all this stored in a day to day basis on a hard disc.

EXPERIMENTAL CONDITIONS:

(a) All subjects received Tac-Tic stimulation from the experimenter for at least one 3-4 minute session (max. 2 sessions) daily from the day on which medical permission was given to begin the study on a given infant, to the day on which s/he was detatched from computerized monitoring. If two sessions of this occured in the one day, one of these sessions was always immediately prior to (b) below.

(b) Mothers were also encouraged to "touch" their infants for 3-4 minutes, in whatever way they felt like, on a daily basis.

An independent, interrupted time series design was employed to analyze the relative effects of the Tac-Tic and maternal touch conditions upon the physiological measures, Hr, Rr and Tcpo2.

7.2.2 Subjects

The 13 subjects (9 female 4 male) in this study were all recruited from the intensive care section of the neonatal unit in St. George's hospital, Tooting, London. All subjects were ventilated preterms, attached to M.O.N.I.C computer monitors due to their critical health status.

Infants not recruited (n=25), were those not attached to the six M.O.N.I.C computers (and thus not having their physiological measures of Hr, Rr and Tcpo2 assessed, stored and demarcated according to intervention) for at least 2 days or more.

The number of subjects looked at across each of the measures varied due to day to day variation in the measures selected to be monitored, for each infant, by the medical staff.

Table 7.2.2.A SUBJECT CHARACTERISTICS

	MEAN	S.D.	MIN	MAX	N
GESTATION	29.23	4.51	24	36	13
BIRTHWGT (kg)	1.36	0.66	0.71	2.62	13
APGAR 1 min	5.42	2.64	1	9	12
APGAR 5 min	8.33	1.87	4	10	12
DAYS ON VENT	11.15	7.58	4	28	13
MATERNAL AGE	25.23	6.98	17	42	13

7.2.3. Stimulation

see section 6.2.3.

A modified version, of the Tac-Tic programme was used, lasting for 4 ass compared to 20 minutes and using only those strokes that did not require the infant to be moved from his/her position, to acquire ethical permission for the study. The stimulation began when the infants were on average 3 days old (mean = 3, s.d. = 1.6, min = 2, max = 8).

7.2.3 Equipment

This consisted of the M.O.N.I.C system (Bass et al 1986), see Figure 7.2.3.A, incorporating an Apple II microcomputer, which received infant sensory input i.e heart rate, respiratory rate, Tcpo2, noninvasively from electrodes on the infant's skin connected to a Simonen and Weel 8000 series stacking monitor.

Heart and respiration rates were collected by electrode sensors monitoring beats and breaths/min while tcpo2 was collected by electrode sensors monitoring oxygen diffusion from the arterialized capillary bed through the epidermis to the skin surface. The electrodes were attached to the skin by self-adhesive rings thereby minimizing pressure against the skin and compression of blood vessels underneath.

Heart rate was collated within a range of 0-250 beats/min, repiratory rate within a range of 0-200 breaths/min and tcpo2 within a range of 0-20 kPA.

Data was collected at a sampling rate of 1 value per second,averaged at 60 second intervals and printed graphically, with a value scale and with markers demarcating before, during and after stimulation phases, as 1 minute data points across 24 hours (see Figures 7.2.3.B and 7.2.3.C).

This data was interpreted (i.e assigned values according to the value scale on the printouts and divided into before, during and after stimulation phases according to the printout markers) by both the experimenter and a blind examiner so that reliability of the data could be checked.

This computer set up was similar to that used in the study by Gorski et al (1990).

Figure 7.2.3.A

Figure 7.2.3.B

```
                                     Simonen
      electrodes  Resp. Amp.         Weel
Infant ------>    Heart Rate -->     Monitors---> A to D
                  Tcpo2                          convertor
                                                     |
                                                     |
                        Keyboard ---> Apple II-->Disc
                          Input      microcomputer |
                                                   |
                           Screen display <----    |
                                                   |
                         Printed output <--------  |
```

Figure 7.2.3.C

7.2.4 Procedure

This may be broken down into 3 phases:

(a) Tac-Tic stimulation was administered by the experimenter to all the subjects for 4 minutes, accompanied by continuous recording of infant physiological measures (see section 7.2.1), before during and after Tac-Tic, from day of medical permission to day of removal from computerized monitoring.

(b) On the days when maternal touching was recorded (these days were determined by maternal consent), phase (a) was repeated immediately prior to phase (c).

(c) Mothers touched their infant in whatever way they wished for 3-4 minutes, accompanied by continuous recording of infant physiological measures (see section 7.2.1), before during and after their touching, randomly from day of medical permission to day of removal from computerized monitoring.

Within Procedural phases (a) and (b):

(ab1) Four minutes before every experimenter stimulation (Tac-Tic) session, the experimenter typed the identification label "Before Experimenter Stimulation" into the subject's attached computer. This demarcated the subsequent recordings of Hr, Rr and Tcpo2 as occuring immediately prior to stimulation.

(ab2) Just before begining the Tac-Tic procedure "During Experimenter Stimulation" was typed into the computer. This demarcated the subsequent recordings of Hr, Rr and Tcpo2 as occuring during stimulation.

(ab3) Immediately after Experimenter Stimulation "Experimenter Stimulation End" was typed into the computer.This demarcated the subsequent recordings of Hr, Rr and Tcpo2 as occuring immediately after stimulation.

Finally, "Experimenter End" was typed into the computer four minutes after the end of the experperimenter stimulation (Tac-Tic) procedure.

Using "Mother" in place of "Experimenter" in each of the identification labels entered into the computer, (ab1) to (ab3) was repeated, with maternal touching rather than experimenter Tac-Tic, being the stimulation performed.

7.3 RESULTS

Means, standard deviations and ranges were calculated on the data of the 3 physiological measures of:

1. Heart Rate
2. Respiratory Amplitude
3. Tcpo2

collected for 4 minutes before, 4 minutes during and 4 minutes after experimenter Tac-Tic/maternal touching.

The data acquired from experimenter Tac-Tic performed on infants daily, over a mean duration of 18 days, has been termed "Experimenter1 Tac-Tic" data, whilst the data acquired from the experimenter Tac-Tic session immediately before/after the maternal touching session of each infant has been termed "Experimenter2 Tac-Tic". The data acquired from the maternal touching session has been termed "Maternal Touching" data. The number of cases was not constant for the three physiological measures due to day to day variations in the measures to be monitored chosen by the medical personnel.

As a consequence of maternal reluctance to touch their ventilated infants the number of subjects was lower in this analysis as compared to the experimenter1 analysis.

Data analysis consisted of comparing the data from each of the phases:

1. Before Tac-Tic/Touching

2. During Tac-Tic/Touching

3. After Tac-Tic/Touching

(a) with that of the other phases within each of the physiological measures

(b) with its matching phase in the other physiological measures

(c) with its matching phase, in the same physiological measure in the "alternate toucher" session (only performed on data of mother compared with experimenter2).

(d) with its matching phase, in the same physiological measure, when experimenter2 Tac-Tic touching occured before as compared to after maternal touching.

This analysis was also conducted with maternal touching thereby checking that no order effect biased the data.

Only experimenter2 Tac-Tic was compared with maternal touching as it occured immediately prior to or after it, whereas experimenter1 Tac-Tic was at a different time of the day and was performed daily over a period of weeks, to obtain greater reliability in terms of the physiological effects of Tac-Tic alone.

Percentage increases across the phases i.e:

1. Before to During

2. During to After

3. Before to After

for each of the physiological measures were obtained by dividing the mean of the later phase by the former phase, in 1 to 3 above and multiplying by 100 (eg in 1 above, dividing the during mean by the before mean and multiplying by 100).

Percentage decrease data was represented as a percentage value below 0.00 (-14.16 was the highest % decrease value and for statistical analysis purposes 14.16 was added to every % value to convert -14.16% to 00.00%).

Using this percentage increase data:

(a) Each of the physiological measures were compared with each other in term of their percentage increase in phases 1-3 above using a MANOVA and a-priori repeated measures t-tests.

(b) Maternal touching was compared with experimenter2 Tac-Tic in phases 1-3 within each of the physiological measures using one-way ANOVAs.

Finally, Cronbach Alphas were performed to assess the reliability of data selected as belonging to before, during and after phases, beween the experimenter and a blind examiner.

7.3.1 Heart Rate

7.3.1.1 Inter-Rater Reliability

Heart rate values from three days (9 values in total from each infant, i.e 3 days = 3 Before values, 3 During values and 3 After values) of each infants experimental period, were scored again by another rater and the inter-rater Cronbach Alpha reliabilities overleaf were found.

Inter-rater Reliabilities

	n	Cronbach Alpha
Before Heart Rate	36	.986
During Heart Rate	36	.991
After Heart Rate	36	.978

These high Cronbach alphas indicate that a significant reliability occurred between the experimenter and the blind examiner on heart rate raw data interpretation.

7.3.1.2 Effect of order of stimulation presentation on Heart-Rate

Looking at the effect on heart-rate of when:

(1) experimenter2 Tac-Tic touching came before, as compared to after, maternal touching

(2) maternal touching came before, as compared to after, experimenter2 Tac-Tic touching

mean heart rate values of the earlier were compared to the latter within both (1) and (2). This was done using the mean heart rate data of four infants, (see Appendix 7.3.1.2.1) across each of the Before, During and After stimulation phases.

No significant differences in heart rate were found in the analyses of variance across each of the Before, During and After phases, implying that heart rate was not significantly affected by whether:

(1) experimenter2 touching was performed before as compared to after maternal touching

(2) maternal touching was performed before,as compared to after experimenter2 Tac-Tic touching

Analyses of Variance

(1) Before phase

Source of Var	Sum of Squares	DF	Mean Square	F	Signif of F
Main Effects	8195928.6	3	2731976.2	2.31	.128
Order	8195928.6	3	2731976.2	2.31	.128
Explained	8195928.6	3	2731976.2	2.31	.128
Residual	14181750.7	12	1181812.5		
Total	22377679.4	15	1491845.29		

(2) During phase

Source of Var	Sum of Squares	DF	Mean Square	F	Signif of F
Main Effects	4896530.6	3	1632176.8	1.95	.175
Order	4896530.6	3	1632176.8	1.95	.175
Explained	4896530.6	3	1632176.8	1.95	.175
Residual	10034236.7	12	836186.3		
Total	14930767.4	15	995384.4		

(3) After phase

Source of Var	Sum of Squares	DF	Mean Square	F	Signif of F
Main Effects	1888670.7	3	629556.9	.644	.601
Order	1888670.7	3	629556.9	.644	.601
Explained	1888670.7	3	629556.9	.644	.601
Residual	11728233.0	12	977352.7		
Total	13616903.7	15	907793.5		

7.3.1.3 Experimenter1 Tac-Tic Touching

Though a slight increase was found in heart rate During the experimenter1 Tac-Tic procedure (Table 7.3.1.3.1), this was non-significant ($t= 0.70$, $df= 12$, $p< 0.245$, 1 tailed). However, the subsequent drop in heart rate, following the Tac-Tic procedure (Figure 7.3.1), was found to be significant i.e the After, as compared to During Tac-Tic heart rate mean, was significantly lower ($t= 1.86$, $df= 12$, $p< 0.044$, 1 tailed).

As no significant change was found in heart rate from Before to After the Tac-Tic procedure (t= 0.64, df= 12, p< 0.268, 1 tailed), it can thus be concluded that the Tac-Tic procedure had little, if any, effect on infant heart rate.

7.3.1.4 Experimenter2 Tac-Tic Touching

Looking at the heart rate data of experimenter2 Tac-Tic (Table 7.3.1.4.1; Figure 7.3.1), it is obvious that little change in heart rate occured During, as compared to Before, the experimenter2 Tac-Tic (t= 0.22, df= 10, p< 0.417, 1 tailed).

Comparing During to After the Tac-Tic stimulation (t= 0.24, df= 10, p< 0.402, 1 tailed) and Before to After the Tac-Tic stimulation (t= 0.40, df= 10, p< 0.349, 1 tailed), again no significant changes were found in heart rate.

Table 7.3.1.3.1 Experimenter1 Tac-Tic: Heart-Rate

	MEAN	S.D.	MIN	MAX	N
Before	160.56	13.44	131.31	181.96	13
During	161.02	14.50	130.17	182.93	13
After	160.19	13.76	132.21	182.60	13

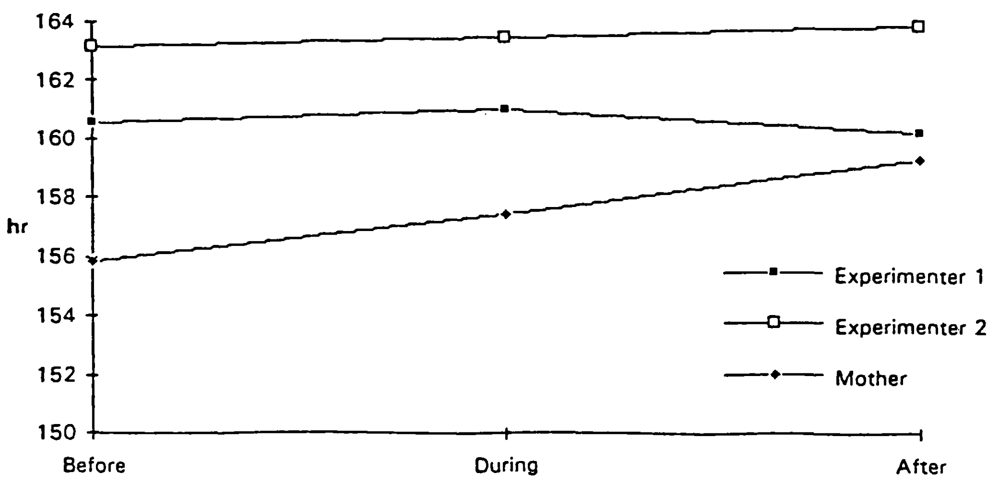
Table 7.3.1.4.1 Experimenter2 Tac-Tic: Heart-Rate

	MEAN	S.D.	MIN	MAX	N
Before	163.13	13.05	143.91	182.83	11
During	163.52	15.04	144.56	186.51	11
After	163.84	13.88	143.56	188.54	11

Table 7.3.1.5.1 Maternal Touching: Heart-Rate

	MEAN	S.D.	MIN	MAX	N
Before	155.82	16.57	126.77	183.04	11
During	157.43	17.36	126.98	188.33	11
After	159.28	15.04	137.13	187.01	11

Figure 7.3.1 Heart Rate



7.3.1.5 Maternal Touching

In the maternal touching data (Table 7.3.1.5.1), an increase in heart rate that approached significance was found from Before to During the touching ($t= 1.65$, $df= 10$, $p< 0.064$, 1 tailed).

This was followed by a non-significant increase from During to After the touching ($t= 1.21$, $df= 10$, $p< 0.127$, 1 tailed). Overall however, this pattern of a cumulative increase in heart rate resulted in a significant increase from Before to After the touching, Before to After the touching ($t= 1.87$, $df= 10$, $p< 0.045$, 1 tailed).

7.3.1.6 Experimenter2 Tac-Tic vs Maternal Touching

Comparing experimenter2 Tac-Tic and maternal touching heart rate data in terms of percentage increase of the original (Before) value (Table 7.3.1.6.1), one way ANOVAS (Section 7.3.1.6.1), showed no significant difference between maternal touching and experimenter2 Tac-Tic touching, despite the increase in heart rate from before to during maternal, but not, experimenter2 Tac-Tic, touching (Tables 7.3.1.4.1 and 7.3.1.5.1).

Table 7.3.1.6.1 % Increase in Heart-Rate Data

% Heart Rate increase from Before to During stimulation			
Entire Pop	13.96	3.82	22
MOTHER	14.36	3.33	11
EXPER2	13.56	4.39	11
% Heart Rate increase from During to After stimulation			
	Mean	**Sd**	**N**
Entire Pop	14.75	3.43	22
MOTHER	15.47	3.36	11
EXPER2	14.03	3.51	11
% Heart Rate increase from Before to After stimulation			
Entire Pop	14.65	4.56	22
MOTHER	15.25	4.88	11
EXPER2	14.04	4.37	11

7.3.1.6.1 One Way Anovas: % Increase in Heart-Rate

(1) % Inc in Heart Rate from before to during stimulation by Mother/Experimenter2

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	1	34880.7	34880.7	.22	.63
Within Groups	20	3045507.6	152275.3		
Total	21	3080388.3			

(2) % Inc in Heart Rate from during to after stimulation by Mother /Experimenter2

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	1	113042.2	113042.2	.95	.33
Within Groups	20	2365534.5	118276.7		
Total	21	2478576.7			

(3) % Inc in Heart Rate from before to after stimulation by Mother/Experimenter2

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	1	81131.6	81131.6	.37	.54
Within Groups	20	4296721.6	214836.0		
Total	21	4377853.2			

7.3.1.7 Correlations

As expected, Before, During and After heart rate values all correlated positively with each other, within the experimenter1, mother and experimenter2 sessions. Gestation and birthweight both showed significant negative correlations with the experimenter1 Before, During and After Tac-Tic heart rate values.

Gestation showed significant negative correlations with all of the maternal Before, During and After heart rate values and the During and After heart rate values of the experimenter2 Tac-Tic touching. Apgar at 1 minute correlated significantly with Apgar at 5 minutes and birthweight with gestation, as expected, also showed a significant positive correlation. Number of days on ventilation was not found to correlate significantly with any measure or infant characteristic (Table 7.3.1.7.1).

E1BHR= Experimenter before stimulation
E1DHR= Experimenter during stimulation
E1AHR= Experimenter after stimulation

MUMBHR= Mother before stimulation
MUMDHR= Mother during stimulation
MUMMAHR= Mother after stimulation

E2BHR= Experimenter2 before stimulation
E2DHR= Experimenter2 during stimulation
E2AHR= Experimenter2 after stimulation

Gestation = Gestational age
Ventil = Number of days on ventilation

Table 7.3.1.7.1 Pearson Correlations

	E1BHR	E1DHR	E1AHR	MUMBHR	MUMDHR	MATAHR
E1BHR	-	.98**	.98**	.77*	.80*	.86**
E1DHR	.98**	-	.99**	.78*	.81*	.85**
E1AHR	.98**	.99**	-	.78*	.82*	.86**
MUMBHR	.77*	.78*	.78*	-	.98**	.92**
MUMDHR	.80*	.81*	.82*	.98**	-	.96**
MUMAHR	.86**	.85**	.86**	.92**	.96**	-
E2BHR	.65	.62	.61	.62	.52	.52
E2DHR	.69	.69	.68	.67	.58	.58
E2AHR	.63	.64	.64	.60	.50	.47
GEST	-.93**	-.94**	-.93**	-.72*	-.73*	-.74*
BWGT	-.90**	-.88**	-.86**	-.65	-.63	-.68
APGAR1	-.58	-.47	-.50	-.59	-.58	-.66
APGAR5	-.17	-.07	-.10	-.35	-.31	-.31
VENTIL	.33	.30	.33	.42	.43	.53

1-tailed Signif: * - .01 ** - .001

	E2BHR	E2DHR	E2AHR	GEST	BWGT	APGAR1
E1BHR	.65	.69	.63	-.93**	-.90**	.58
E1DHR	.62	.69	.64	-.94**	-.85**	-.47
E1AHR	.61	.68	.64	-.93**	-.86**	-.50
MUMBHR	.62	.67	.60	-.72*	-.65	-.59
MUMDHR	.52	.58	.50	-.73*	-.63	-.58
MUMAHR	.52	.58	.47	-.74*	-.68	-.66
E2BHR	-	.97**	.92**	-.68	-.69	-.39
E2DHR	.97**	-	.96**	-.73*	-.71	-.37
E2AHR	.92**	.96**	-	-.73*	-.66	-.24
GEST	-.68	-.73*	-.73*	-	.91**	.40
BWGT	-.69	-.71	-.66	.91**	-	.57
APGAR1	-.39	-.37	-.24	.40	.57	-
APGAR5	-.17	-.15	-.09	.06	.17	.83*
VENTIL	.08	.14	.04	-.12	-.35	-.66

	APGAR5	VENTIL
E1BHR	-.17	.33
E1DHR	-.07	.30
E1AHR	-.10	.33
MUMBHR	-.35	.42
MUMDHR	-.31	.43
MUNAHR	-.31	.53
E2BHR	-.17	.08
E2DHR	-.15	.14
E2AHR	-.09	.04
GEST	.06	-.12
BWGT	.17	-.35
APGAR1	.83*	-.66
APGAR5	-	-.42
VENTIL	-.42	-

1-tailed Signif: * - .01 ** - .001

7.3.2 Respiration Rate

7.3.2.1 Respiration Rate Reliability

Respiration rate values from three days (9 values in total from each infant, i.e 3 days = 3 Before values, 3 During values and 3 After values) of each infants experimental period, were scored again by another rater.

The following inter-rater Cronbach Alpha reliabilities were found:

	n	Cronbach Alpha
Before Respiration Rate	27	.994
During Respiration Rate	27	.977
After Respiration Rate	27	.956

These high Cronbach alphas again show that a significant reliability occurred between the experimenter and blind examiner on their respiration rate raw data interpretation.

7.3.2.2 Effect of order of presentation of stimulation on respiration rate

Looking at the effect on respiration rate of when:

(1) experimenter2 Tac-Tic touching came before, as compared to after, maternal touching

(2) maternal touching came before, as compared to after, experimenter2 Tac-Tic touching

mean respiration rate values of the earlier were compared to the latter within both (1) and (2).

This was done using the mean respiration rate data of four infants, (see Appendix 7.3.2.2.1) across each of the Before, During and After stimulation phases.

No significant differences in respiration rate were found in the analyses of variance across each of the Before, During and After phases, implying that respiration rate was not significantly affected by whether:

(1) experimenter2 touching was performed before as compared to after maternal touching

(2) maternal touching was performed before, as compared to after experimenter2 Tac-Tic touching

Analyses of Variance

(1) Before phase

Source of Var	Sum of Squares	DF	Mean Square	F	Signif of F
Main Effects	2054226.2	3	684742.0	1.44	.301
Order	2054226.2	3	684742.0	1.44	.301
Explained	2054226.2	3	684742.0	1.44	.301
Residual	3799318.6	8	474914.8		
Total	5853544.9	11	532140.4		

(2) During phase

Source of Var	Sum of Squares	DF	Mean Square	F	Signif of F
Main Effects	6099923.5	3	2033307.8	2.72	.114
Order	6099923.5	3	2033307.8	2.72	.114
Explained	6099923.5	3	2033307.8	2.72	.114
Residual	5961129.3	8	745141.1		
Total	12061052.9	11	1096459.3		

(3) After phase

Source of Var	Sum of Squares	DF	Mean Square	F	Signif of F
Main Effects	5458054.6	3	1819351.5	1.19	.373
Order	5458054.6	3	1819351.5	1.19	.373
Explained	5458054.6	3	1819351.5	1.19	.373
Residual	12235808.0	8	1529476.0		
Total	17693862.6	11	1608532.9		

7.3.2.3 Experimenter1 Tac-Tic Touching

From Table 7.3.2.3.1 and Figure 7.3.2 below, a general increase can be seen to have occured in respiration rate across the whole experimenter1 Tac-Tic Touching procedure.

However, there was no significant change in respiration rate from Before to During the Tac-Tic touching ($t= 0.46$, $df= 10$, $p< 0.326$, 1 tailed), but there was a significant increase in respiration rate from During to After the experimenter1 Tac-Tic touching ($t= 2.30$, $df= 10$, $p< 0.022$, 1 tailed). An increase in respiration rate that approached significance was also found from Before to After the Tac-Tic touching ($t= 1.67$, $df= 10$, $p< 0.063$, 1 tailed).

7.3.2.4 Experimenter2 Tac-Tic Touching

The same pattern occured during the experimenter2 as experimenter1 Tac-Tic touching (Table 7.3.2.4.1; Figure 7.3.2).

No significant differences were found though between the phases Before to During ($t= 1.20$, $df= 6$, $p< 0.138$, 1-tailed), Before to After ($t= 1.48$, $df= 6$, $p< 0.095$, 1 tailed) or During to After ($t= 1.51$, $df= 6$, $p< 0.091$, 1 tailed).

7.3.2.5 Maternal Touching

In the maternal touching session (Table 7.3.2.5.1), respiration rate increased (approaching significance) from Before to During ($t= 1.84$, $df= 6$, $p< 0.057$, 1 tailed), the touching phase. Following this, there is a slight, but not significant, decrease in respiration rate from During to After the touching, ($t= 0.25$, $df= 6$, $p< 0.406$, 1 tailed), which accounts for there being no significant change in respiration from Before to After the touching ($t= 0.75$, $df= 6$, $p< 0.240$, 1 tailed).

Table 7.3.2.3.1 Experimenter1: Respiration Rate

	MEAN	S.D.	MIN	MAX	N
Before	57.31	7.46	50.05	78.38	11
During	57.66	7.31	48.80	77.40	11
After	59.02	8.10	47.75	79.24	11

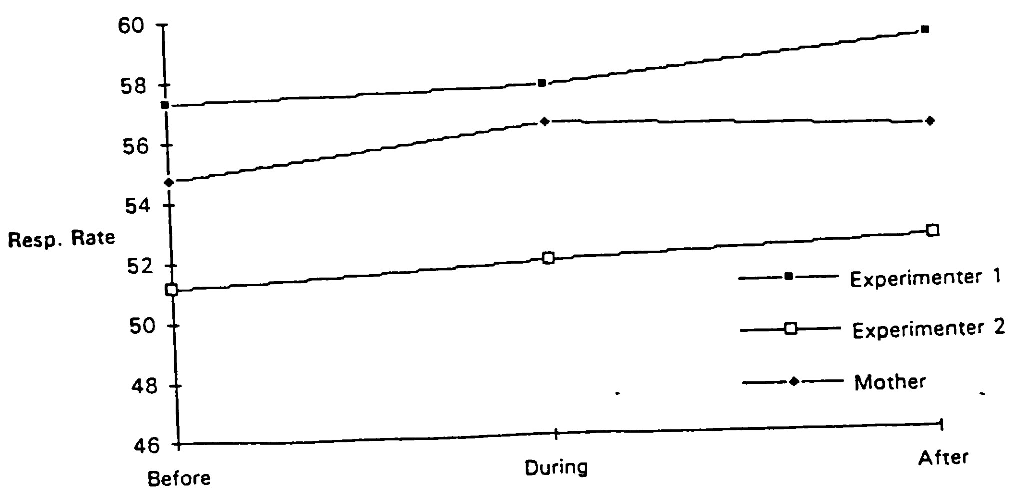
Table 7.3.2.4.1 Experimenter2: Respiration Rate

	MEAN	S.D.	MIN	MAX	N
Before	51.15	6.36	38.80	56.43	7
During	51.86	6.27	39.14	57.69	7
After	52.40	6.50	38.80	57.43	7

Table 7.3.2.5.1 Mother: Respiration Rate

	MEAN	S.D.	MIN	MAX	N
Before	54.78	5.55	46.72	63.27	7
During	56.39	4.90	47.86	62.14	7
After	56.07	2.00	52.51	58.05	7

Figure 7.3.2 Respiration Rate



7.3.2.6 Experimenter2 Tac-Tic vs Maternal Touching

Comparing maternal touching with experimenter2 Tac-Tic using percentage increase in respiratory rate across the phases (Table 7.3.2.6.1), no significant differences were found between the maternal touching and experimenter2 Tac-Tic touching phases.

Table 7.3.2.6.1 % Respiration Rate Increase Data

% Respiration Rate Inc from before to during stimulation			
	Mean	**Sd**	**N**
Entire Pop	15.60	4.41	16
Mother	16.29	4.90	8
Experimenter2	14.92	3.97	8
% Respiration Rate Inc from during to after stimulation			
Entire Pop	13.86	4.81	16
Mother	13.42	6.34	8
Experimenter2	14.30	2.98	8
% Respiration Rate Inc from before to after stimulation			
Entire Pop	15.93	6.69	16
Mother	16.21	8.50	8
Experimenter2	15.64	4.84	8

7.3.2.6.1 One Way Anovas: % increase in Respiration Rate

(1) % Inc in Respiration Rate from Before to During stimulation by Mother /Experimenter2

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	1	74939.0	74939.0	.36	.55
Within Groups	14	2847914.8	203422.4		
Total	15	2922853.9			

(2) % Inc in Respiration Rate from During to After stimulation by Mother/Experimenter2

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	1	30625.0	30625.0	.12	.72
Within Groups	14	3443764.0	245983.1		
Total	15	3474389.0			

(3) % Inc in Respiration Rate from Before to After stimulation by Mother /Experimenter2

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	1	12939.0	12939.0	.02	.87
Within Groups	14	6709761.8	479268.7		
Total	15	6722700.9			

7.3.2.7 Correlations

Pearson correlations performed on the data (Table 7.3.2.7.1), revealed significant positive correlations between gestation and birthweight as well as between Apgar scores at 1 and 5 minutes as expected. Significant positive correlations in respiration rate means were found between:

1. During and after phases in experimenter1 Tac-Tic session

2. Before and during phases in the maternal touching session

3. Before, during and after in the experimenter2 Tac-Tic session

As with heart rate, number of days on ventilation (ventil), did not correlate significantly with any measure or infant characteristic (Table 7.3.2.7.1)

E1BR= Experimenter before stimulation
E1DR= Experimenter during stimulation
E1AR= Experimenter after stimulation

MUMBR= Mother before stimulation
MUMDR= Mother during stimulation
MUMAR= Mother after stimulation

E2BR= Experimenter2 before stimulation
E2DR= Experimenter2 during stimulation
E2AR= Experimenter2 after stimulation

Table 7.3.2.7.1 Pearson Correlations

	GEST	BWGT	AP1	AP5	VENT	E1BR
GEST	-	.94*	.62	.35	-.09	-.41
BWGT	.94*	-	.73	.48	-.35	-.31
AP1	.62	.73	-	.89*	-.69	-.38
AP5	.35	.48	.89*	-	-.58	-.27
VENT	-.09	-.35	-.69	-.58	-	.02
E1BR	-.41	-.31	-.38	-.27	.02	-
E1DR	-.39	-.39	-.22	-.10	.05	.84
E1AR	-.36	-.31	-.03	.09	-.13	.81
MUMBR	.38	.40	.88	.86	-.52	-.35
MUMDR	.34	.44	.90*	.99**	-.57	-.32
UMAR	.07	.31	.77	.82	-.85	-.30
E2BR	-.34	-.42	-.65	-.44	.67	.73
E2DR	-.25	-.36	-.56	-.40	.62	.75
E2AR	-.26	-.34	-.50	-.36	.51	.81

	E1DR	E1AR	MUMBR	MUMDR	MUMAR	E2BR	E2DR	E2AR
GEST	-.39	-.36	.38	.34	.07	-.34	-.25	-.26
BWGT	-.39	-.31	.40	.44	.31	-.42	-.36	-.34
AP1	-.22	-.03	.88	.90*	.77	-.65	-.56	-.50
AP5	-.10	.09	.86	.99**	.82	-.44	-.40	-.36
VENT	.05	-.13	-.52	-.57	-.85	.67	.62	.51
E1BR	.84	.81	-.35	-.32	-.30	.73	.75	.81
E1DR	-	.97**	.02	-.09	-.28	.62	.75	.83
E1AR	.97**	-	.18	.09	-.06	.50	.62	.72
MUMBR	.02	.18	-	.91*	.65	-.53	-.38	-.32
MUMDR	-.09	.09	.91*	-	.81	-.48	-.43	-.38
MUMAR	-.28	-.06	.65	.81	-	-.68	-.71	-.65
E2BR	.62	.50	-.53	-.48	-.68	-	.96**	.93*
E2DR	.75	.62	-.38	-.43	-.71	.96**	-	.98**
E2AR	.83	.72	-.32	-.38	-.65	.93*	.98**	-

1-tailed Signif: * - .01 ** - .001

7.3.3 Tcpo2

7.3.3.1 Inter-Rate Reliability

Tcpo2 values from three days (9 values in total from each infant, i.e 3 days = 3 Before values, 3 During values and 3 After values) of each infants experimental period, were scored again by another rater and the following inter-rater Cronbach Alpha reliabilities were found:

	n	Cronbach Alpha
Before Tcpo2 Value	29	.996
During Tcpo2 Value	29	.997
After Tcpo2 Value	29	.988

These high Cronbach Alphas indicate that as with heart and respiration rate values, a significant reliability occurred between the experimenter and the blind examiner on tcpo2 raw data interpretation.

7.3.3.2 Effect of order of stimulation presentation on Tcpo2

Looking at the effect on tcpo2 of when:

(1) experimenter2 Tac-Tic touching came before, as compared to after, maternal touching

(2) maternal touching came before, as compared to after, experimenter2 Tac-Tic touching

mean tcpo2 values of the earlier were compared to the latter within both (1) and (2).

This was done using the mean tcpo2 data of four infants, (see Appendix 7.3.3.2.1) across each of the Before, During and After stimulation phases. No significant differences in tcpo2 were found in the analyses of variance across each of the Before, During and After phases, implying that tcpo2 was not significantly affected by whether:

(1) **experimenter2 touching was performed before as compared to after maternal touching**

(2) **maternal touching was performed before,as compared to after experimenter2 Tac-Tic touching**

Analyses of Variance

(1) Before phase

Source of Var	Sum of Squares	DF	Mean Square	F	Signif of F
Main Effects	96903.0	3	32301.0	1.364	.374
Order	96903.0	3	32301.0	1.364	.374
Explained	96903.0	3	32301.0	1.364	.374
Residual	94721.0	4	23680.2		
Total	191624.0	7	27374.8		

(2) During phase

Source of Var	Sum of Squares	DF	Mean Square	F	Signif of F
Main Effects	99477.0	3	33159.0	1.391	.367
Order	99477.0	3	33159.0	1.391	.367
Explained	99477.0	3	33159.0	1.391	.367
Residual	95379.0	4	23844.7		
Total	194856.0	7	27836.5		

(3) After phase

Source of Var	Sum of Squares	DF	Mean Square	F	Signif of F
Main Effects	164487.0	3	54829.0	1.733	.298
Order	164487.0	3	54829.0	1.733	.298
Explained	164487.0	3	54829.0	1.733	.298
Residual	126517.0	4	31629.2		
Total	291004.0	7	41572.0		

7.3.3.3 Experimenter1 Tac-Tic Touching

A non-significant decrease (Table 7.3.4.3.1) was found in tcpo2, from Before to During experimenter1 Tac-Tic ($t= 0.67$, $df= 10$, $p< 0.260$, 1 tailed), followed by an increase in tcpo2, from During to After experimenter1 Tac-Tic (Figure 7.3.3), which again was non-significant ($t= 1.24$, $df= 10$, $p< 0.122$, 1 tailed). The resultant overall rise in tcpo2, from Before to After experimenter1 Tac-Tic, was also non-significant ($t= 0.73$, $df= 10$, $p< 0.121$, 1 tailed).

7.3.3.4 Experimenter2 Tac-Tic Touching

Similar to the tcpo2 data of experimenter1 Tac-Tic, experimenter2 data (Table 7.3.3.4.1), also showed a non-significant increase in tcpo2 from Before to During Tac-Tic ($t= 0.18$, $df= 6$, $p< 0.431$, 1 tailed).

Unlike the data of experimenter1 however, a non-significant ($t= 1.22$, $df= 6$, $p< 0.134$, 1 tailed) drop in tcpo2, occurred from During to After the Tac-Tic stimulation (Figure 7.3.3). An overall decrease thus occurred from Before to After the Tac-Tic stimulation (Table 10) and this also was non-significant ($t= 0.48$, $df= 6$, $p< 0.323$, 1 tailed).

7.3.3.5 Maternal Touching

A pattern of decreasing tcpo2, from Before to After touching, was observable in the maternal touching session (Table 7.3.3.5.1; Figure 7.3.3).

The drops in tcpo2 from Before to After ($t= 2.77$, $df= 6$, $p< 0.016$, 1 tailed) and During to After ($t= 2.95$, $df= 6$, $p< 0.013$, 1 tailed), touching were significant. The drop from Before to During touching approached significance ($t= 1.72$, $df= 6$, $p< 0.068$, 1 tailed).

Table 7.3.3.3.1 Experimenter1 Tac-Tic: Tcpo2

	MEAN	S.D.	MIN	MAX	N
Before	9.09	2.33	7.46	15.70	11
During	9.02	2.15	7.69	15.21	11
After	9.26	2.37	7.64	16.04	11

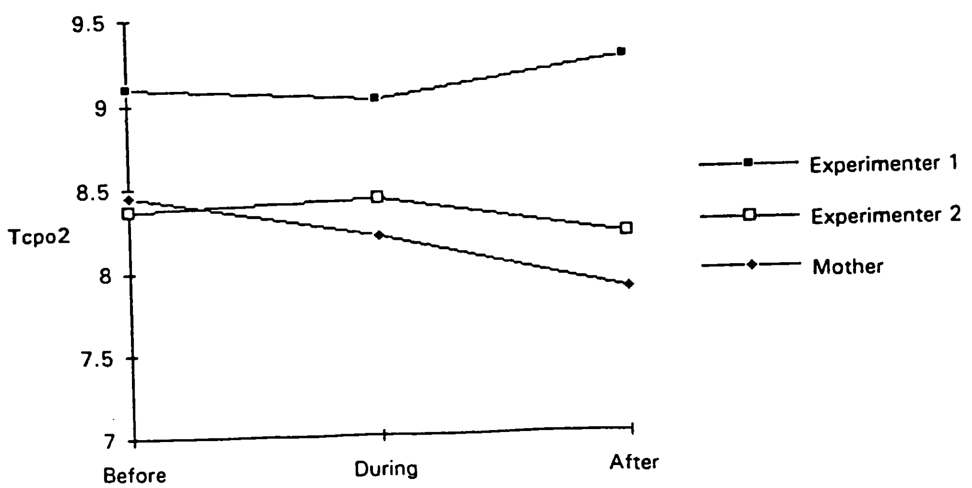
Table 7.3.3.4.1 Experimenter2 Tac-Tic: Tcpo2

	MEAN	S.D.	MIN	MAX	N
Before	8.36	1.79	5.19	10.45	7
During	8.43	1.35	7.20	10.66	7
After	8.21	1.09	6.62	9.76	7

Table 7.3.3.5.1 Maternal Touching: Tcpo2

	MEAN	S.D.	MIN	MAX	N
Before	8.45	1.34	7.35	11.35	7
During	8.21	1.06	6.99	10.37	7
After	7.87	1.00	6.90	9.87	7

Figure 7.3.3 Tcpo2



7.3.3.6 Experimenter2 Tac-Tic vs Maternal Touching

Comparing maternal touching and experimenter2 Tac-Tic phases, using percentage increase in tcpo2 data (Table 7.3.3.6.1, one way ANOVAS showed no significant differences between maternal touching and experimenter2 Tac-Tic across the 3 phases.

Table 7.3.3.6.1 % Increase in Tcpo2

% Tcpo2 Inc from before to during stimulation			
	Mean	Sd	N
Entire Pop	14.13	11.64	14
Mother	10.82	3.56	7
Experimenter2	17.44	15.98	7
% Tcpo2 Inc from during to after stimulation			
Entire Pop	10.38	4.25	14
Mother	9.87	3.59	7
Experimenter2	10.89	5.07	7
% Tcpo2 Inc from before to after stimulation			
Entire Pop	10.75	10.23	14
Mother	7.20	5.24	7
Experimenter2	14.31	13.03	7

(1) **% Inc in Tcpo2 from before to during stimulation by Mother/Experimenter2**

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	1	1529884.5	1529884.5	1.14	.30
Within Groups	12	16100102.8	1341675.2		
Total	13	17629987.4			

(2) **% Inc in Tcpo2 from during to after stimulation by Mother/Experimenter2**

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	1	36823.1	36823.1	.19	.67
Within Groups	12	2317188.2	193099.0		
Total	13	2354011.4			

(3) **% Inc in Tcpo2 from before to after stimulation by Mother/Experimenter2**

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	1	1770034.5	1770034.5	1.79	.20
Within Groups	12	11853651.1	987804.2		
Total	13	13623685.7			

7.3.3.7 Correlations

Before, during and after tcpo2 means within experimenter1 and experimenter2 Tac-Tic and maternal touching sessions all showed significant positive correlations. Birthweight, gestation and apgar at 1 minute also, as expected correlated positively with each other but not with any tcpo2 value.

Number of days on ventilation (ventil) or Apgar at 5 minutes also did not correlate significantly with any tcpo2 value (Table 7.3.3.7.1).

E1BT= Experimenter before stimulation

E1DT= Experimenter during stimulation

E1AT= Experimenter after stimulation

MUMBT= Mother before stimulation

MUMDT= Mother during stimulation

MUMAT= Mother after stimulation

E2BT= Experimenter2 before stimulation

E2DT= Experimenter2 during stimulation

E2AT= Experimenter2 after stimulation

Table 7.3.3.7.1 Pearson Correlations

	GEST	BWGT	AP1	AP5	VENT	E1BT
GEST	-	.89*	.71	.37	-.36	-.09
BWGT	.89	-	.86*	.47	-.61	.16
AP1	.71	.86*	-	.80	-.62	.21
AP5	.37	.47	.80	-	-.31	.06
VENT	-.36	-.61	-.62	-.31	-	-.29
E1BT	-.09	.16	.21	.06	-.29	-
E1DT	.07	.33	.33	.15	-.35	.97**
E1AT	.17	.32	.40	.34	-.19	.90*
MUMBT	.34	.59	.54	.31	-.36	.82
MUMDT	.24	.50	.45	.25	-.21	.80
MUMAT	.36	.56	.53	.41	-.10	.64
E2BT	-.24	.12	.15	-.09	-.29	.82
E2DT	.02	.34	.23	-.10	-.52	.89*
E2AT	-.06	.28	.17	-.15	-.35	.84*

	E1DT	E1AT	MUMBT	MUMDT	MUMAT	E2BT	E2DT	E2AT
GEST	.07	.17	.34	.24	.36	-.24	.02	-.06
BWGT	.33	.32	.59	.50	.56	.12	.34	.28
AP1	.33	.40	.54	.45	.53	.15	.23	.17
AP5	.15	.34	.31	.25	.41	-.09	-.10	-.15
VENT	-.35	-.19	-.36	-.21	-.10	-.29	-.52	-.35
E1BT	.97**	.90*	.82	.80	.64	.82	.89*	.84*
E1DT	-	.93**	.92*	.90*	.77	.76	.90*	.84*
E1AT	.93**	-	.89*	.85*	.80	.57	.70	.62
MUMBT	.92*	.89*	-	.97**	.92*	.66	.81	.78
MUMDT	.90*	.85*	.97**	-	.95**	.70	.78	.80
MUMAT	.77	.80	.92*	.95**	-	.51	.58	.61
E2BT	.76	.57	.66	.70	.51	-	.86*	.95**
E2DT	.90*	.70	.81	.78	.58	.86*	-	.95**
E2AT	.84*	.62	.78	.80	.61	.95**	.95**	-

1-tailed signif: * - .01 ** - .001

7.3.4 Interaction Analyses

7.3.4.1 Multivariate Anovas

To examine the interaction and differences between the % increases of the 3 physiological measures of:

1. Heart Rate
2. Respiration Rate
3. Tcpo2

i.e the within subjects factors, across the 3 phases of the experiment:

1. Before to During Stimulation
2. During to After Stimulation
3. Before to After Stimulation

and between the 2 stroker sessions of:

1. Experimenter2
2. Mother

a 3 x 3 x 2 multivariate analysis of variance was performed on the data.

Phase = Before to During, During to After and Before to After Stimulation (3 levels)

Meas = Physiological measure (Heart rate, Respiration rate, Tcpo2) % increase or decrease from 1 phase to another data (3 levels)

Con = Stroker (Experimenter2/Mother) i.e 2 levels

7.3.4.1.1 Phase by Con

Source of Var	SS	DF	MS	F	Sig.F
WITHIN CELLS	1628412.5	16	101775.7		
PHASE	76523.8	2	38261.9	.38	.69
CON BY PHASE	23294.8	2	11647.4	.11	.89

7.3.4.1.2 Meas by Con

Source of Var	SS	DF	MS	F	Sig.F
WITHIN CELLS	6986985.2	16	436686.5		
MEAS	4444583.3	2	2222291.7	5.0	.01
CON BY MEAS	1056574.0	2	528287.0	1.2	.32

7.3.5.1.3Con by Phase by Meas Interaction

Source of Var	SS	DF	MS	F	Sig.F
WITHIN CELLS	3416091.4	32	106752.8		
PHASE BY MEAS	720006.7	4	180001.6	1.6	.17
CON BY PHASE BY MEAS	216027.8	4	54006.9	.5	.73

7.3.4.1.4 Conclusion

From the MANOVA, it may be concluded that

(A) no significant difference occured between maternal touching and experimenter2 Tac-Tic in overall percentage increase of the physiological measures between the phases:

(a) before to during

(b) during to after

(c) before to after (section 7.3.4.1.1)

(B) between the 3 physiological measures, a significant difference was found in their percentage increase across the phases, (particularly Before to During/ After) and no significant difference was found between maternal touching andexperimenter2 Tac-Tic in this (section 7.3.4.1.2)

(C) No significant difference occured between the percentage increases of each of the physiological measures of heart rate, respiration Rate and tcpo2, across each of the phases of:

(a) Before to During

(b) During to After

(c) Before to After

or between maternal touching and experimenter2 Tac-Tic when in this (section 7.3.4.1.3)

7.3.4.2 Post-hoc Scheffe t-tests

In conjunction with the MANOVA, repeated measures t-tests were performed comparing, the percentage increase data overall (maternal and experimenter2 data) in Heart rate, Respiration Rate and Tcpo2 with each other, across the 3 phases of:

1. Before to During stimulation

2. During to After stimulation

3. Before to After stimulation.

This was done to determine whether any of the physiological variables were affected more by the Tac-Tic/Maternal touching, than any of the other variables.

7.3.4.2.1 Before to During Stimulation

1. Heart Rate vs Resp. Rate

	N	Mean	S.D.
Heart Rate	16	14.23	3.95
Resp. Rate	16	15.60	4.41

t	df	2-tailed prob
1.47	15	.16

2. Heart Rate vs Tcpo2

	N	Mean	S.D.
Heart Rate	14	12.91	3.49
Tcpo2	14	14.13	11.64

t	df	2-tailed prob
0.35	13	.73

3. Resp. Rate vs Tcpo2

	N	Mean	S.D.
Resp. Rate	10	15.33	5.31
Tcpo2	10	11.74	3.74

t	df	2-tailed prob
2.34	9	.04

7.3.4.2.2 During to After Stimulation

1. Heart Rate vs Resp. Rate

Heart Rate	16	13.73	2.67
Resp. Rate	16	13.86	4.81

t	df	2-tailed prob
0.10	15	.92

2. Heart Rate vs Tcpo2

	N	Mean	S.D.
Heart Rate	14	14.84	3.67
Tcpo2	14	10.38	4.24

t	df	2-tailed prob
3.49	13	.00

3. Resp. Rate vs Tcpo2

	N	Mean	S.D.
Resp. Rate	10	14.48	U5.61
Tcpo2	10	10.16	4.63

t	df	2-tailed prob
1.57	9	.15

7.3.4.2.3 Before to After Stimulation

1. Heart Rate vs Resp. Rate

	N	Mean	S.D.
Heart Rate	16	13.93	3.87
Resp. Rate	16	15.93	6.69

t	df	2-tailed prob
1.27	15	.22

2. Heart Rate vs Tcpo2

	N	Mean	S.D
Heart Rate	14	13.76	4.74
Tcpo2	14	10.75	10.23

t	df	2-tailed prob
0.87	13	.40

3. Resp. Rate vs Tcpo2

	N	Mean	S.D.
Resp. Rate	10	16.84	7.40
Tcpo2	10	8.59	6.03

t	df	2-tailed prob
2.56	9	.03

7.3.4.2.4 Conclusion

1. From Before to During and Before to After stimulation, respiration rate was found to show a significantly greater increase than tcpo2, while from During to After stimulation, heart rate increased significantly more than tcpo2.

7.3.5 Conclusions

(A) Heart Rate

1 Heart rate showed a significant drop following the Tac-Tic procedure.

2 Comparing Tac-Tic and maternal touching, no significant difference was found between these in terms of their effects on heart rate.

This occured despite a significant elevation in heart rate occuring from Before to After maternal touching, but not Before to After experimenter2 Tac- Tic.

3 The benefical impact of an older gestational age and larger birthweight may be seen in their significant negative correlations with experimenter1 Before, During and After Tac-Tic heart rate.

4 Before, During and After heart rate of maternal touching and During and After heart rate of the experimenter2 Tac-Tic, and gestation, though not birthweight again showed significant negative correlations.

5 Number of days spent on ventilation had no significant relationship with heart rate.

(B) Respiration Rate

1 After the Tac-Tic procedure, respiration rate increased significantly.

2 Comparing maternal touching with Tac-Tic, no significant differences were found between them, despite respiration rate increasing (approaching significance) During maternal touching but not During Tac-Tic.

3 Respiration rate was not significantly related to birthweight, gestational age, Apgars or number of days spent on ventilation.

(C) Tcpo2

1 There was no significant alteration in tcpo2 During or After Tac-Tic.

2 In terms of alteration in tcpo2, no significant differences were found between maternal touching and Tac-Tic.

3 Within the maternal touching session however, a pattern of decreasing tcpo2, from Before to After touching was visible, with the Before to After drop and the During to After drop significant and Before to During touching approaching significance.

4 No significant changes in tcpo2 were found within the experimenter session.

5 Birthweight, gestational age, Apgars and number of days on ventilation were not found to relate to tcpo2.

(D) Data Validity

1 Order of presentation of the Tac-Tic touching and maternal touching (i.e. which came first/second) had no significant affect on any of the physiological measures.

2 Agreement of the blind examiner with the experimenter in the raw data interpretation, as reflected in the significant reliability alphas, occured in the all the measures.

7.4 DISCUSSION

7.4.1 The immediate physiological effects of the tactile stimulation programme (Tac-Tic)

Overall, the major conclusion regarding the Tac-Tic stroking programme is that it can be seen to have no harmful effects upon the high-risk ventilated preterms, thereby supporting the hypothesis (except for respiration rate) that no physiological deterioration would occur when infants received the Tac-Tic stroking. The findings of no significant increase in heart rate and no significant decrease in tcpo2 either during or after the stroking suggests this, as such a significant increase would have indicated infant distress (Gandy and Roberton, 1987).

However, respiration rate was found to increase significantly suggesting infant distress, after the stroking procedure. Along with this though, heart rate was found to decrease significantly after the stroking procedure and this pattern is indicative of an improvement in or more developmentally enhanced state.

This somewhat "paradoxical" pattern is understandable given the extreme immaturity, disorganization and lack of regulation that high risk preterm physiology exhibits (Hutchison, 1975).

In sum, the conclusion to be drawn is that further research should be conducted into the immediate effects of tactile stimulation programmes with ventilated high-risk preterms before advocating their incorporation into routine ventilated infant care in neonatal units, but that there are good reasons for believing that these programmes are indeed not harmful in their immediate effects.

Given that the tactile stimulation programme employed in this programme (Tac-Tic) was modified and shortened, using only those strokes that did not require the infant to be moved and overall took only 4 minutes, future research determining the optimal strokes that should be used and optimal duration of daily supplemental tactile stimulation to exert maximal benefit, needs to be pursued.

The use of alternative physiological dependent variables such as temperature, blood pressure and gastric activity, all of which are examined by medical staff in the determination of infant prognoses, should also be employed in such research to establish an "overall picture" of the physiological effects of tactile stimulation programmes.

The implications of this study are that tactile stimulation programmes, at least the Tac-Tic programme, could be performed with high-risk ventilated preterms in the neonatal unit, given that no harmful effects were found and so many benefits have been shown when such programmes have been conducted with low-risk "healthy" preterms as well as the minimal social touching such infants experience.

Furthermore, given that social touching, in comparison to nappy changing/feeding, medical treatments and other procedures eg. in/out of incubator, is the least frequent activity, (along with being the activity with the shortest duration) found with such infants in neonatal units (Blackburn, 1979), Tac-Tic represents a means of encouraging parents to provide their infants with a greater amount of social touching, whilst also facilitating their development.

7.4.2 The immediate physiological effects of the tactile stimulation programme (Tac-Tic) as compared to maternal touching

Overall, the experimental hypothesis that fewer beneficial effects would occur in maternal touching as compared to experimenter Tac-Tic stroking was not supported, implying that Tac-Tic stroking did not benefit infants any more than maternal touching. No significant differences were found between maternal touching and experimenter Tac-Tic in percentage increase of heart and respiration rate and tcpo2.

This could be due to the Tac-Tic stroking programme being administered in a shortened, modified form (to acquire ethical permission). It may have been "inadequate", either in terms of quantity (insufficient number of strokes) or quality (strokes which have the greatest beneficial effect being missed out). Research has yet to determine the optimal quantity and quality of strokes in the Tac-Tic or for that matter any of the stroking programmes.

Upon analysis of the data though, from the before to during to after phases within the experimenter Tac-Tic/maternal touching, tcpo2 was found to decrease significantly within the maternal touching session while no significant change occurred within the experimenter Tac-Tic session.

This suggests that the maternal touching had a greater detrimental or less of a regulating influence than experimenter Tac-Tic on tcpo2, which is in agreement with the experimental hypothesis. Patterned sequences of stroking movements have been argued to be more beneficial than random touching as they encompass more of the body and are contended to be more therapeutic and "womb-like" (Macedo, 1984; Rice, 1977).

The argument that as tcpo2 was higher to begin with when maternal touching, as compared to experimenter Tac-Tic, was carried out and so could have been more likely to fall is not applicable, as no significant difference was found between the before stimulation tcpo2 values of the experimenter as compared to mother.

Since the prone position has been recognised as aiding respiration and increasing oxygenation more than the supine or on-side positions (Wagaman et al., 1979; Martin et al., 1979), this could have biased the data if infants were in the prone position more for experimental stroking than maternal touching. However, infants were in the same position when maternal touching as opposed to experimenter stroking was being performed, thus the above argument cannot be seen to apply to this study.

Extraneous events that occurred when the mother was touching her infant such as loud noises (Long et al., 1980) may have accounted for the drop in tcpo2.

This however was equally probable to have occurred during experimenter stroking, but as the experimenter did not notice such disturbances, either during maternal touching or experimenter stroking, it is unlikely that they took place at all.

Equally, the predominant order of stimulation presentation, (experimenter Tac-Tic first, followed by maternal touching) could have biased the data in that, as a consequence of having already received 4 minutes stroking, infants might not have been able to cope with the maternal touching and thus exhibited a deterioration in physiological condition, reflected in decreased tcpo2. However, the analysis performed into the effect of the order of Tac-Tic/maternal touching presentation revealed that this factor did not have a significant bearing upon any of the physiological measures.

In sum, it is still not clear cut whether Tac-Tic stroking as compared to maternal touching exerts more immediate beneficial physiological effects.

Repeating the same study except this time comparing maternal touching to maternal Tac-Tic (this time using all of the programme) stroking, after mothers had been trained in the Tac-Tic procedure, would control for any effects (eg. pressure of touch) resulting from different individuals (experimenter /mother) performing the touching/stroking procedures, that may have occurred in this study and determine more accurately whether Tac-Tic stroking as compared to touching exerts more immediate beneficial physiological effects.

With regard to the significance of the results found for long-term development, the stability of the heart rate and tcpo2 measures, before, during and after the Tac-Tic stimulation is suggestive of improved viability and physiological regulation, beyond this however, no further conclusions can be drawn.

CHAPTER 8

THE IMMEDIATE GASTRIC EFFECTS OF A TACTILE STIMULATION PROCEDURE ON PREMATURE INFANTS.

8.1 INTRODUCTION: How do stimulation programmes exert their effects ?

Despite the number of studies that have shown benefits in preterm physical and psychological development, as a result of supplemental early tactile stimulation (Rice, 1977; Jay, 1982; Macedo, 1984; Field et al., 1986), few studies have investigated how these benefits, particularly those of a physical nature, are brought about. With regard to the physical benefits of tactile stimulation programmes with preterms (see Chapter 5), speculation on possible mediating mechanisms has focused on the endocrine and digestive systems.

8.1.1 The endocrine system: possible mediating mechanisms

8.1.1.1 Ornithine Decarboxylase

Research with animals, (Butler and Schanberg, 1977; Evoniuk et al., 1979), has suggested that an enzymatic-hormonal mechanism may bring about the physical benefits associated with tactile stimulation programmes.

Interruption of active tactile stimulation (licking, rubbing) of rat pups by the rat mother, as a consequence of maternal seperation, has been found to trigger a decline in ornithine decarboxylase (ODC) activity in the rat pups (Butler and Schanberg, 1977).

ODC is the first enzyme in the synthesis of polyamines, (substances involved in protein synthesis regulation; Bachrach, 1973) and thus of immense significance in digestion. Activity of this enzyme is also an index of general tissue growth and differentiation (Schanberg and Field, 1987), the rudiments of physical growth and motor development.

To determine whether this ODC decline was purely a phenomenon of tactile stimulation deprivation and not maternal body heat and smell deprivation rat pups were placed with a mother rat that had been anesthetized with unethane to prevent maternal tactile stimulation and feeding activity (Lincoln and Waverly, 1974).

Tissue ODC activity however, still changed in the same way that separating the pups from their mother altered ODC activity (Butler et al., 1978), revealing ODC activity to decrease despite other sensory cues, eg. body heat and smell, being passively transferred to the pups by the mother.

When such rat pups were stroked though, using a camelhair brush and with a pressure and frequency that approximated maternal tongue licking motions, ODC activity and growth hormone was found to return to normal levels in all tissues and this was not found for any other form of sensory stimulation eg. tail pinching (Schanberg and Field, 1987).

Similarly, Pauk et al. (1986) gave maternally deprived rats either tactile, vestibular or kinaesthetic stimulation (stroking, rocking, passive limb movement) while another group of rat pups served as a control group.

They found that the controls (i.e the rat pups that were not stimulated in any way) displayed significant decreases in ODC and growth hormone as well as significant increases in corticosterone levels (indicating a stress response).

Tactile stimulated rat pups however, showed the reverse of this while vestibular and kinaesthetically stimulated pups showed decreases in ODC and growth hormone and increases in corticosterone though these differences were not significant. This study thus reinforced that the only form of stimulation that lead to an increase in ODC, which had fallen as a consequence of maternal deprivation, was that of a tactile kind, suggesting that it was a deprivation of this stimulation (as a consequence of maternal deprivation) that lead to a fall in ODC to begin with.

Though the increase in corticosterone and decrease in growth hormone following maternal separation (Kuhn et al., 1978; Pauk et al., 1986) is characteristic of a stress response, as would be expected from such an experience, serum levels of other stress responsive hormones eg. prolactin did not change. The decrease of growth hormone though does explain the fall in ODC activity as it regulates ODC activity both in the brain and peripheral tissues (Rogers et al., 1974).

Schanberg and Field (1987) concluded that all this research supports the notion that tactile stimulation is the sensory modality that most effectively contributes to the regulation of serum growth hormone and tissue ODC activity.

It has also been proposed that early handling induces an alteration in the balance of hypothalmic activity that could be permanent resulting in an increase in growth hormone production and possibly increased activation of the reticular formation, which serves as a general arousal centre (Bovard and Newton, 1953).

Associated with this is the finding of Van Wyk and Underwood (1978) that physical activity increases growth hormone, given that quite a significant increase in physical activity in infants has been noted to occur during tactile and/or kinaesthetic stimulation (Solkoff et al., 1969). On top of this, they hypothesized that stimulation instigates accelerated growth hormone release and/or decreases stress and thus increases growth hormone (Stubbe and Wolf, 1971) reflected in greater ODC levels.

As ODC activity is an accurate and sensitive index of cell growth and development, its decline during maternal separation could represent, according to Schanberg and Field (1987), a specific biochemical mechanism through which environmental stimuli (and stimulation programmes) affect growth and development.

It is thus quite plausible, given that it has been empirically established, that this, or a similar endocrine mechanism, may account for how tactile stimulation programmes increase weight gain, more mature behaviour and so on in human infants (Field et al., 1986; Rice, 1977).

Kramer et al.'s (1975) study did assess the effects of a tactile stimulation programme upon plasma cortisol level in response to stress and found no significant difference between the experimental and control infants. Further research though is needed both to establish the immediate endocrine effects of tactile stimulation given to human infants and to evaluate sympathoadrenal and andrenocortical effects, of such stimulation, thereby allowing for a distinction between stress induction and stress reduction mediated decreases on growth hormone secretion associated with stimulation (Schanberg and Field, 1987).

As some handling procedures eg. the Brazelton assessment (Gunnar et al., 1987) appear to elicit stressful responses, whilst other tactile stimulation procedures (Casler, 1965; Field et al., 1986; Solkoff et al., 1969) do not, this would establish exactly what kind of tactile stimulation is/is not stressful to the infant.

The subsequent findings could then be employed, to the benefit of preterm and other high-risk infants, in the design of future infant tactile stimulation programmes.

8.1.1.2 Stress Response

A number of other animal studies have revealed that supplemental tactile stimulation, provided in early life, improves endocrinal response to stress, such that it is more adaptive and similar to a more mature stress response (Levine et al., 1958; Bell et al., 1961; Levine and Broadhurst, 1963; Levine and Mullins, 1966; Denelsky and Dennenberg, 1967; Ader, 1969).

Endocrinal response to stress, though greater to begin with, diminishes quicker in rats who have been "handled" in early life as compared to those who were not handled, and thus the negative side effects of stress, eg. ulceration, are less likely to occur in the handled rats (Levine, 1962).

Equally, animals who have received supplemental tactile stimulation in early life, as compared to those who did not, are better able to "cope" with stressful situations in later life (Bovard, 1958; Levine and Broadhurst, 1963).

For example, such animals are more likely to survive a thyroidectomy operation (Hammett, 1922; Greenman and Duhring, 1931), suffer less organic damage under food/water deprivation (Weininger, 1956; Denenberg and Karas, 1959) and are inhibited less by a novel environment as adults (Levine and Broadhurst, 1963). Akin to tactile stimulation programmes with human infants, those conducted with infant animals also show similar physical benefits, eg. greater weight gain (Levine and Otis, 1958) and improved motor development (Greenough, 1976), as well as enhanced cognitive development (Denenberg, 1962; Denelsky and Denenberg, 1967).

In sum, all these studies, like those of Schanberg and Field (1987) and Pauk et al. (1986), suggest that tactile stimulation, provided in early life, has endocrine effects which may underlie associated physical, if not also cognitive benefits.

The need to fill the vacuum in research on the endocrine effects of tactile stimulation with human infants is thus of immense importance if we are to determine exactly how tactile stimulation programmes with human infants, bring about their physical (and also cognitive) benefits.

8.1.2 The Digestive System: possible mediating mechanisms

8.1.2.1 Tactile Stimulation and Digestion

The relationship of tactile stimulation to the digestive system has long been recognised. Tjossem (1976) argued that increased sensory input can alter the body structurally and functionally, such that a greater density of nerve cells, greater electrical activity of certain areas of the brain and increased protein biosynthesis result.

Montagu (1953) stated that "*It is recognised that stimulation of the peripheral sensory nerves of the skin is a necessary part of activating the nerves of the gastro-intestinal tract through the connection of the peripheral and central nervous systems with the autonomic*" (p293). He also acknowledged how deprivation of such tactile stimulation results in the autonomic nervous system being inadequately stimulated culminating in a failure of activation of the gastro-intestinal tract as well as the genito-urinary system (Montagu, 1953).

Several studies of tactile stimulation deprivation in animals have shown deterioration in both digestive and genito-urinary functioning (Reyniers, 1946, 1949; McCance and Oatley, 1951).

However, when such tactually deprived animals were stroked on the genital and perineal regions with a wisp of cotton after each feeding, they did not exhibit such deteriorated digestive and genito-urinary functioning (Reyniers, 1946, 1949).

Tactile stimulation in early life, either in the form of licking or grooming in animals or touching/stroking in humans, has thus been seen as essential for survival, instigating the functioning of such systems as the digestive and genito-urinary sytems (Montagu, 1953). No research however has yet established the effects of tactile stimulation programmes, with preterms or other infants, at the digestive level.

8.1.2.2 Tactile Stimulation and Weight Gain

Several studies have investigated whether the frequent sequelae of greater weight gain in human infants given, as compared to those not given, supplemental early tactile stimulation, is a consequence of increased fluid intake. Though some studies found this to be the case (Freeman, 1969, White and LaBarba, 1976; Rausch, 1981,) others did not (Macedo, 1984; Bernbaum et al., 1983; Scafidi et al., 1990).

Levine (1960), on the basis of tactile stimulation programmes with animals, argued that food intake is not related to faster growth as a result of stimulation but that stimulation assists in greater, more optimal utilization of food consumed.

It may be possible also that hormones involved in promoting the muscular propulsion of food through the digestive tract may be activated by tactile stimulation.

Muscular contractions and the intestinal wall serve to mix milk with digestive enzymes and other compounds to make milk easier to digest, and this is necessary as nutrients can be absorbed only when they are in a suitably digested form.

The greater activation of such hormones involved in the muscular propulsion and break down of milk, may thus be one means of accounting for the greater weight gain often displayed by stimulated in comparison to control infants. This may apply especially to stimulated premature infants whose digestive hormones are not released in a normal co-ordinated way (Pounder, 1986).

Akin to this, Macedo (1984) proposed that the greater weight gain findings of some tactile stimulation programmes (Rice, 1977; Rausch, 1981; Macedo, 1984), may be a function of more efficent digestion rather than increased fluid/caloric intake.

This was found by Ruegamer and Silverman (1956) with rat pups who received supplemental tactile stimulation and by Hopper and Pinneau (1957) with human infants who received supplemental tactile stimulation, in terms of decreased regurgitation.

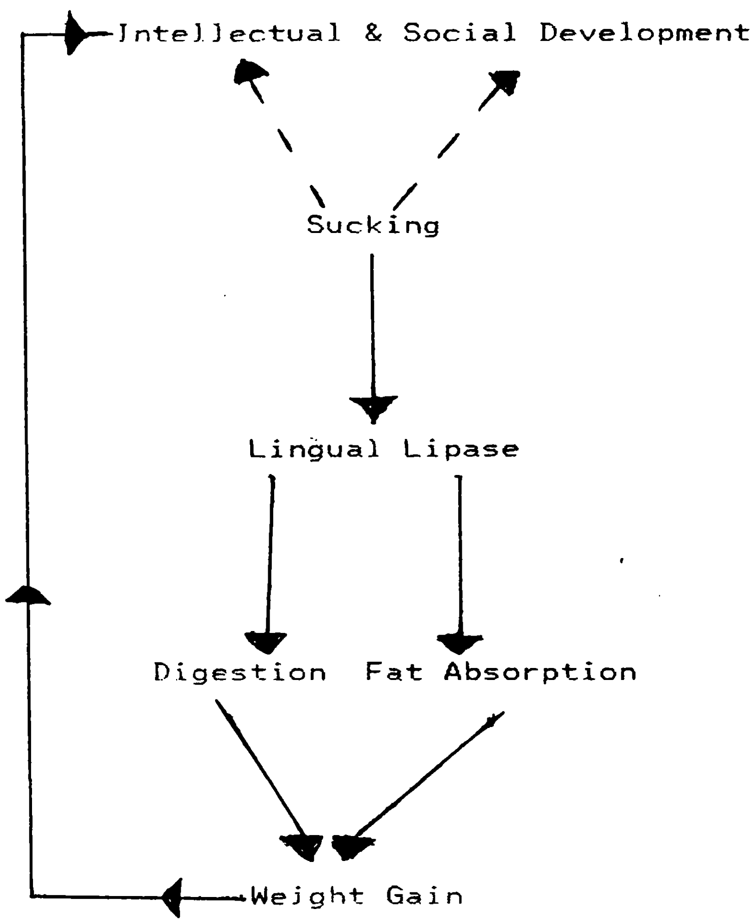
8.1.2.3 Macedo's (1984) Mechanism

The mechanism (see Figure 8.1.2.3.1) that Macedo (1984) proposed to account for such enhanced efficency of digestion is based upon the findings of improved sucking as a result of supplemental tactile stimulation with human infants (Tryowski, 1979; Macedo, 1984) and the correlated development of sucking and increased quantity of lingual lipase (Wozniak et al., 1983; Hamosh, 1983).

Hamosh (1983) found lingual lipase (a lipase secreted from the serous glands at the base of the tongue (Von Ebner, 1899) which breaks down fat in the stomach Hamosh, 1979) to arise prior to 26 weeks gestation, accumulating in the stomach before birth and to be a catalyst later in the hydrolysis of dietary fat in the stomach. He also recognised that infants above 34 weeks gestation have significantly higher levels of lingual lipase activity than younger infants.

This along with Wozniak et al.'s (1983) finding that the sucking reflex begins to develop from 33 weeks gestation and the contention that the importance of and the possibility of early development of sucking has still to be established, led Macedo (1984) to propose that through improving and/or accelerating sucking, tactile stimulation enhances digestion as a result of increased lingual lipase secretion and/or activity (see Figure 8.1.2.3.1).

FIGURE 8.1.2.3.1 Macedo's (1984) Model



(Macedo, 1984)

Given that tactile stimulation has been shown to accelerate the onset of sucking action, (Macedo, 1984, Tryowski, 1979), Macedo (1984) argued that "*..the prime questions are whether or not there is a demonstratable reflex action between tactile stimulation and the sucking action on the one hand and tactile stimulation and nutrient absorption on the other*" (p180). As fat accounts for approximately half of a preterm infant's dietary energy and since malabsorption of fat due to physiological immaturity is found in preterms (Macedo, 1984), the significance of Macedo's (1984) proposition and argument cannot be overestimated.

Along with this, Macedo (1984) contended that through glandular action and hormones or by the cortical or subcortical loci acting through the hypothalmus and in the adrenohypophesis, tactile stimulation in the form of stroking, could also accelerate the liberation of important hormones which promote growth, eg. growth hormone.

Given that growth hormone controls the regulation of ODC, which has been shown, in animals, to increase as a consequence of tactile stimulation, (Schanberg and Field, 1987), Macedo's (1984) contention is quite plausible. No research with human infants though has investigated this or the general gastric effects of tactile stimulation, despite a relationship between tactile stimulation and digestive functioning having been noted in the past (Montagu, 1953).

This study thus set out to investigate this, assessing Macedo's (1984) digestive mechanism.

Due to practical difficulties and ethical requirements, in acquiring lingual lipase samples from the mouth, this was not conducted. However, as lingual lipase passes from the mouth to the stomach, where it functions with gastric lipase to hydrolize fat (Hamosh, 1990), overall stomach lipase (i.e lingual and gastric lipase, which could not be separated by the laboratory tests available in this study) was analyzed.

Concentration of overall lipase in the stomach reflects quantity of lingual, as well as gastric, lipase, such that when the quantity of lingual lipase reaching the stomach is reduced, there is an overall reduction in lipase in the stomach and reduced intragastric lipolysis (i.e fat breakdown) as well as reduced fat and bile acid absorption (Hamosh, 1990; Pluciniski et al., 1979; Roy et al., 1979). Stomach lipase concentration, before and after tactile stimulation as compared to a control period, was thus examined to assess Macedo's (1984) model.

8.1.2.4 Hydrochloric Acid Mechanism

As it is also possible that more efficent digestion could be achieved through increased hydrochloric acid (HCL) secretion, gastric ph, which is an index of acid increase/decrease, was also assessed. Hydrochloric acid (which is composed of hydrogen ions) secretion into the stomach is controlled by gastrin (Hawker, 1981) release and gastric ph is a function of the number of hydrogen ions present in the stomach solution, with a 1 unit ph increase/decrease reflecting a 10 fold hydrogen ion increase/decrease.

The functions of HCL include:

1. lowering the gastric ph to establish the ph necessary for pepsin to start protein digestion

2. assisting protein digestion

3. killing ingested bacteria

4. stimulating the flow of bile and pancreatic juice necessary for digestion in small intestine

Stomach digestion, which requires an acid medium (i.e low gastric ph) thus relys upon HCL (and thus gastrin) secretion for its functioning. In the increased or decreased secretion of HCL, gastrin, a gastrointestinal tract hormone and the only known stimulating hormone of gastric secretion (Pounder, 1986), thus plays a very important role, with its increase or decrease effecting the secretion of HCL.

Gastrin is secreted by the G cells in the antrum region of the stomach and in the duodenum and serves to:

1. stimulate HCL secretion by the parietal cells

2. increase gastric motility

3. increase pepsinogens (inactive proenzymes which upon being acted upon by HCL, are converted to pepsins i.e active enzymes and then serve to break down protein into polypeptides)

4. increase blood flow to the gastric mucosa

5. regulate histamine (a paracrine agent and neuromodulator) release

6. increase the flow of exocrine secretion of the pancreas

amongst other functions (Ganong, 1985).

Figure 8.1.2.4.1 illustrates the relationship of tactile stimulation to digestion in the stomach and the role and mechanism of gastrin and HCL in this process.

Gastrin secretion is increased by:

1. Luminal factors such as peptide and amino acid concentration and stomach distention

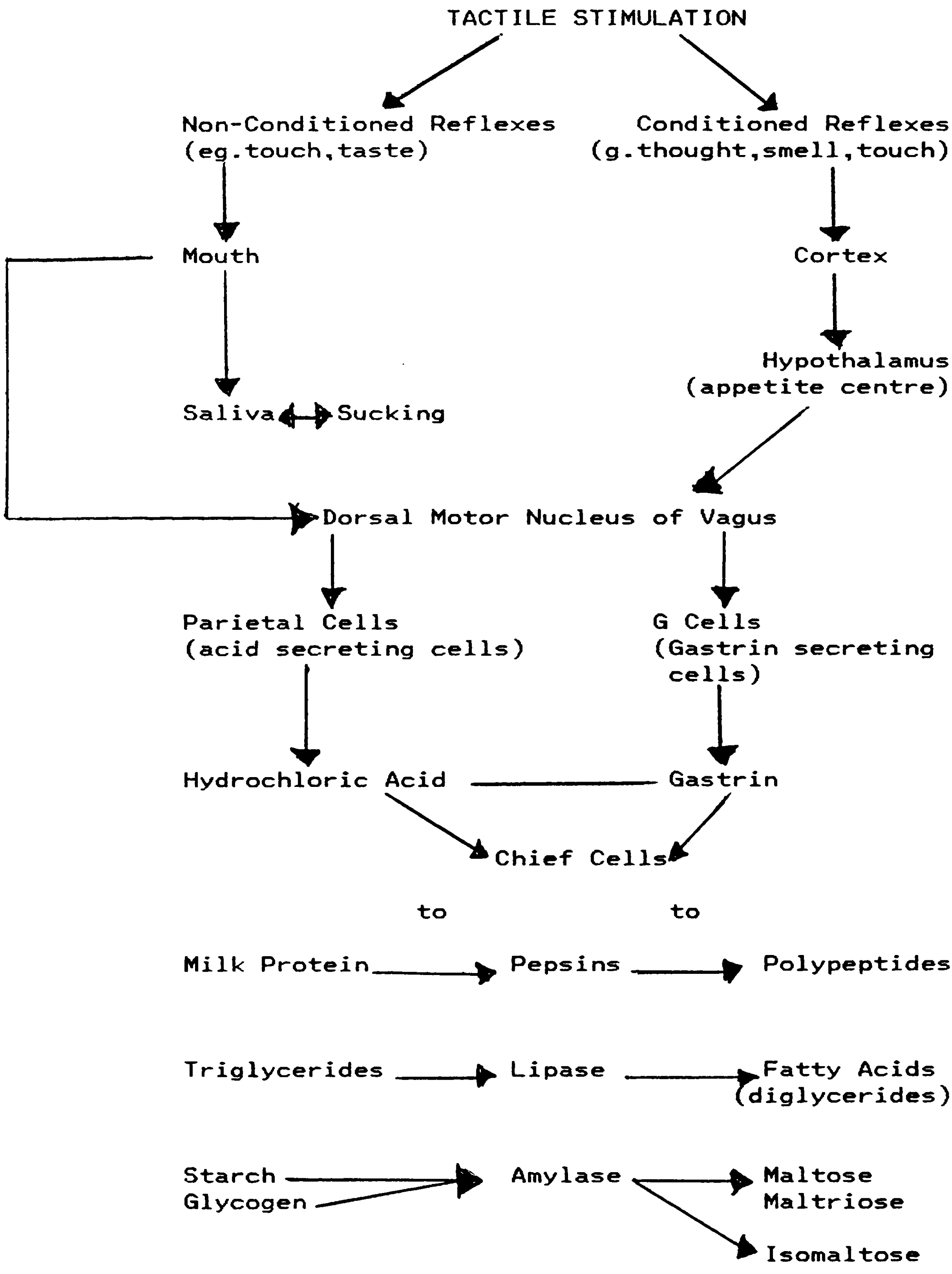
2. Neural factors such as vagal discharge and direct neural stimulation of stomach

3. Blood borne factors such as calcium and epinephrine.

GIP (gastrin inhibiting peptide, a neurotransmitter), VIP (vasoactive intestinal peptide) and secretin (a peptide hormone), all blood borne factors, as well as stomach acid concentration above a certain threshold, decrease gastrin secretin.

Conditioned and unconditioned reflexes may also increase gastrin and general gastric juice secretion (Oppenheimer, 1959). Visual, olfactory, auditory, tactile and gustatory stimuli, via cortical connections to the hypothalamus and the vagus nerve can also increase/decrease gastric secretions, see Figure 8.1.2.4.1 (Pavlov, 1910; Oppenheimer, 1959).

FIGURE 8.1.2.4.1 Tactile stimulation and digestion in the stomach



Adapted from Hawker (1981)

Vagal stimulation, via afferent fibres which with vagi and sympathetic nerves mediate visceral sensations, increase gastrin secretion by the:

1. release of GRP

2. release of acetylcholine (a chemical transmitter released from some peripheral nerve endings and from some neurons in the C.N.S.) which acts directly on the cells of the fundus region of the stomach

Stimulation of the vagus nerve in the chest or neck also increase gastrin (and thus HCL) and pepsin secretion (Ganong, 1985) and emotional state is also, through the vagus, associated with this secretion.

States of arousal, anger and hostility are associated with general gastric secretion while states of fear and depression are related to inhibition of gastric secretion and decreased gastric blood flow (Beaumont in Ganong, 1985; Margolin et al., 1950). Gastrin, and HCL, secretion can thus be seen to be quite a complex process, with both emotive and learning influences.

8.1.3 Conclusion

This study set out to investigate the effects of a programme of tactile stimulation (Tac-Tic) with preterm infants upon:

1. Stomach Lipase

2. Gastric ph

with the experimental hypotheses being that concentration of overall gastric lipase would be higher and gastric ph lower (i.e increased HCL secretion) after tactile stimulation as compared to a control period.

Along with these the following were also included as dependent variables to obtain an overall picture of physical and general development:

3. age in days when first sucking all feeds

4. age in days when moved from an incubator into a cot

5. age in days at discharge home

6. daily average food intake

7. daily average weight gain

with the experimental hypotheses being that the experimental, as compared to control, sample would show earlier ages on variables 3-5, greater average intake on variable 6 and greater average weight gain on variable 7. These patterns being reflective of improved development.

As a side-issue the question of whether Tac-Tic stimulation has a greater impact on high-risk (low gestational age and birthweight) as opposed to low-risk preterm (high gestational age and birthweight) infants was also examined for the same reasons and in the same way as stated in Chapter 6 (Section 6.1.5.1).

The experimental hypotheses here being that:

(a) the high-risk group in the experimental sample would show significantly greater gastric lipase concentration, lower gastric ph, earlier ages and greater daily average food intake and weight gain on the above variables, than the high-risk group of the control sample and that the likelihood of a significant difference between these groups would be greater than between the low-risk groups.

8.2 METHOD

8.2.1 Design

This study was conducted to assess the immediate effects of Tac-Tic stimulation on preterm gastric activity as well as its effects on general infant development. The independent variable was the Tac-Tic stimulation procedure and the dependent variables were:

(a) gastric ph, assessed from gastric aspirate analysis

- a.1 before ph
- a.2 after ph
- a.3 before ph - after ph

(b) stomach lipase assessed from gastric aspirate analysis

(c) age in days when first sucking all feeds

(d) age in days when moved from an incubator into a cot

(e) age in days at discharge home

(f) average daily food intake

(g) average daily weight gain

Hospital records were used to determine dependent variables (c) through to (g).

Samples were matched as far as possible on their overall distribution on the following variables:

(a) Birthweight

(b) Gestation

(c) Apgars 1 and 5

(d) Gender

but it is an independent samples design.

All infants recruited were firstly assigned to the experimental group and thereafter assigned to the control group if they matched one of the experimental subjects on the above mentioned criteria (See Appendix 6.2.1.1).

When examining the immediate gastric effects of Tac-Tic, a pretest-posttest design was employed, with gastric aspirates being taken before and after the Tac-Tic stimulation in the experimental infants and before and after a 20 minute (length of time of the Tac-Tic procedure) control period in the matched controls. The gastric effects of taking an aspirate in itself were thus controlled for.

During the control time period, control infants were observed to ensure that no medical or caretaking intervention occured with the infants as such could effect the infant's gastric state.

The design therefore is a 2 group independent samples design, where the groups are experimental and control.

8.2.2 Subjects

23 premature infants from the Queen Mother's hospital, Yorkhill, Glasgow, all of which were below 2.5 kg in birthweight, at/below 37 weeks gestation and being tube fed.

The latter was a precondition for obtaining ethical permission to take gastric aspirates. 3 subjects had to be discarded due to insuffficent quantities of aspirates for analysis and transferral to other hospitals.

The final sample consisted of 20 infants, 10 experimental and 10 matched controls, all of whom suffered no debilitating medical disorder other than jaundice. Of those who experienced jaundice, their treatment of phototherapy was completed when the gastric analyses were taken.

Subject characteristics, broken down into high and low-risk, (high risk = at/below 33 wks gestation, this threshold was selected as it conveniantly divides groups into near equal numbers), for referal to later on, are detailed in the Tables 8.2.2.1 to 8.2.2.4.

Table 8.2.2.1 BIRTHWEIGHT

	MEAN	S.D.	RANGE	N
Entire Pop. 12f 8m:	1.68	0.50	0.82-2.41	20
Experimental 6f 4m:	1.74	0.54	1.00-2.41	10
High risk:	1.52	0.49	1.00-2.24	5
Low risk:	1.96	0.54	1.02-2.41	5
Control 6f 4m:	1.63	0.48	0.82-2.28	10
High risk:	1.30	0.36	0.82-1.74	6
Low risk:	2.10	0.13	2.00-2.28	4
Overall High Risk:	1.42	0.45	0.82-2.24	11
Overall Low Risk:	2.00	0.38	1.02-2.41	9

Table 8.2.2.2 GESTATION

	MEAN	S.D.	RANGE	N
Entire Population:	32.4	2.77	26-37	20
Experimental:	32.6	2.41	27-35	10
High risk:	31.0	2.54	27-34	5
Low risk:	34.0	0.70	33-35	5
Control:	32.2	3.22	26-37	10
High risk:	30.1	2.31	26-33	6
Low risk:	35.2	1.25	34-37	4
Overall High Risk:	30.5	2.33	26-34	11
Overall Low Risk:	34.5	1.13	33-37	9

Table 8.2.2.3 APGAR AT 1 MINUTE

	MEAN	S.D.	RANGE	N
Entire Population:	7.95	1.53	3-9	20
Experimental:	8.40	0.96	6-9	10
High risk:	8.20	1.30	6-9	5
Low risk:	8.60	0.54	8-9	5
Control:	7.50	1.90	3-9	10
High risk:	7.50	2.34	3-9	6
Low risk:	7.50	1.29	6-9	4
Overall High Risk:	7.81	1.88	3-9	11
Overall Low Risk:	8.11	1.05	6-9	9

Table 8.2.2.4 APGAR AT 5 MINUTES

	MEAN	S.D.	RANGE	N
Entire population:	8.80	0.52	7-9	20
Experimental:	8.90	0.31	8-9	10
High risk:	8.80	0.44	8-9	5
Low risk:	9.00	0.00	9	5
Control:	8.70	0.67	7-9	10
High risk:	8.66	0.81	7-9	6
Low risk:	8.75	0.50	8-9	4
Overall High Risk:	8.72	0.64	7-9	11
Overall Low Risk:	8.88	0.33	8-9	9

8.2.3 Stimulation

See Section 6.2.1.3.

8.2.4 Apparatus/Procedure

Immediately before and after:

(a) the Tac-Tic procedure in experimental infants

(b) a 20 minute non-intervention period in the control infants

a gastric aspirate was taken using sterilized suction syringes.

Separate sterilized suction syringes were employed to take the gastric aspirates to ensure that the before stimulation or control period aspirate did not interfere with the aspirate taken after the stimulation/control period.

Aspirates were drawn, using the suction syringes, from the subject's stomach, through their nasogastric feeding tube. The sample was then sealed into a container and sent for analysis to the hospital biochemistry department.

Lipase quantity and concentration in the samples were measured by assessing optical density of lipase at 340 nm using triolein (a neutral fat hydrolized by lipase) as a substrate.

Ph of the samples was determined using a Corning Ph meter, model 120 (accuracy +/- 0.01 ph).

Figure 8.2.4.1 A GASTRIC ASPIRATE BEING TAKEN

8.3 RESULTS

Due to the quantities of gastric aspirate generally being rather small (mean vol.= 4.3 ml), no laboratory analysis could be conducted to detect stomach lipase concentration. However, it was possible to measure gastric ph concentration.

8.3.1 Before and After Gastric Aspirate PH

The experimental and the control samples were compared on their before stimulation/control period ph and their after stimulation/control period ph using an a-priori independent t-test.

A oneway ANOVA with post-hoc Scheffe t-tests was conducted to examine the differences between the high-risk and low-risk groups of the experimental and control samples.

The experimental, in comparison to control infants, were found to have a higher pre and post Tac-Tic/control period gastric ph (Tables 8.3.1.1 to 8.3.1.2, Figure 8.3.1.1). Over both the experimental and control infants, it is also visible, from Tables 8.3.1.1 and 8.3.1.2, that the high-risk as compared to low-risk infants, had a higher ph in both the pre and post Tac-Tic/control period data.

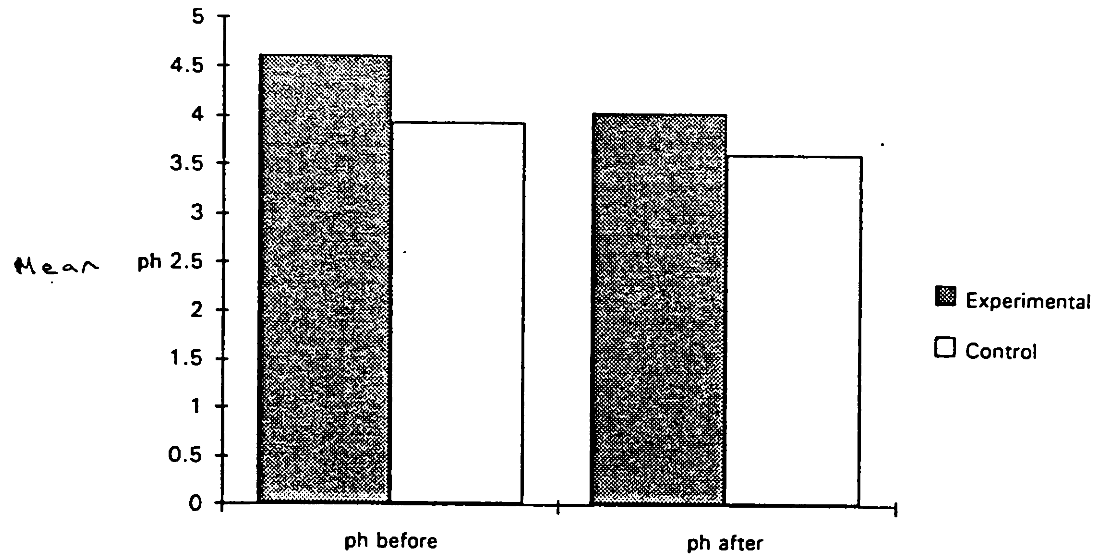
Table 8.3.1.1 BEFORE ASPIRATE PH

	Mean	S.D.	N
Entire Population:	4.27	1.11	20
Experimental:	4.61	0.90	10
High risk:	5.01	0.74	5
Low risk:	4.21	0.93	5
Control:	3.92	1.24	10
High risk:	4.06	1.14	6
Low risk:	3.71	1.55	4
Overall High Risk:	4.34	1.02	11
Overall Low Risk:	4.18	1.28	9

Table 8.3.1.2 AFTER ASPIRATE PH

	Mean	S.D.	N
Entire Population:	3.82	1.13	20
Experimental:	4.04	0.95	10
High risk:	4.46	0.97	5
Low risk:	3.62	0.80	5
Control:	3.61	1.30	10
High risk:	3.92	1.24	6
Low risk:	3.14	1.43	4
Overall High Risk:	3.98	1.05	11
Overall Low Risk:	3.62	1.25	9

Figure 8.3.1.1 BEFORE AND AFTER STIM./CONTROL PERIOD MEAN GASTRIC ASPIRATE PH



No significant differences occured between the experimental and control infants, either on their before ($t= 1.42$, $df= 18$, $p< 0.17$, 2 tailed) or after ($t= 0.84$, $df= 18$, $p< 0.41$, 2 tailed) ph.

Comparing the high-risk and low-risk groups, none of these differed significantly with each other at the $p< 0.05$ level (see section (A)).

(A) ANOVAs and post-hoc Scheffe t-tests

1. BEFORE ASPIRATE MEAN

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob
Between Grps	3	4298188.4	1432729.4	1.18	.34
Within Grps	16	19425223.3	1214076.4		
Total	19	23723411.80			

The value actually compared with Mean(J)-Mean(I)

is 779.1266 * Range * Sqrt(1/N(I) + 1/N(J)). No

two groups are significantly different at the

$p < 0.05$ level.

2. AFTER ASPIRATE MEAN

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Grps	3	4135095.7	1378365.2	1.08	.38
Within Grps	16	20309284.4	1269330.2		
Total	19	24444380.2			

The value actually compared with Mean(J)-Mean(I)

is 796.6587 * Range * Sqrt(1/N(I) + 1/N(J))

No two groups are significantly different at the

$p < 0.05$ level.

The multivariate analysis of variance (MANOVA) in section (B), reveals that over the sample as a whole, (experimental and control), the ph of the before aspirates was significantly higher than the ph of the after Tac-Tic/control period aspirates.

(B) MANOVA: Before and After ph by Exper./Control Groups

CON= Experimental\Control

BA= Before/After stimulation/control period gastric aspirate ph

Source of Var	SS	DF	MS	F	Sig.F
WITHIN CELLS	1964606.4	3	654868.83		
BA	6052609.0	1	6052609.1	9.24	.056
CON BY BA	130355.7	1	130355.7	.20	.686

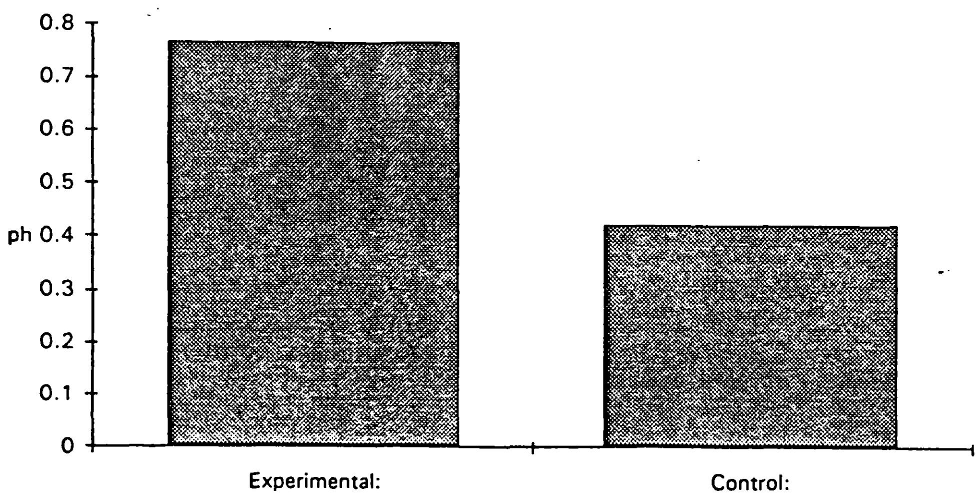
8.3.2 Before to After Gastric Aspirate Ph Difference

By looking at the difference in gastric aspirate ph in the experimental and control infants (Table 8.3.2.1, Figure 8.3.2.1), from before to after Tac-Tic/the control time period, a drop is found to occur.

Table 8.3.2.1 BEFORE TO AFTER ASPIRATE PH DIFFERENCE

	Mean	S.D.	N
Entire Population:	0.593	0.34	20
Experimental:	0.765	0.31	10
High risk:	0.746	0.42	5
Low risk:	0.783	0.22	5
Control:	0.422	0.29	10
High risk:	0.335	0.27	6
Low risk:	0.553	0.31	4
Overall High Risk:	0.543	0.38	11
Overall Low Risk:	0.655	0.29	9

Figure 8.3.2.1 BEFORE TO AFTER STIM./CONTROL PERIOD MEAN DROP IN PH



An a-priori independent samples t-test and oneway ANOVA found that this drop was significantly larger in the experimental as compared to control infants (t= 2.50, df= 18, p< 0.02, see also section (A)).

(A) Oneway Analysis of Variance: Experimental vs Control Before to After Stimulation/Control period ph

Source	D.F	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Groups	1	587216.45	587216.45	6.23	.02
Within Groups	18	1695779.30	94209.96		
Total	19	2282995.75			

Looking at those of high-risk in Table 8.3.2.1, it is noticable that the experimental as compared to control infants show a much larger mean drop in ph with the same pattern being repeated in those of low-risk though the difference between experimental and control infants is not as large.

This again follows on from the pattern of the previous studies, suggesting that Tac-Tic has more powerful effects on those of a lower gestational age and birthweight. However, an ANOVA and post-hoc Scheffe t-tests found that none of the high-risk and low-risk groups differed significantly with each other at the $p < 0.05$ level (see Section (A)).

(A) ANOVAs and post-hoc Scheffe t-tests

1. DIFFERENCE IN ASPIRATE MEANS

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Grps	3	705220.3	235073.4	2.38	.10
Within Grps	16	1577775.4	98610.9		
Total	19	2282995.7			

The value actually compared with Mean(J)-Mean(I) is 222.0484 * Range * Sqrt(1/N(I) + 1/N(J)). No two groups are significantly different at the $p < 0.05$ level.

As stated previously, the high-risk and low-risk group data needs to be interpreted cautiously because of low cell number.

Overall, the experimental infants exhibited a mean ph drop of 17.33% (percentage of the original before aspirate ph) whilst the control infants showed a mean percentage ph drop of 10.36%.

Within the high risk sample, the experimental infants showed a mean drop of 16.15% and the control infants a mean drop of 8.62%, whereas within the low risk sample the experimental infants displayed a mean drop of 18.52% and the controls a mean drop of 12.99%.

8.3.3 Daily average food intake

Looking at daily average food intake (Table 8.3.3.1), the control infants in general show the more developmentally advanced means.

Table 8.3.3.1 DAILY AVERAGE FOOD INTAKE (ml)

	Mean	S.D.	N
Entire Population:	64.05	28.05	20
Experimental:	62.70	29.72	10
High risk:	41.60	14.38	5
Low risk:	83.80	25.85	5
Control:	65.40	27.80	10
High risk:	57.83	30.22	6
Low risk:	76.75	22.60	4
Overall High Risk:	49.54	24.52	11
Overall Low Risk:	81.77	21.77	9

An a-priori t-test ($t= 0.21$, $df= 18$, $p< 0.41$, 1 tailed) revealed no significant difference between experimental as compared to control infants in their daily average food intake. The experimental in comparison to the control infants displayed the lesser food intake means, both overall and within the high-risk sample but in the low risk-sample, the experimental infants showed the larger food intake mean (Section 8.3.3.1).

A oneway ANOVA with post-hoc Scheffe t-tests was conducted to examine the differences between the high and low risk sub-groups of the experimental and control samples.

Comparing these groups, none of them differed significantly with each other at the $p < 0.05$ level (Section 8.3.3.1).

(A) **ANOVAs and post-hoc Scheffe t-tests**

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Grps	3	5347.3	1782.4	2.97	.06
Within Grps	16	9601.5	600.0		
Total	19	14948.9			

The value actually compared with Mean(J)-Mean(I) is 17.3219 * Range * Sqrt(1/N(I) + 1/N(J)). No two groups are significantly different at the $p < 0.05$ level.

8.3.4 Daily average weight gain

Looking at daily average weight gain, from Table 8.3.4.1 overleaf, the control infants in general show the more developmentally advanced means in terms of daily average weight gain, particularly within the low-risk sample.

Table 8.3.4.1 DAILY AVERAGE WEIGHT GAIN (kg)

	Mean	S.D.	N
Entire Population:	0.435	0.28	20
Experimental:	0.355	0.28	10
High risk:	0.432	0.27	5
Low risk:	0.277	0.29	5
Control:	0.516	0.27	10
High risk:	0.414	0.28	6
Low risk:	0.669	0.20	4
Overall High Risk:	0.383	0.29	11
Overall Low Risk:	0.499	0.27	9

Using an a-priori independent samples t-test, no significant difference was found in daily average weight gain between experimental and control infants ($t= 1.29$, $df= 18$, $p< 0.10$, 1 tailed).

A oneway ANOVA with post-hoc Scheffe t-tests, conducted to examine the differences between the high-risk and low-risk groups of the experimental and control samples, found none of the high-risk and low-risk groups to differ significantly with each other at the $p< 0.05$ level (section (A)).

(A) ANOVAs and post-hoc Scheffe t-tests

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Grps	3	34543339	11514446	1.55	.23
Within Grps	16	118668467	7416779		
Total	19	153211807			

The value actually compared with Mean(J)-Mean(I) is 1925.7179 * Range * Sqrt(1/N(I) + 1/N(J)). No two groups are significantly different at the $p< 0.05$ level.

8.3.5 Age in days when first sucked all feeds in a day

As can be seen from Table 8.3.5.1, the experimental in comparison to the control infants displayed the more developmentally advanced means, with this being shown to a similar extent between experimental versus control high-risk as compared to experimental versus control low-risk infants.

No significant difference was found using an a-priori independent sample t-test, between the experimental and control sample ($t= 0.47$, $df= 16$, $p< 0.32$, 1 tailed).

Table 8.3.5.1 AGE IN DAYS WHEN FIRST SUCKING ALL FEEDS IN A DAY

	Mean	S.D.	N
Entire Population:	27.44	19.43	18
Experimental:	25.22	17.66	9
High risk:	38.00	12.51	5
Low risk:	9.25	3.30	4
Control:	29.66	21.90	9
High Risk:	42.60	20.81	5
Low Risk:	13.50	8.66	4
Overall High Risk:	39.20	18.29	10
Overall Low Risk:	12.75	6.58	8

A oneway ANOVA with post-hoc Scheffe t-tests was again conducted, to examine the differences between the high-RISK and low-risk groups of the experimental and control samples. Both the experimental low-risk and control low-risk groups were found to suck, for the first time, all their feeds in a day, significantly earlier ($p< 0.05$) than the control high-risk group (section (A)).

(A) ANOVAs and post-hoc Scheffe t-tests: Age of first suck of all feeds in a day

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Grps	3	3807.49	1269.16	6.78	.0047
Within Grps	14	2616.95	186.92		
Total	17	6424.44			

The value actually compared with Mean(J)-Mean(I)

is 9.6676 * Range * Sqrt(1/N(I) + 1/N(J)).

8.3.6 Age in days at removal from care in an incubator to care in a cot (thermoregulation)

Experimental, as compared to control infants, displayed the more developmentally advanced means in thermoregulation (Table 8.3.6.1), with high risk experimental versus control infants displaying a larger difference than low risk experimental versus control infants.

Table 8.3.6.1 AGE AT REMOVAL FROM AN INCUBATOR TO A COT (Thermoregulation)

	Mean	S.D.	N
Entire Population:	15.93	10.88	15
Experimental:	15.28	11.07	7
High risk:	21.00	11.97	4
Low risk:	7.66	0.57	3
Control:	16.50	11.45	8
High risk:	25.50	7.59	4
Low risk:	7.50	5.68	4
Overall High Risk:	23.00	10.00	8
Overall Low Risk:	7.85	4.14	7

An a-priori independent samples t-test found no significant difference between the experimental and control infants in this variable ($t= 0.21$, $df= 13$, $p< 0.41$, 1 tailed). Comparing the high-risk and low-risk groups, an ANOVA found none of these to differ significantly with each other at the $p< 0.05$ level (section (A)).

(A) ANOVAs and post-hoc Scheffe t-tests

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Grps	3	958.26	319.42	5.01	.019
Within Grps	11	700.66	63.69		
Total	14	1658.93			

The value actually compared with Mean(J)-Mean(I)

is 5.6434 * Range * Sqrt(1/N(I) + 1/N(J)). No two

groups are significantly different at the

$p < 0.05$ level.

8.3.7 Age in days at discharge

As can be seen from Table 8.3.7.1 overleaf, the experimental in comparison to the control infants displayed the more developmentally advanced means in age at discharge, with experimental versus control high-risk infants showing a larger difference than experimental versus control low-risk infants.

No significant difference was found, using an a-priori independent samples t-test, between the experimental and control infants ($t= 0.33$, $df= 15$, $p< 0.37$, 1 tailed).

Table 8.3.7.1 AGE IN DAYS AT DISCHARGE

	Mean	S.D.	N
Entire Population:	31.23	20.05	17
Experimental:	29.66	18.04	9
High risk:	42.40	12.72	5
Low risk:	13.75	6.65	4
Control:	33.00	23.25	8
High risk:	48.75	23.11	4
Low risk:	17.25	8.13	4
Overall High Risk:	43.77	19.58	9
Overall Low Risk:	17.12	7.18	8

Comparing the high-risk and low-risk groups, an ANOVA and post-hoc Scheffe t-tests found the experimental low-risk group to be discharged significantly earlier than the control high-risk group (section (A)).

(A) ANOVA and post-hoc Scheffe t-tests

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Grps	3	3855.60	1285.20	6.47	.006
Within Grps	13	2581.45	198.57		
Total	16	6437.05			

The value actually compared with Mean(J)-Mean(I)

is 9.9643 * Range * Sqrt(1/N(I) + 1/N(J)).

8.3.8 Manova

By combining the three variables of suck, cot and discharge together, a meta-analysis involving a multi-variate analysis of variance was performed. This was done to determine whether the experimental, as compared to control, sample showed a significantly larger overall benefit.

Tests of Between-Subjects Effects.

Tests of Significance for T1 using UNIQUE sums of squares

Source of Var.	SS	DF	MS	F	Sig.F
WITHIN CELLS	9431.43	13	725.49		
CONSTANT	25594.03	1	25594.03	35.28	.000
CON	29.14	1	29.14	.04	.844

EFFECT .. CON BY ALLVAR (All the variables combined together).
Multivariate Tests of Significance (S = 1, M = 0, N = 5)

Test Name	Value	Approx.F	Hyp. DF	Error DF	Sig.F
Pillais	.09067	.59827	2.0	12.0	.565
Hotellings	.09971	.59827	2.0	12.0	.565
Wilks	.90933	.59827	2.0	12.0	.565
Roys	.09067				

No significant difference wqas found between the experimental and control samples when all three variables were combined together.

8.3.9 Pearson Correlations

Pearson correlations performed on data (Table 8.3.8.1), showed as expected, significant positive correlations between birthweight and gestation, before and after aspirate ph and Apgars at 1 and 5 minutes.

Significant negative correlations occured, as expected, between age at first suck of all feeds, age at removal from incubator into cot care and age at discharge with gestational age and birthweight, which highlights the importance of matching infants on these characteristics.

Daily average food intake did not correlate significantly with daily average weight gain, suggesting that that other factors than just food intake are involved in weight gain. No factor was found to correlate significantly with drop in ph from before to after Tac-Tic/control period.

GEST=	Gestational Age
BWGT=	Birthweight
DIFFPH=	Difference between ph before and after the stimulation/control time period
BASPPH=	Before stimulation/control period ph
AASPPH=	After stimulation/control period ph
AFI=	Average Food Intake
AWG=	Average Weight Gain
SUCK=	Age in days at first suck of all feeds in a day
COT=	Age in days at removal from incubtor to cot care
DISCH=	Age in days at discharge from hospital
APGAR1=	Apgar score at 1 minute
APGAR5=	Apgar score at 5 minutes

Table 8.3.8.1 PEARSON CORRELATIONS

	GEST	BWGT	DIFFPH	BASPPH	AASPPH	AFI
GEST	1.00	.65*	.15	-.25	-.38	.51
BWGT	.65*	1.00	.00	.05	.03	.43
DIFFPH	.15	.00	1.00	.31	.03	-.42
BASPPH	-.25	.05	.31	1.00	.94**	-.19
AASPPH	-.38	.03	.03	.94**	1.00	-.13
AFI	.51	.43	-.42	-.19	-.13	1.00
AWG	.23	.23	-.15	.14	.14	.55
SUCK	-.74**	-.77**	.18	.22	.22	-.74**
COT	-.87**	-.86**	-.04	.10	.17	-.57
DISCH	-.74**	-.78**	.04	.07	.11	-.71*
APGAR1	-.12	.08	.08	.03	.10	-.38
APGAR5	.12	.24	.04	.08	.19	-.18

	AWG	SUCK	COT	DISCH	APGAR1	APGAR5
GEST	.23	-.74**	-.87**	-.74**	-.12	.12
BWGT	.23	-.77**	-.86**	-.78**	.08	.24
DIFFPH	-.15	.18	-.04	.04	.08	.04
BASPPH	.14	.22	.10	.07	.03	.08
AASPPH	.14	.22	.17	.11	.10	.19
AFI	.55	-.74**	-.57	-.71*	-.38	-.18
AWG	1.00	-.08	-.24	-.14	-.17	-.12
SUCK	-.08	1.00	.85**	.96**	.29	.00
COT	-.24	.85**	1.00	.88**	-.00	-.18
DISCH	-.14	.96**	.88**	1.00	.29	.03
APGAR1	-.17	.29	-.00	.29	1.00	.76**
APGAR5	-.12	.00	-.18	.03	.76**	1.00

1 -tailed Signif: * - .01 ** - .001

8.3.9 CONCLUSIONS

(1) Infants who were stroked display a significantly greater drop in their gastric ph than matched non-stroked infants after a control time period.

(2) This drop in ph was not found to corrrelate significantly with any infant characteristic.

(3) No significant difference was found between stroked and non-stroked infants on:

1. Age at first suck of all feeds in a day

2. Age at removal from incubator into cot care

3. Age at discharge from the hospital

4. Daily average food intake

5. Daily average weight gain.

However across all except the final two variables, the stroked as compared to non-stroked infants showed the developmentally more advanced means.

No overall significant difference was found between the two groups of infants when these 3 variables were combined together in a multi-variate analysis of variance.

(4) Those of high-risk (low gestational age and birthweight) were not found to benefit more from the stroking procedure, than those of older gestations with heavier birthweights.

This was concluded given the lack of significant benefits in the high-risk experimental as compared to high-risk control groups.

The findings that the experimental low-risk group sucked, for the first time, all their feeds in a day and were discharged home significantly earlier ($p < 0.05$) than the control high-risk group is not surprising given their greater maturity (gestation).

8.4 DISCUSSION

8.4.1 Lingual Lipase

The lingual lipase model proposed by Macedo (1984) was not tested in this study due to inadequate quantities in the gastric aspirates that were drawn. The only foreseeable means of preventing this from happening is by taking aspirates nearer the last feed, however as a consequence of this, food would also be aspirated up and regurgitation may occur, which could set-back infant development and growth. Understandably, the ethics of doing this would be questionable.

To achieve this, though, another technique would need to be employed such as salivary analysis, measuring the concentration of lingual lipase in saliva. Equally, by conducting faecal fat analyses, in stroked/non-stroked matched infants, lipolytic activity could be assessed to determine whether increased lipolytic activity (and thus fat absorption) occurred as a consequence of tactile stimulation.

However, the finding of a significantly greater drop in ph in the stroked as compared to non-stroked infants, suggesting that stroking has an effect on preterm digestion, further strengthens the call to investigate further the link between digestion and tactile stimulation including Macedo's (1984) model. Given that lipase in general (i.e gastric and lingual lipases) has a low though broad ph of 2.2 to 6 (Hamosh et al., 1975; Liao et al., 1983), with greater stability of functioning at the lower end (Hamosh, 1990), any lowering of ph to/within this range benefits lipolytic activity.

8.4.2 Ph Drop

The prime feature of the of the results was that the stroked infants exhibited a significantly greater drop in gastric ph than matched non-stroked infants after a control time period. These results can be taken as not having been biased by any infant characteristic eg. gestational age as the experimental and control infants were matched on various characteristics and as drop in ph was not found to correlate significantly with any infant characteristic.

Current digestive situation could not have affected the results as experimental and controlled infants all had their before aspirates taken between 60-90 minutes after last feed.

The lack of a significant difference on "after stimulation/control period aspirate ph" was probably due to the slightly, though not significantly, lower "before stimulation/control period ph" in the control as compared to experimental sample, which could have been due to individual variation in stomach condition.

The actual gastric aspirate taking procedure, may in itself also have been partly responsible for the promotion of acid secretion given the fall in ph in both the experimental and control groups. The infant may have associated the sensations accompanying the gastric aspirate procedure with feeding, resulting in the stomach preparing for the ingestion of food, with the gastric procedure itself acting as a conditioned stimulus for this.

This is particularly relevant in that all infants were being tube fed and thus were very familiar with the sensations of the passage of air in the tube and tube suctioning/pressure, all of which are components of the feeding process. However, as ph fall was compared between experimental and control subjects, this variable was controlled for.

Overall, the result found suggests that in those infants who received supplemental tactile stimulation, in the form of Tac-Tic stroking, a more suitable stomach environment for digestion is established after a session of such stroking. This supports the contention of Rausch (1981) that tactile stimulation improves gastrointestinal functioning in preterms and the finding implies that better digestion and greater nutrient absorption is facilitated by stroking prior to feeds.

Those of high-risk (low gestational age and birthweight) were not found to benefit more from the stroking procedure, than those of older gestations with heavier birthweights, as no significant difference occurred between the high-risk experimental as compared to the high-risk control groups.

Given that a decrease in stomach ph reflects a more acidic environment, the release of gastrin and thus HCL appears to be triggered by such tactile stimulation, but why and how this occurs is debatable.

8.4.2.1 Direct Neural Stimulation

Direct neural stimulation of the stomach is acknowledged as a factor that increases gastrin secretion and thus HCL release (Ganong, 1985) and it could be that stroking, via a direct skin-stomach neural pathway induces nervous signals to be triggered which travel to the stomach stimulating the release of gastrin from G cells.

Equally, stimulation of vagal nerves in the chest or neck (Ganong, 1985), by such stroking, could via the vagus increase gastrin secretion and thus HCL release.

8.4.2.2 A Learning Mechanism

Another possible mechanism that could account for the ph result is a conditioned or non-conditioned learning mechanism (see Figure 8.1.2.4.1).

Either through a learnt association of tactile contact or stroking with feeding (conditioned learning) or an innate learnt association of tactile contact/stroking with feeding (non-conditioned learning, imprinting), infants may have come to "expect" feeding after experiencing such tactile sensations. As a consequence, their stomach may immediately prepare for the expected event by gastrin secretion and HCL release, lowering their stomach ph to optimise breakdown and absorption of fluid.

With children, Bogen (1967) has previously shown what he called the "*psychic secretion of gastric juice*" (p231). He found that gastrin secretions of hydrochloric acid could be conditioned by the mere visual presentation of food, though he only used one three year-old child as his subject.

In terms of the conditioned learning proposition, a very strong motivation for infants in neonatal units, to make the association between stroking and feeding, can be seen to exist.

Such infants receive very little "positive" or social tactile contact, such as stroking (Blackburn, 1979), and may come to associate such stimulation with feeding which generally includes much social tactile contact (Day, 1982).

With regard to a non-conditioned association, an inborn preparedness to associate positive or pleasant tactile contact with feeding is very adaptive and understandable. It is adaptive in that to obtain maximal nourishment it is necessary for the breast-fed infant to snuggle in close and cling to the mother, thereby receiving continuous tactile contact from the mother's breast and body.

Following on from this, it is a very understandable association in that to breast feed an infant the mother needs to hold her infant close, thereby providing tactile contact.

Day (1982) with 4-6 week old infants, found that feeding, in comparison to play, bathing, holding/carrying and so on, is the mother-infant activity that provides the most stimulation with tactile stimulation being the form of stimulation with the longest duration per minute.

Tactile, in comparison to vestibular, proprioceptive, auditory and visual, stimulation during feeding, was also found to be the largest amount of stimulation provided daily and out of all the activities, it was during feeds that the greatest amount of tactile stimulation occurred (Day, 1982).

From an ethological perspective, given that feeding is essential for survival, tactile contact during feeding may be seen as a form of "attachment behaviour" (Bowlby, 1969), promoting optimal nourishment as well as "bonding" between infant and caregiver, both of which are of survival value.

The relationship between early tactile contact and feeding was investigated by Kennell et al. (1974), who found that greater quantity of early tactile contact was associated with prolonged breastfeeding and more affectionate behaviour. However, a number of studies, despite finding short-term benefits, have failed to find any long-term benefits of early extended tactile contact for affectionate behaviour and attachment (Schaller et al., 1979; Carlsson et al., 1979).

There can be no doubt though that tactile contact is a primary interactive behaviour during parent-infant interaction (Kaye and Fogel, 1980), especially during feeding (Dunbar, 1977).

In sum, the infant may thus be construed as "pre-wired" or prepared to experience "positive" tactile contact, particularly during feeding and possibly particularly from his/her primary caregiver, while the primary caregiver/mother may be "programmed" to provide such contact, especially during feeding.

The finding that parents seem to follow what appears to be an innate "species-specific pattern" in touching their infants, first using their fingertips and then their palms, going from the infant's extremities first and then on to their trunk (Rubin, 1963; McDonald, 1978; Rodholm and Larsson, 1970), can be seen to support this notion of "programmed tactile behaviour".

Further research however, on the prevalence, role and kinds of tactile contact during early feeding, is required to lend credence to the aforementioned contention.

8.4.3 Food Intake/Weight Gain

Akin to the tactile stimulation programmes of Kramer et al. (1975) and Jay (1982), no significant differences were found between the experimental and control infants on either daily average food intake or daily average weight gain, suggesting that on these more obvious measures of digestive functioning, stroking had no effect.

This could be due to the stroking not having occurred near enough to feeding to exert a potential effect on food intake or absorption i.e weight gain.

Given that the controls on general showed the higher daily average food intake and average weight gain, sample number hardly accounts for experimental infants not showing significantly higher results than the controls on these measures. The higher average food intake in the control sample may account for their higher average weight gain though these variables were not found to be significantly correlated with each other.

It could be also that there was not enough stroking provided to the experimental infants to exert an effect large enough to bring about significantly greater food intake and/or weight gain than their controls. This study only provided 20 minutes of stroking once daily whereas many tactile stimulation programmes provide more frequent and thus greater quantities of stroking and perhaps therefore, greater benefits in weight gain.

Rice (1977) performed her programme (15 mins.) 4 times daily, Field et al. (1986) performed their programme (15 mins.) 3 times daily, while Macedo (1984) performed her programme (20 mins.) twice daily. All of these programmes found significantly increased weight gain in experimental as compared to control infants.

Equally, it could be that weight gain was not monitored for a sufficently long period. Schanberg and Field (1987) for example, found stroked infants to show significantly larger weight gain at 8 and 12 months.

8.4.4 Age at: First Suck of All Feeds/Removal from Incubator into Cot/Discharge

No significant differences were found between stroked and control infants on the dependent variables of:

1. Age at first suck of all feeds in a day
2. Age at removal from incubator into cot care
3. Age at discharge

thereby failing to replicate the findings of Field et al. (1986), Porter and Anderson-Shanklin (1979) and Macedo (1984). No significant difference was found between the two groups either when the three variables were combined together in multi-variate analysis of variance.

However, on all of these variables, the experimental as compared to control infants showed the developmentally more advanced means, and as the standard deviations were quite high on each of these variables, possibly with a larger sample and tighter controls, significance on each of these would have been achieved.

With each of these variables, low-risk as compared to high-risk infants, within both the experimental and control samples, showed significantly earlier (more developmentally advanced) ages, as would be expected given their older gestational age and better medical condition.

The pattern of high-risk as compared to low-risk infants benefiting more from the tactile stimulation, was not found with any of these variables, as no significant difference occurred within the high-risk (or low-risk) population between experimental and control infants in these variables.

Factors such as the subject sample used, insufficient stroking or the procedure of taking gastric aspirates negating any benefits induced by the stroking, could all account for why differences between the experimental and control samples never reaching significance.

The taking of gastric aspirates, being as it is an unpleasant procedure may have upset the infant, resulting in the tactile stimulation not exerting as great effects as it normally (i.e when it is not preceded and followed by the taking of a gastric aspirate) does.

Criteria (eg. attempts at sucking, stability of temperature, weight gain) among doctors, within any hospital, for moving infants from tube to suck feeds, an incubator to a cot and hospital to home care are generally consistent but discharge home can also be affected by the home situation, which, dependent upon the doctor, may lead him/her to retain the infant in hospital care for longer than necessary.

For example, where there is a history of infant neglect or a home which is not adequately prepared to take care of an infant particularly vulnerable for infection or temperature instability. When this occurs it is noted in the infant's hospital file and since these files were consulted regularly and no incident of this nature was found, the variable of age at discharge could not have been systematically biased in this way.

8.4.5 Conclusion

In conclusion, this study established that tactile stimulation, in the form of Tac-Tic, affected the preterm digestive system such that gastric ph was lowered, thereby rendering the stomach environment more suitable for lipase activity and general digestion.

No significant findings on weight gain, food intake, age at onset of first suck of all feeds in a day, age at removal from an incubator into a cot or age at discharge were found.

Future research could examine whether this lowering of gastric ph was due to a neural or learning mechanism as well as investigating the effects of tactile stimulation on lingual lipase and delineating what features of tactile stimulation or subject characteristics determine whether benefits in:

1. weight gain
2. food intake
3. age at onset of first all suck feeds in a day
4. age at removal from an incubator into a cot
5. age at discharge

come about, in any given tactile stimulation programme.

ASPECTS OF TACTILE STIMULATION WITH INFANTS IN INTENSIVE AND SPECIAL CARE BABY UNITS

Volume 2

Eilis Aine Mhaire de Roiste B.A. (Cork)

Thesis submitted for the degree of Doctor of Philosophy, in the Department of Psychology, Faculty of Social Science, University of Glasgow.

December, 1991.

CONTENTS – VOLUME 2

Volume 2

CHAPTER 9	THE EFFECT OF A PROGRAMME OF TACTILE STIMULATION UPON PRETERM INFANT PERFORMANCE IN AN INSTRUMENTAL CONDITIONING TASK.	424
9.1	Introduction: Cognitive Sequelae of Prematurity	425
9.1.1	Learning	425
9.1.2	Animal Studies	427
9.1.3	Human Studies	428
9.1.4	General Studies of Infant Learning using Conditioning Tasks	431
9.1.4.1	Classical Conditioning Studies	431
9.1.4.2	Instrumental Conditioning Studies	434
9.1.5	Sucking Behaviour	437
9.1.5.1	Sucking and Physical Development	440
9.1.5.2	Sucking and Psychological Development	441
9.1.5.3	Sucking and Stimulation	444
9.1.6	Conclusion	447

Chapter 9 Cont'd

9.2	**Method**	449
9.2.1	Design	449
9.2.2	Subjects	451
9.2.3	Equipment	454
9.2.3.1	Calibration of Pressure Transducer	456
9.2.3.2	Running of program/experimental procedure	457
9.2.4	Procedure	460
9.3	**Results**	**464**
9.3.1	**Instrumental Learning Measures**	**464**
9.3.1.1	Descriptive statistics	464
9.3.1.2	MANOVAs, Co-Variate analyses, ANOVAs and t-tests	468
9.3.1.3	Pearson Correlations	472
9.3.2	**Sucking Pressure Measures**	**473**
9.3.2.1	Descriptive Statistics	473
9.3.2.2	MANOVAs, Co-Variate analyses, ANOVAs and t-tests	475
9.3.2.3	Pearson Correlations	477
9.3.3	**Developmental Measures**	**478**
9.3.3.1	Descriptive statistics and a-priori t-tests	478

Chapter 9 Cont'd

9.3.3.2 ANOVAs and post-hoc Scheffe t-tests 480

9.3.3.3 Pearson Correlations 481

9.3.4 Conclusions 482

9.4 Discussion 484

9.4.1 Learning Performance 484

9.4.2 Sucking Pressure 487

9.4.3 Developmental measures 490

9.4.4 Validity of the data 491

9.4.5 Conclusion 491

CHAPTER 10 THE IMPACT OF A PROGRAMME OF TACTILE STIMULATION IN THE SPECIAL-CARE BABY UNIT, UPON INFANT BEHAVIOUR AND PARENTAL ANXIETY. 492

10.1 Introduction: Effects of Infant Care Within a Neonatal Unit upon the Parents 493

10.1.1 Parental Effects 493

10.1.2 Intervention Programmes in the Neonatal Unit 497

10.1.2.1 General Intervention Programmes: Effects on Parents 497

10.1.2.2 Supplemental Early Tactile Contact 498

Chapter 10 Cont'd

10.1.2.3	Tactile Stimulation Programmes: Effects on Parents	500
10.1.3	Parent Implemented Sensory Stimulation in the Neonatal Unit	502
10.1.3.1	The Need for Early Father-Infant Contact	502
10.1.3.2	The Need for Partner Support	505
10.2	**Method**	509
10.2.1	Design	509
10.2.2	Subjects	514
10.2.3	Stimulation	517
10.2.4	Materials	517
10.2.5	Procedure	519
10.3	**Results**	**527**
10.3.1	**What are the effects of the tactile stimulation programme (Tac-Tic) on parents ?**	**527**
10.3.1.1	Descriptive statistics and t-tests: P.A.A.S total	527
10.3.1.2	MANOVA/Co-variate analysis: P.A.A.S total	527
10.3.1.3	Descriptive statistics: P.A.A.S Sub-sections	528

Chapter 10 Cont'd

10.3.1.4 P.A.A.S Sub-sections: t-tests 530

10.3.1.5 Mothers 531

10.3.1.6 Fathers 532

10.3.1.7 Mothers as compared to Fathers 533

10.3.1.8 Correlations 534

10.3.1.9 Stroking Questionnaire 534

10.3.1.10 Diaries 536

10.3.2 What are the most frequent reactions elicited by the various Tac-Tic strokes, categorized according to bodily area stroked, for each stroker? 536

10.3.2.1 Which reactions occurred significantly more than the others to each bodily category of the Tac-Tic strokes ? 539

10.3.2.2 Which bodily category of the Tac-Tic strokes elicited significantly more reactions than the others 566

10.3.3 What is the number of reactions elicited by the various categories of Tac-Tic strokes, when the mother as compared to the father is the stroker? 569

Chapter 10 Cont'd

10.3.4	**Correlations**	**570**
10.3.4.1	Maternal Stroking Session	572
10.3.4.2	Paternal Stroking Session	573
10.3.4.3	Reaction Correlations	575
10.3.5	**Conclusions**	**576**
10.4	**Discussion**	580
10.4.1	Arm and leg movements: the most common reactions to Tac-Tic stroking	581
10.4.2	Maternal and Paternal Tac-Tic stroking	585
10.4.3	Head, trunk or limb Tac-Tic strokes, in comparison to each other	587
10.4.4	Experimental as compared to Control parents: P.A.A.S Results	588
10.4.5	The Stroking Questionnaire	589

CHAPTER 11 AN INVESTIGATION INTO THE ATTITUDES OF THE MEDICAL AND NURSING PROFESSIONS TOWARDS PSYCHOLOGICAL INTERVENTIONS IN THE NEONATAL UNIT. **591**

11.1	**Introducation: Psychology and Medicine**	**592**
11.1.1	Nurse Training	594
11.1.2	Medical Training	595
11.1.3	Conclusion	598

Chapter 11 Cont'd

11.2	**Method**	**600**
11.2.1	Design	600
11.2.2	Subjects	601
11.2.3	Materials	603
11.2.4	Procedure	603
11.2.4.1	Scoring of A.T.P.I.Q.	604
11.3	**Results**	**606**
11.3.1	Introduction	606
11.3.2	Gender, Age and Attitude Score	606
11.3.3	Profession and Attitude Score	607
11.3.4	Level of Training and Attitude Score	610
11.3.4.1	Students Only	612
11.3.4.2	Staff Only	613
11.3.4.3	Nursing Students Only	614
11.3.4.4	Medical Students Only	615
11.3.5	Attitude Scores across Hospitals	618
11.3.6	Conclusions	619
11.4	**Discussion**	**621**
11.4.1	Attitudes of Medical vs Nursing Profession	621
11.4.2	Attitudes of Staff vs Students	623
11.4.3	Attitudes of Medical vs Nursing students	624

CHAPTER 12 FINAL CONCLUSIONS 627

12.1 Does the "Tac-Tic" programme of supplemental tactile stimulation benefit premature infants in both their short-term and long-term development ? 628

12.2 Does this programme compromise the health of ventilated preterms cared for in neonatal intensive care units ? 630

12.3 Are the immediate physiological effects of the tactile stimulation programme in preterms different from those of maternal touching ? 631

12.4 What are the immediate gastric effects of this programme in preterms ? 631

12.5 What behavioural reactions in the preterm are elicited by this programme and do these vary according to the bodily area being stroked ? 632

12.6 Is parental anxiety and behaviour affected by their involvement in a programme of preterm tactile stimulation? 633

12.7	What are the attitudes of the medical and nursing professions towards psychological interventions in the neonatal unit ?	633
12.8	Does tactile stimulation benefit high-risk preterms more than those of low-risk ?	634
12.9	Implications	635

REFERENCES **638**

APPENDICES

TABLES INDEX: VOLUME 2

CHAPTER 9 THE EFFECT OF A PROGRAMME OF TACTILE STIMULATION UPON PRETERM INFANT PERFORMANCE IN AN INSTRUMENTAL CONDITIONING TASK.

		Page
9.2.2.1	BIRTHWEIGHT (kg)	452
9.2.2.2	GESTATION	452
9.2.2.3	APGAR AT 1 MINUTE	453
9.2.2.4	APGAR AT 5 MINUTES	453
9.2.2.5	AGE IN DAYS AT LEARNING PROCEDURE	454
9.3.1.1.1	OVERALL AVERAGE CRITICAL PHASE LENGTH (SECONDS)	464
9.3.1.1.2	MEAN PERCENTAGE INCREASE IN CRITICAL PHASE SUCKING PRESSURE	466
9.3.1.1.3	MEAN PERCENTAGE INCREASE IN STIMULATION SUCKING PRESSURE	468
9.3.1.3.1	PEARSON CORRELATIONS:LEARNING MEASURES	473
9.3.2.1.1	SUCKING PRESSURE THRESHOLD	474
9.3.2.1.2	OVERALL AVERAGE SUCKING PRESSURE	474
9.3.2.3.1	PEARSON CORELLATIONS: SUCKING PRESSURE AND LEARNING MEASURES	478
9.3.3.1.1	AGE AT FIRST ALL SUCK FEED	479
9.3.3.1.2	AGE IN DAYS AT DISCHARGE	479
9.3.3.1	PEARSON CORRELATIONS	481

CHAPTER 10 THE IMPACT OF A PROGRAMME OF TACTILE STIMULATION IN THE SPECIAL-CARE BABY UNIT, UPON INFANT BEHAVIOUR AND PARENTAL ANXIETY.

	Page
10.2.2.1 GESTATIONAL AGE	515
10.2.2.2 BIRTHWEIGHT	515
10.2.2.3 APGAR AT 1 MINUTE	515
10.2.2.4 APGAR AT 5 MINUTES	515
10.2.2.5 PARENTAL AGE	516
10.2.2.6 PARITY1: LIVE BIRTHS	516
10.2.2.7 PARITY2: UNFINISHED PREGNANCIES AND STILLBIRTHS	516
10.2.2.8 MARITAL STATUS	516
10.2.2.9 SOCIO-ECONOMIC STATUS	517
10.3.1.1 NEW MODIFIED PAAS TOTAL (NEWT)	527
10.3.1.3.1 NSP1: % NEW SECT1 PREG ATT TO SELF	528
10.3.1.3.2 NSP2 % NEW SECT2 PREG ATT TO FETUS	528
10.3.1.3.3 NSP3 % NEW SECT3 ATT TO LABOR/BIRTH	529
10.3.1.3.4 NSP4 % NEW SECT4 ATT TO POST-BIRTH	529
10.3.1.3.5 NSP5 % NEW SECT5 ATT TO POSTPARTUM	529
10.3.1.3.6 NSP6 % NEW SECT6 ATT TO PREG	530
10.3.1.8.1 CORRELATIONS	534
10.3.1.9 STROKING QUESTIONNAIRE: % DATA	535
10.3.2.1 FREQUENCIES OF INFANT REACTIONS	538
10.3.2.2.1 TOTAL AND % NUMBER OF REACTIONS	567

CHAPTER 11 AN INVESTIGATION INTO THE ATTITUDES OF THE MEDICAL AND NURSING PROFESSIONS TOWARDS PSYCHOLOGICAL INTERVENTIONS IN THE NEONATAL UNIT.

		Page
11.2.1.1	AGE	602
11.2.1.2	AGE BY HOSPITAL	603
11.3.2.1	GENDER AND ATTITUDE SCORE	607
11.3.3.1	MEDICAL VS NURSING PROFESSION ATTITUDE SCORES	608
11.3.3.2	MEDICAL VS NURSING NEONATAL UNIT STAFF ATTITUDE SCORES	609
11.3.3.3	MEDICAL VS NURSING STUDENT ATTITUDE SCORES	610
11.3.4.1	STUDENT VS STAFF ATTITUDE SCORES	611
11.3.4.1.1	ATTITUDE SCORES ACROSS STUDENT LEVELS OF STUDY	612
11.3.4.2.1	ATTITUDE SCORES ACROSS LEVELS OF STAFF	614
11.3.4.3.1	ATTITUDE SCORES ACROSS LEVELS OF NURSING STUDENTS	615
11.3.4.4.1	ATTITUDE SCORES ACROSS LEVELS OF MEDICAL STUDENTS	615
11.3.5.1	ATTITUDE SCORES ACROSS THE HOSPITALS	618

FIGURES INDEX: VOLUME 2

CHAPTER 9 THE EFFECT OF A PROGRAMME OF TACTILE STIMULATION UPON PRETERM INFANT PERFORMANCE IN AN INSTRUMENTAL CONDITIONING TASK.

		Page
9.2.3.1	EQUIPMENT	455
9.2.3.2.1	FLOW CHART DIAGRAM	459
9.2.4.1	PHOTO OF EXPERIMENTAL SITUATION	463
9.3.1.1.1	OVERALL AVERAGE CRITICAL PHASE LENGTH	465
9.3.1.1.2	MEAN PERCENTAGE INCREASE IN CRITICAL PHASE SUCKING PRESSURE	467
9.3.2.1.1	SUCKING PRESSURE THRESHOLD	475
9.3.2.1.2	OVERALL AVERAGE SUCKING PRESSURE	475

CHAPTER 10 THE IMPACT OF A PROGRAMME OF TACTILE STIMULATION IN THE SPECIAL-CARE BABY UNIT, UPON INFANT BEHAVIOUR AND PARENTAL ANXIETY.

		Page
10.3.2.1	MEAN FREQUENCY OF INFANT REACTIONS	537

Chapter 10 Cont'd

10.3.2.1.A MEAN FREQUENCY OF REACTIONS ACROSS BODILY CATEGORY OF STROKES WITH MOTHER AS STROKER 540

10.3.2.1.B MEAN FREQUENCY OF REACTIONS ACROSS BODILY CATEGORY OF STROKES WITH FATHER AS STROKER 541

CHAPTER 11 AN INVESTIGATION INTO THE ATTITUDES OF THE MEDICAL AND NURSING PROFESSIONS TOWARDS PSYCHOLOGICAL INTERVENTIONS IN THE NEONATAL UNIT.

Page

11.3.2.1 GENDER AND ATTITUDE SCORE 607

11.3.3.1 MEDICAL VS NURSING PROFESSION ATTITUDE SCORE 608

11.3.4.3.1 MEAN ATTITUDE SCORES ACROSS STUDENT LEVEL 616

APPENDICES

All the appendices are listed according to the section where they were referred to, except for appendix 12 which is referred to in Chapter 5.

INDEX OF APPENDICES

		Page
6.1.4	ILLUSTRATIONS OF THE TAC-TIC STROKES	I
6.2.1.1	RULES OF MATCHING	XIII
6.2.2.1.1	SELF PERCEPTIONS OF THE PARENTAL ROLE (S.P.P.R) QUESTIONNAIRE	XIV
6.2.2.1.2	HOME INVENTORY	XVII
6.2.2.2.4.1.1	EXPERIMENTAL LONG-TERM LETTER	XVIII
6.2.2.2.4.1.2	CONTROL LONG-TERM LETTER	XIX
7.2.4.1	EXAMPLE OF PRINTOUT	
7.3.1.2.1	MEAN HEART RATE VALUES FOR ORDER OF EXPERIMENTER2 AND MOTHER	XXI
7.3.1.2.3	MEAN RESPIRATION RATE VALUES FOR ORDER OF EXPERIMENTER2 AND MOTHER	XXII
7.3.3.2.4	MEAN TCPO2 VALUES FOR ORDER OF EXPERIMENTER2 AND MOTHER	XXIII
10.2.1.1	MATERNAL VERSION OF THE PERINATAL ANXIETIES AND ATTITUDES SCALE	XXIV
10.2.1.2	PATRNAL VERSION OF THE PERINATAL ANXIETIES AND ATTITUDES SCALE	XXVII
10.2.1.3	ORIGINAL VERSION OF THE P.A.A.S	XXX
10.2.1.4	DIARY	XXXI
10.2.1.5	STROKING QUESTIONNAIRE	XXXII
10.2.1.6	REACTION BOOKLET	XXXIV

APPENDICES CONT'D

10.2.1.7	CATEGORIZATION OF STROKES ACCORDING TO BODY AREA	XLIII
10.2.1.8	EXPERIMENTAL LETTER	XLIV
10.2.1.9	CONTROL LETTER	XLVI
11.2.1	ATTITUDES TOWARDS PSYCHOLOGICAL INTERVENTION QUESTIONNAIRE	XLVII
11.2.1.2	COVERING LETTER	LV
12	TABLES OF STUDIES	LVI

CHAPTER 9

THE EFFECT OF A PROGRAMME OF TACTILE STIMULATION UPON PRETERM INFANT PERFORMANCE IN AN INSTRUMENTAL CONDITIONING TASK.

9.1 INTRODUCTION: Cognitive Sequelae of Prematurity

The cognitive effects of a premature birth are multiple and varied. Preterms in comparison to fullterms, have been found to show poorer academic achievement (Holmes et al., 1988; Drillen, 1967), failure of recognition of invariant features of previously exposed stimuli (Caron and Caron, 1981), poorer performance on the WISC-R assessment test (Caputo et al., 1979) as well as a greater number of intellectual deficits (Knoblach et al. 1956) and slower habituation i.e poorer learning (Fox and Lewis, 1983; Friedman et al., 1981).

Early intervention, in the form of the provision of supplemental stimulation has been proposed as a means of preventing cognitive deficits, such as debilitated learning ability from arising and even of extending the upper limits of the development of various abilities (Wright, 1971).

9.1.1 Learning

Learning, as seen by Gardner (1964) "..*is the acquiring of new habits or ways of behaving, as a result of experience with the environment..* " (p66). While according to Bolles (1972), learning is the process by which lawful relations between environmental events and ones' own behaviour and between ones' own behaviour and succeeding environmental events are determined. As a consequence, a seemingly chaotic environment acquires an order.

Most definitions of learning however focus on the linking of a stimulus and a response. Grant (1964) for example viewed learning as primarily the establishment and strengthening of stimulus-response associations i.e the process of conditioning, of which there are two forms, classical and instrumental.

Classical conditioning is where the subject has no control over the sequence of events while in instrumental conditioning the subject's response or lack of response determines whether rewards or punishments will occur.

Such processes of learning are seen to underlie cognitive advance and development, with early environmental stimulation and experience construed as critical ingredients for this to occur (Provence, 1968; Gagne, 1968).

Bruner (1965), focusing on the pertinence of early learning and activity for later intellectual development, proposed that "*..intellectual development may be conceived as the building of increasingly complex and interacting structures of learned capabilities*" (p111).

Similarly, Hebb (1949) also viewed infancy as a critical period for cognitive development in that active, continuous learning during this period lays the basis for all those processes, cognitive and motor, through which "*..the child becomes able to establish effective transactions with his environment and move towards a greater degree of autonomy*" (p320).

For such learning and development to occur however, there needs to be plentiful and varied stimulation available and active social stimulation by an adult has been deemed to be essential for an infant's biological and cognitive development (Gardner, 1964).

Spear (1979) acknowledged this and argued that the various sources of environmental stimulation, which to an experimenter may seem extraneous, can constitute the critical parameters of conditioning for newborn or older infants.

9.1.2 Animal Studies

Studies with animals have revealed the critical role early stimulation, particularly tactile stimulation, plays in the development of learning and general cognitive ability.

Meier and Stewart (1959) found that Siamese kittens given extra handling display superior ability in discrimination tasks as compared to those not given the extra handling. Similarly, rats, caressed and cuddled as pups, show better learning than those not given this treatment (Benjamin, 1978) and Levine et al. (1957, 1958) found that stimulated rats (shocked or handled) learnt an avoidance response more rapidly than non-stimulated rats while Bernstein (1952) found that early handling of rats leads to enhanced maze learning ability in adulthood.

Levine (1958) contended that in a wide variety of species, early stimulation effects later performance in terms of the ability of the organism to learn or perform adaptively.

He believed that such effects exerted by early stimulation were learning phenomena involving modification of the central nervous system whereby an alteration occurred in the programming or the basic "wiring diagram" of the central nervous system thereby modifying future inputs to the benefit later learning eg. by giving them some basis for matching.

Sokolov's (1963) assertion that in a mismatch of neural acts, orienting responses occur until a match is obtained and his finding that non-handled animals fail to display as much capacity to generalize and match, support this notion.

9.1.3 Human Studies

Equally with human infants, tactile stimulation has been found to benefit learning and cognitive development.

Various programmes of tactile stimulation with preterm infants have shown general cognitive benefits in terms of better Bayley mental development scores (Powell, 1974, Rice, 1977, Field et al., 1986), information processing ability or visual recognition memory (Rose et al., 1980) in comparison to non-stimulated counterparts. Such studies though, like most other tactile stimulation programmes did not specifically examine learning ability.

Improvements in learning ability however, may co-occur with or underlie the better overall cognitive development scores shown by the stimulated infants.

One study that did examine the effects of supplemental tactile stimulation on preterm infant learning was that conducted by Siqueland in 1973. He provided 10 minutes of daily supplemental handling, during the first 4-6 weeks of life, to preterms along with extra stimulation given contingently upon eye opening behaviour in a 10 minute naturalistic conditioning procedure.

At 4 months, these infants were tested on a visual conditioning task whereby visual reinforcement was presented contingent upon high amplitude sucking. Significant differences were discovered between those infants who were and were not given the extra handling, with the extra handled infants showing better learning.

According to Siqueland (1973), the differences at four months in exploratory behaviour resulting from early differential handling experiences, suggested relatively long-term effects of the handling, though comments of the mothers suggested that differences in handled preterm infant behaviour at the time of discharge from the hospital may have altered the way mothers interacted with their infants.

Wright (1971) also investigated the effects of supplemental tactile stimulation upon preterm infant learning using a conditioning task.

Experimental preterms received a 21 day programme of tactile, kinaesthetic, visual and auditory stimulation (picking up and carrying the infant around the room 10 minutes before and after each feed, rocking in a rocking cot for 30 minutes prior to each feed, striped blankets and a radio playing). Matched control preterms received routine care.

To assess learning at 21 days, the infant's cheek was touched with a nipple/piece of cotton (unconditioned stimulus) to elicit the rooting reflex, i.e head turning in search of nipple, (unconditioned response), and a buzzer (conditioned stimulus) was sounded when the conditioned stimulus (touching the infant's cheek) occurred. However, as none of the premature infants exhibited a fully developed rooting reflex, Wright (1971) found it impossible to condition the infants to emit the response.

He thus decided to use operant conditioning to assess learning, whereby head turning was reinforced (across 30 trials) with an opportunity to suck on the nipple stimulus (thereby obtaining a sweet tasting glucose solution) for three seconds.

The experimental, as compared to control, infants were found to show a significantly greater number of rooting responses across the trails, suggesting better learning and neurological (reflex) development.

Both of these studies though did not provide solely tactile stimulation and thus the benefits in learning may not be due to the their tactile stimulation component alone.

Further research is thus called for to determine whether tactile stimulation alone enhances infant learning ability, assessed, for example, using a conditioning task.

9.1.4 General Studies of Infant Learning using Conditioning Tasks

Successful investigations into the classical conditioning of newborn infants have generally employed headturning or sucking as the responses to be conditioned, given their early organization and the control newborns display over such behaviours.

Both of these behaviours may though also represent responses developmentally prepared for interaction with environmental stimulation and contingencies, suggesting that the results of the conditioning studies may be due to more fundamental developmental processes rather than learning per se (Sameroff and Cavanagh, 1979).

9.1.4.1 Classical Conditioning Studies

As with instrumental conditioning, studies looking at classical conditioning in infants have generally employed infants a few day old. Papousek (1967) used a classical conditioning paradigm with term infants, whereby the UCS was a tactile stimulus to the side of the mouth, the UCR headturning and an auditory stimulus was the CS. A milk reinforcer (provision of milk upon headturning to UCS) was also employed within this paradigm, adding an element of the instrumental learning paradigm.

This procedure was performed with newborns for one session (10 trials) daily until they reached the set criterion of five successive correct responses within a daily session.

Newborns were said to display classical conditioning in this procedure by reaching the set criterion in an average of 177 trials over 3 weeks of conditioning (Papousek, 1967).

Again with term infants, Siqueland and Lipsitt (1966) used a buzzer as a positive auditory stimulus, pairing it with a tactile stimulus eliciting headturning to one side and response to the buzzer was reinforced using a dextrose solution. A tone was used as a negative auditory stimulus, paired with a tactile stimulus eliciting headturning to the same side and response to this stimulus was not reinforced.

Infants were found to increase their response to the tactile stimulus following the positive, but not negative auditory stimulus.

However, Clifton et al. (1972a) failed to replicate this study and when they did find some evidence of classically conditioned headturning (in terms of degree of angle of headturn), this was only found in the first block of trials (Clifton et al., 1972b), suggesting that results were due to already prepared response systems rather than conditioning (Sameroff, 1968).

Attempts to classically condition sucking behaviour in newborns and young infants have also encountered problems.

Wenger (1936) failed to replicate the classical conditioning that Marquis (1931) "felt" he elicited using a procedure whereby the milk bottle was inserted into the mouths of infants following a 5 second buzzer during the first ten days of life.

A study by Lipsitt and Kaye (1964) used both a control and experimental group of term infants with the experimental infants receiving a tone (CS) followed by nipple insertion into the infants' mouths while in the control group these were not paired together. No differences between the experimental and control infants were found though when conditioning was assessed after (every four trials) by not placing the nipple into the mouths of the experimental infants and comparing the responses of the two infant groups to the tone alone.

However, during extinction the experimental as compared to control infants were found to exhibit a greater number of sucking responses, suggesting that they had associated the tone with the nipple. Clifton (1971, 1974) though failed to replicate these results when she performed the same procedure.

The fact that sucking behaviour occurs even without the nipple to several stimuli eg. pulling of the hair or squeezing of the infant's toe (Jensen, 1932) questions the validity of anticipatory sucking in studies of classical conditioning. Equally, an unconditioned sucking response has been found to occur to the onset of auditory stimulation (Keen, 1964; Semb and Lipsitt, 1968) and this questions the neutrality of an auditory stimulus as a CS.

It is thus not surprising that classical conditioning of neonates, especially preterms, is acknowledged as difficult, if not impossible, to demonstrate since often the classical conditioning stimulus is an unconditioned one that automatically triggers a response (Sameroff, 1972).

Difficulty in establishing classical conditioning in neonates may also be due to newborns being "prepared" for instrumental but not for classical contingencies (Sameroff, 1972; Seligman, 1970).

Instrumental conditioning however, appears to be more readily established than classical conditioning in newborn infants.

9.1.4.2 Instrumental Conditioning Studies

As in studies using classical conditioning, headturning and sucking behaviour have also been commonly used in studies of instrumental learning. Siqueland (1968) reinforced headturning of more than 10 degrees by letting the term infant suck on a non-nutritive nipple for 5 seconds. After being reinforced for the twenty-fifth time, infants were found to have increased their rate of response from 5-18 responses per minute.

Along with this, term infants who had been reinforced when they held their heads still for 20 seconds showed a decrease (but non-significant) in headturning, indicating that the results were not simply due to excitation as a result of the nipple presentation (Sameroff and Cavanagh, 1979).

Looking at sucking behaviour, Lipsitt et al. (1966) reinforced term infant sucking on a tube with the presentation of dextrose through the tube in experimental as compared to control (no dextrose) infants. Sucking has been found to increase in response to reinforcement by, for example, an auditory tone (Lipsitt and Kaye, 1967), intensities of light (Kasatkin and Levikova, 1935), mothers' voice (Spence and DeCasper, 1987) and visual slides (Siqueland and DeLucia, 1969), all of which were presented contingent upon the infants' sucking behaviour.

Siqueland and DeLucia (1969) used a 15 minute conditioning procedure, consisting of 2 minute baseline, 4 minute conditioning, 2 minute extinction, 4 minute reconditioning and a second 3 minute extinction phase.

The visual slides were presented contingent upon the occurrence of criterion sucking (at/above the sucking pressure that occurred for approximately 35% of the baseline infant non-nutritive sucking pressure) during each of the two 4 minute conditioning phases.

Fullterm infants who received such contingent reinforcement, as compared to those who did not, responded with a significantly higher rate of sucking and greater drop in this rate during the extinction phases suggesting response acquisition and extinction effects.

The duration of individual sucks (Siperstein, 1973), latency to initiate sucking (Brown, 1972), increase of the suction or expression component of sucking (Sameroff, 1968), amongst other measures influenced by contingent stimulation demonstrate the operant conditionability of the sucking response.

Looking at instrumental conditioning studies that have involved premature infants, Gekowski et al. (1984) used a mobile conjugate reinforcement paradigm, whereby movement of a mobile was dependent upon infant foot-kicking, with one year old preterms and fullterms.

Infants received this reinforcement for 12 minutes (broken into four 3 minute blocks) daily, preceded and followed by 3 minutes of non-reinforced foot-kicking (i.e. mobile was in view but non-responsive) for 2 consecutive days and again for a single day one week later, which served as a long-term retention test. The preceding 3 minute block of each daily session served as the pretraining, baseline foot-kicking level while the post 3 minute block served as an immediate retention test.

Although fullterms were found to acquire the reinforcement (foot-kicking significantly exceeded baseline foot-kicking level) in the first day, it was not until the third 3 minute block of the session on the second day that the preterms acquired the reinforcement.

This thus implied that preterms (corrected for conceptional age) were significantly slower than their fullterm counterparts in making the association between foot-kicking and mobile movement. Furthermore, only the fullterm infants exhibited evidence of one-week retention.

These are consistent with the findings that older (12 week olds) as compared to younger fullterm infants (8 week olds), learn an instrumental conditioning task more rapidly and show retention of the association 1 week later unlike those of the younger age (Davis and Rovee-Collier, 1983; Rovee-Collier, 1984; Vander-Lind, 1982).

Not only age or maturity however determine such learning, as number of medical complications and length of hospitalization (interrelated factors) have been found to effect preterm infant learning performance in an instrumental conditioning task (Werner and Siqueland, 1978). These factors are thus controlled for in the present study which involves preterm newborns in an instrumental conditioning task whereby the reinforcer is controlled by their sucking behaviour.

9.1.5 Sucking Behaviour

The basic suck is a very complex, internally organized response, a "high frequency micro-rhythm", (i.e an activity organized into complex time sequences), which is variable according to the nature of the external stimulation it encounters (Schaffer, 1977).

It has been found to be a very sensitive activity, varying according to:

1. The rate of milk flow (Schaffer, 1977), faster sucking arising with an increased rate.

2. Size, contour and compressibility of the nipple (Rochat 1983, 1986). As a consequence of this, Rochat (1983, 1986) concluded that oral, as well as manual, activities at birth appear to be controlled on the basis of sensory information issued from a coalition of modalities.

3. Type of nutrient (Kaye, 1966) with sweetness of the solution increasing sucking.

4. Environmental Temperature. Elder (1970) found that the baby's sucking pressure at the breast is lower at 40 degrees than at 80 showing the influence of temperature.

5. Environmental stimulation (Schaffer, 1977). Sucking rate is altered by visual, auditory (Sameroff, 1967), tactile (Wolf and Simmons, 1967) and kinaesthetic (Kaye, 1977) stimulation. Sameroff (1970) and Dubignon and Campbell (1969) both found the sucking reflex to increase in strength with softness of tubing placed in the mouth.

6. Duration of sucking. A decrease in strength has been found to occur with increased duration (Levin and Kaye, 1966).

7. Gestational Age (Crook, 1979). Premature as compared to fullterm, infants have been found to show shallower, less frequent sucking (Crook, 1979; Kaye, 1967) and though preterms from 30 weeks gestational age can suck within hours after birth (Ellison et al., 1979; Anderson and Vidyasagar, 1979), tube feeding is often required until around 35 weeks gestation when infants display more efficient suck feeding from a bottle (Avery and Fletcher, 1981; Hack, 1983).

   Even once they are bottle feeding however, sucking amplitude is poorer in preterms as compared to fullterms though this difference in pressure diminishes within 10 days of bottle feeding (Brake et al., 1988).

In all infants, the suck itself is produced by a pulling down of the lower jaw. As the cheeks are rigid the space inside the mouth is increased and with the closing of the passages to the stomach and lungs a suck is thus produced (Ribble, 1943). It is one of the reflexes we are born with, which is built upon and serves as one of the most fundamental activities (Schaffer, 1977) of the neonate, whom Cameron (1922) described as primarily a sucking machine.

It is not a simple stereotyped activity, passively elicited by the mother's stimulation, but rather a precisely regulated and highly sophisticated activity, not only in its internal organization and structure but also in the way it is synchronized with other physiological functions like swallowing and breathing (Schaffer, 1977).

Finally, as an important component of the total feeding act, sucking contributes to both physical and psychological development (Schaffer, 1977).

9.1.5.1 Sucking and Physical Development

Efficient sucking enhances nutrient absorption, thereby facilitating physical growth and as the first feeding experience it contributes an unquantified investment into later feeding habits (Schaffer, 1977).

It is a critical component of feeding, (correlating positively with food intake (Kunst, 1948), being finely integrated with the rooting reflex, opening of the mouth, grasping of the nipple with the lips, breathing and swallowing in any optimal feeding session.

It is related to overall physical development also in that babies who show difficulty in establishing sucking also tend to exhibit problems in breathing, circulation and muscle tone (Ribble, 1943).

The findings of Halverson (1938) and Buka and Lipsitt (1991) that strong sucking is accompanied by strong muscular tension (measured by strength of hand grasp) and weak sucking by low tension, with hand muscle tension diminishing during rests between sucking, again illuminates the relationship of sucking to physical development.

Akin to this, Ribble (1943) proposed that sucking is the tactile nucleus around which early perception is organized with the biological functions of sucking and breathing forming a base for the development of sensory processes and through these for the development of muscular activity.

Sucking itself may be enhanced by additional oral and peri-oral experiences in early life. Supplemental early oral and perioral experiences have been found to accelerate feeding efficiency and rate of physical growth (Bernbaum et al., 1983; Ignatoff and Field, 1982; Measel and Anderson, 1979), and this, according to Brake et al., (1988) may be specifically through effects on the sucking component of feeding.

9.1.5.2 Sucking and Psychological Development

As an early psychological experience, sucking acts as a powerful moulding influence of later events eg. the development of personality, through both the satisfaction and pleasure it arouses and its interactive role in feeding (Freud, 1905, 1930; Brody, 1956).

It has been identified as one of the earliest and most effective ways in which an infant communicates with the environment (Crook, 1979) as well as being one of a number of early cognitive structures, whose adaptations follow the general principles of cognitive development (Piaget, 1952b).

During the early months of an infant's life according to Ribble (1943), sucking is the infant's most gratifying and all absorbing activity, quickly becoming associated with other sensory activities (eg. touch, smell) which further reinforce sucking, by the end of the second month.

Sucking provides what Rado (1931) sees as the achievement of a pleasant feeling of sensual pleasure in which the whole organism participates in an "alimentary orgasm". It is also the infant panacea for tension states, (possibly by reducing sensory input from other senses), which becomes partly superseded as infants grow by other satisfactions (Kahn, 1971a; Bridger, 1962).

Non-nutritive sucking has been acknowledged as having a pacification effect (Cohen, 1967; Kessen and Leutzendorff, 1963) which may be argued to promote cognitive development in that some studies have found newborn visual pursuit to be more effective, in an active, awake state, when the infant has a pacifier as compared to when s\he has not (Wolff and White, 1965; Gregg et al., 1976).

The finding that scanning, saccadic eye movements towards a motion picture, are more common during bursts of sucking as compared to the pauses between such bursts (Bruner, 1973), has been seen as demonstrating that sucking facilitates visual scanning (Mendelson and Haith, 1975). However, no relationship between eye movement measures and the burst-pause structure of sucking has been found in support of this (Mendelson and Haith, 1975).

Sucking, according to Kahn (1971) endows infants with the sensation of love, which Kahn (1971) argued can be experienced either with another person or derived from stimulation and the recollection such. It is thus not surprising that sucking has been construed as an essential activity in early life for optimal psychological development (Ribble, 1941).

The need for sufficient early sucking activity and the mothering which stimulates response in the sense organs, was emphasized by Ribble (1941).

She saw sucking as assisting speech development by drawing an enhanced blood supply to the face and head as well as contributing to the progressive development of facial muscles and the brain itself. In support of this she cited cases of infants in whom severe sucking frustration led to stupor-like behaviour, a shock-like state, failure to develop adequate co-ordination of breathing and sucking and retarded speech development (Ribble, 1939).

To determine exactly how much sucking is typically required in early life, sucking activity was timed and it was found that two hours a day was the minimum sucking experience in the well developed baby, with preterm infants requiring a great deal more (Ribble, 1943).

According to Ribble (1943), in terms of feeding, this suggests that the infant requires a mean of six sucking meals a day with a duration of approximately twenty minutes each, from the end of the first week to the fourth month of life.

If the duration of such feeds (and thus sucking) was less than twenty minutes, infants would, Ribble (1943) stated, invariably suck their fingers afterward for sufficient mouth exercise.

9.1.5.3 Sucking and Stimulation

Stimulation in general has long been recognised as exerting a powerful influence over sucking behaviour. Body movement and sucking initiation was found to occur in infants receiving light cheek stimulation during sucking pauses when compared to the same stimulation during active sucking (Wolf and Simmons, 1967).

Equally, measures of affectionate maternal behaviour have been found to be associated with differences in the baby's sucking rate, greater tactile contact resulting in an increased and smoother sucking or feeding rate (Dunn, 1977).

Response contingent stimulation, where stimulation is presented contingently upon the infant sucking at a given rate, has shown that infants can either increase or decrease their sucking rate to acquire stimulation (Siqueland, 1969; Siqueland and DeLucia, 1969; Kalnis and Bruner, 1973), revealing the powerful role of stimulation on sucking activity.

By monitoring changes in heart rate or in sucking, it has been found that infants suck less when they are in more stimulating physical positions and suck more the greater the elapse of time after feeding, possibly due again to either a surfeit or diminished amount of stimulation respectively (Kunst, 1948).

As response contingent stimulation has shown, timing of stimulation is important with respect to the effects it generates in sucking behaviour and this equally applies to maternal stimulations which may also either elicit or inhibit sucking, depending on the timing of such stimulations.

Kaye (1977) identified that mothers interact with and stimulate their infants in precise synchrony with the burst pause pattern of sucking. During bursts, they are generally quiet and inactive, while during pauses they stimulate their infant (jiggling, stroking and talking) thereby taking turns with her/him in being the principal actor.

This ensures an optimal timing of stimulation and sucking with the mother being paced by the baby. She fits in with his/her natural sucking pattern, responds to her infants' signals such as ceasing to suck, accepts the opportunity to intervene offered by his/her pauses and by this means sets up a dialogue between them.

The effect of the mothers stimulation, Kaye and Brazelton (1971) argued, is partly a function of her timing within the infants suck-pause sequence as stimulation too early in the pause period is more likely to prolong the pause rather than induce sucking. Thus mothers may either facilitate or impede infant feeding organization according to how appropriately she responds to the infants cues of cessation of sucking.

Looking at tactile stimulation alone, Ribble (1943) proposed that "*..the mouth is fundamentally an organ of touch..*" (p25) and that the association of the mouth with tactile sensations arises in foetal life. Hofer (1949), another who recognised the relationship between sucking and tactile stimulation, argued that feeding stimulates pleasurably both oral and tactile sensations in infants and that in the first weeks of life, touch alone of the oral zone produces sucking movements.

Feeding itself, in terms of formula volume intake as well as sucking rate has been found to be significantly enhanced in preterms by simple touching of the infants' mouths during feeding (Tryowski, 1979).

Tactile stimulation has also been argued to accelerate sucking (Macedo, 1984), which Tryowski (1979) found, and Macedo (1984) suggested that possibly there is "*...a demonstratable reflex action between tactile stimulation and sucking action on the one hand and tactile stimulation and nutrient absorption on the other*" (p180). This however, has yet to be investigated.

9.1.6 Conclusion

There thus can be no doubt but that stimulation, including that of a tactile nature, is of immense significance to both infant learning ability and sucking activity.

Whether a programme of supplemental tactile stimulation such as Tac-Tic (Macedo, 1984), given to premature infants benefits their learning and/or sucking behaviour though, yet remains to be answered and thus this was investigated by the present study looking at infant sucking pressure within an instrumental learning paradigm.

As with prior studies (see Chapters 6 and 8), the developmental measures of age at onset of first suck of all feeds in a day and age at discharge, both parameters of infant health and development, were examined as part of a continuous investigation into the effect of tactile stimulation upon these measures.

Again , as a side-issue the question of whether Tac-Tic stimulation has a greater impact on high-risk (low gestational age and birthweight) as opposed to low-risk preterm (high gestational age and birthweight) infants was also examined for the same reasons and in the same way as stated in Chapter 6 (Section 6.1.5.1).

The experimental hypotheses of this study were that:

(1) Experimental (received supplemental tactile stimulation) as compared to control infants will show better learning.

Stated in operational terms, sucking pressure of the experimental infants will, during the pertinent phases of the experiment:

(a) reach the criterion required to instigate the reinforcer quicker than the controls

(b) show a larger percentage increase across the learning experiment than the controls

(2) Better sucking behaviour, i.e higher pressure, will be displayed by the experimental as compared to control infants.

(3) Experimental infants will show improved development, in terms of earlier sucking of all feeds in a day and earlier discharge, in comparison to their matched controls.

(4) the high-risk group in the experimental sample would show significantly better learning and sucking behaviour (in the ways defined above) as well as earlier ages on the variables of age at first sucking of all feeds in a day and age at discharge, than the high-risk group of the control sample.

It was also hypothesized that the likelihood of a significant difference between these groups would be greater than between the low-risk groups.

9.2. METHOD

9.2.1 Design

The objectives of this study were to assess the effects of the independent variable, a tactile stimulation programme, given to 10 preterms but not to their matched controls for a mean duration of 34 days, upon the dependent variables of:

(1) instrumental learning i.e. shortness of the duration of time spent before triggering stimulation (overall average length of the critical phases) and percentage increase in pressure, during those times when pressure increase could lead to stimulation onset (i.e the critical phases), across the learning procedure.

(2) sucking pressure

(3) age in days at first all suck feed in a day

(4) age in days at discharge

Sucking pressure was used as an overall measure of sucking behaviour since sucking amplitude has been found to account for a significant percentage of formula intake variance (Pollitt et al., 1978).

Subjects were matched following the same criteria as outlined in Section 6.2.1. Along with this age in days when the learning assessment took place was checked to ensure that this had no effect on the data (see Table 9.2.2.F).

Assessment of the effects of Tac-Tic upon the dependent variables (a) and (b), employed an Apple IIe computer with a pressure transducer, tape-recorder, tubing and dummy attached to it.

Infant sucking at/above an individually predetermined baseline sucking pressure threshold, instigated the playing of the mother's prerecorded voice (reinforcer) by a tape-recorder for a time period of seven seconds. This time period was selected to be as short as possible while being long enough for the infant to hear several words being spoken so that fatigue or distraction were prevented from affecting the infant's behaviour.

The mother's voice was chosen as the reinforcer since it has already been established as a reinforcer of neonatal behaviour (DeCasper and Fifer, 1980).

Sucking pressure at/above the baseline threshold was not effective in bringing about the reinforcer where the reinforcer was playing and for a set time period (1 second) after it had just played. This ensured that the reinforcer was not kept on for the whole of the experimental procedure, (which could have interfered with the sucking pressure-reinforcer association), and thus learning across the procedure could be examined.

(a) Within the context of the Procedure section outlined below instrumental learning was measured by:

a.1 shortness of the duration of time spent before triggering stimulation (overall average length of the critical phases)

a.2 percentage increase in pressure, during those times when pressure increase could lead to stimulation onset (i.e the critical phases), across the learning procedure.

(b) Sucking pressure was measured by:

b.1 mean threshold pressure

b.2 overall average pressure across the learning procedure

Information on the effects of the Tac-Tic stimulation programme upon the dependent variables (c) and (d) were obtained from hospital records.

9.2.2 Subjects

Altogether 20 preterms, 16 female, 4 male, were involved in this study. The dominance of females in the sample being a consequence of their greater number, as compared to males, in the hospital special care unit, during the four months that the experiment took place.

All the subjects were recruited from the Queen Mother's hospital, Glasgow and assigned to experimental/control conditions depending on how they matched up with subjects previously collected i.e if an infant matched a control that had no experimental match then s/he was assigned to the experimental condition.

The experimental and control samples were all matched on their overall distribution of the variables mentioned in Section 6.4.2. (see Appendix 6.2.1.1).

Subject characteristics, broken down into experimental and control, with these sub-divided into high-risk and low-risk (high-risk = at/below 33 weeks gestation, this threshold was selected as it conveniently divides groups into a near equal number), for reference to in the results and discussion sections, are detailed in Tables 9.2.2.1-9.2.2.5 below and overleaf.

Table 9.2.2.1 BIRTHWEIGHT (kg)

	MEAN	S.D.	RANGE	N
Entire Population 16F 4M:	1.71	0.46	0.78-2.73	20
Experimental 8F 2M:	1.67	0.51	0.78-2.73	10
High risk:	1.46	0.41	0.78-1.83	6
Low risk:	1.98	0.53	1.53-2.73	4
Control 8F 2M:	1.75	0.43	1.16-2.54	10
High risk:	1.37	0.27	1.16-1.72	4
Low risk:	1.99	0.34	1.54-2.54	6
Overall High Risk:	1.42	0.35	0.78-1.83	10
Overall Low Risk:	1.99	0.40	1.53-2.73	10

Table 9.2.2.2 GESTATION

	MEAN	S.D.	RANGE	N
Entire Population:	31.5	3.10	26-35	20
Experimental:	31.0	3.52	26-35	10
High risk:	28.8	2.85	26-32	6
Low risk:	34.2	0.50	34-35	4
Control:	32.1	2.68	26-35	10
High risk:	29.7	2.87	26-33	4
Low risk:	33.6	0.81	33-35	6
Overall High Risk:	29.2	2.74	26-33	10
Overall Low Risk:	33.9	0.73	33-35	10

Table 9.2.2.3 APGAR AT 1 MINUTE

	MEAN	S.D.	RANGE	N
Entire Population:	6.90	2.19	2-10	20
Experimental:	7.20	2.57	2-9	10
High risk:	5.83	2.48	2-9	6
Low risk:	9.25	0.50	9-10	4
Control:	6.60	1.83	4-9	10
High risk:	6.50	1.73	5-9	4
Low risk:	6.66	2.06	4-9	6
Overall High Risk:	6.10	2.13	2-9	10
Overall Low Risk:	7.70	2.05	4-10	10

Table 9.2.2.4 APGAR AT 5 MINUTES

	MEAN	S.D.	RANGE	N
Entire Population:	8.55	0.99	6-10	20
Experimental:	8.70	1.15	6-9	10
High risk:	8.16	1.16	6-9	6
Low risk:	9.50	0.57	9-10	4
Control:	8.40	0.84	7-9	10
High risk:	8.50	1.00	7-9	4
Low risk:	8.33	0.81	7-9	6
Overall High Risk:	8.30	1.05	6-9	10
Overall Low Risk:	8.80	0.91	7-10	10

Table 9.2.2.5 AGE IN DAYS AT LEARNING PROCEDURE

	Mean	S.D.	N
Entire Population:	35.05	25.04	20
Experimental:	32.10	18.94	10
High risk:	38.83	22.38	6
Low risk:	22.00	3.82	4
Control:	38.00	30.76	10
High risk:	65.75	32.83	4
Low risk:	19.50	5.43	6
Overall High Risk:	49.60	28.82	10
Overall Low Risk:	20.50	4.79	10

9.2.3 Equipment (Figure 9.2.3.1)

A Basic computer program written for this study to assess instrumental learning and sucking pressure was run using:

(a) an Apple IIe microcomputer with an 8 bit analog to digital converter and disk drive

(b) a 1 metre flexible polyvinylchloride airline (attached to a dummy and to a pressure transducer)

(c) a model LX-1601-GB Miller Systems solid state pressure transducer (range 1-10 Pounds per Square Inch Atmospheric (P.S.I.A)

Pressure consisted of the movement of air in the pvc tube.

(d) a connection interface box

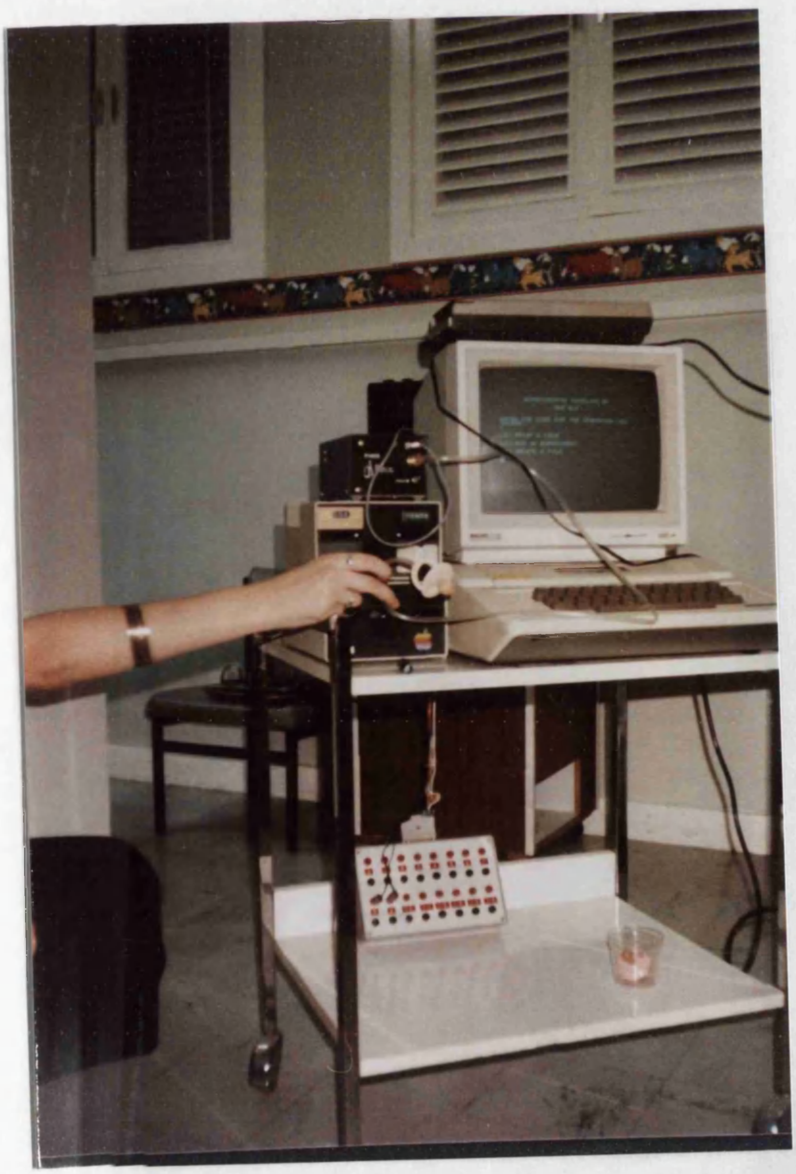
(e) dummies

Across all the infants, 3 dummies of the same make ("grip-tight") and structure were used with the back removed so that the pvc tube could be inserted securely into the dummy.

In addition to this a cone-like top, through which the tube was drawn, was placed where the tube entered the dummy to prevent the escape of air. One dummy was used in any single, learning experiment and was sterilized using Milton solution before use.

(f) a Philips tape-recorder, microphone and tape

Figure 9.2.3.1 EQUIPMENT



9.2.3.1 Calibration of Pressure Transducer

The pressure transducer was calibrated at the beginning of each learning session to ensure accuracy of measurement of pressure.

The analogue to digital converter possessed an internal ladder providing 256 reference voltages equally spaced out over 0-5 volt range. When the computer programme received an input, a conversion was automatically initiated. A search was then performed to find which of the 256 references lies just below the input voltage.

The result of the search was an 8-bit number between 0 and 255 which can be read by the programme. The 0 to 5 volts range was divided into 256 values spaced 0.0196 volts apart with 128 (i.e 128 x 0.0196 = 2.5 volts), being the value to which the pressure transducer was set at the beginning of every session.

Offset calibration was the error band defined by the maximum error in calibrating the transducer output signal obtained when the reference pressure (2.5 volts) is applied.

Offset reference pressure for absolute pressure transducers was the lowest pressure in the pressure range i.e. 0 P.S.I.A. (Pounds per Square Inch Atmospheric). Calibrating the pressure transducer to a value of 128 (indicated on computer screen) represented setting it at 0 P.S.I.A.

9.2.3.2 Running of program/experimental procedure

The computer program controlled the course of the learning experiment, the presentation of stimulation (i.e the tape-recorded mother's voice) and the recording of sucking pressure data over the phases of the experiment (see Figure 9.2.3.2.1).

The program operated to:

(a) begin the threshold and first critical phase and the experiment, only when the space-bar has been pressed.

A. PROCEDURE ONSET

(b) record subject name and date

(c) calibrate pressure transducer

(d) indicate the onset of each of the phases of the experiment with 3 bleeps

(e) record sucking pressure data at a sampling frequency of 5 measures per second

B. Threshold Phase (20 seconds)

(f) record pressure data to determine the threshold sucking pressure for 20 seconds

(g) calculate this threshold as the pressure collected which is at the 90 percentile rank of this data in (e)

C. Critical Phase (Maximum length 30 seconds)

(h) switch on the tape-recorder when there is a pressure at or above the threshold during this critical phase

(i) if the threshold is not reached within 30 seconds then default i.e decrease the threshold value by 5 % if the Y key is pressed and begin C again unless the N key is pressed or which ends the experiment. If after a number of defaults the new threshold is 20% of the original threshold, the experiment ends.

D. Stimulation Phase (7 seconds)

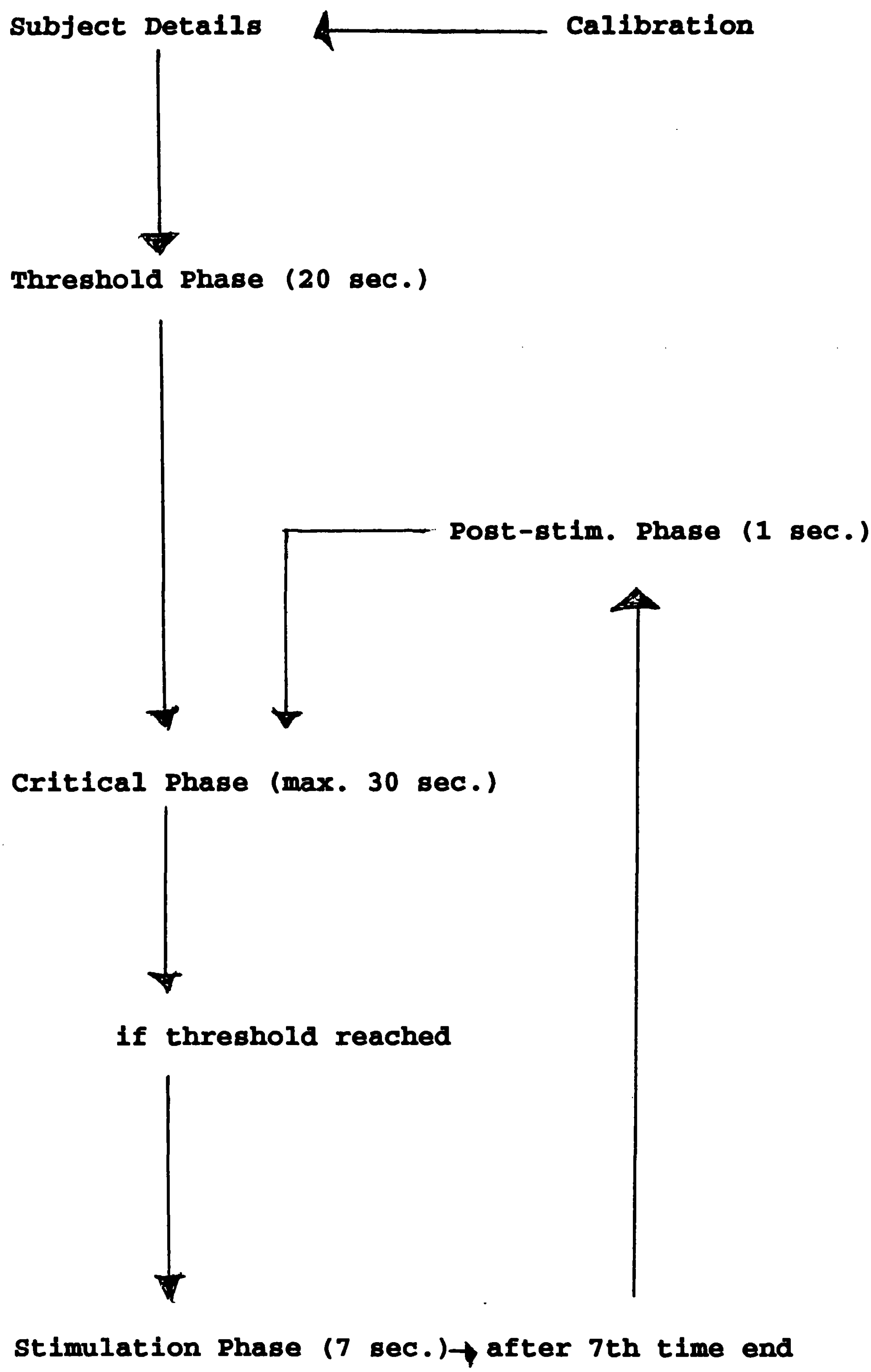
(j) present the taped mother's voice for 7 seconds only, no matter what pressures the subject is sucking at

E. Post-Stimulation Phase (1 second)

(k) do not present the stimulation, no matter what pressures the subject is sucking at

Repeat phases C through to E for another 6 times unless the escape key is pressed which ends the experiment

Figure 9.2.3.2.1 FLOW CHART DIAGRAM



9.2.4 Procedure

(a) Tactile stimulation

Infants in the experimental condition received 1 daily session of Tac-Tic stimulation (see Section 6.1.5.1, Appendix 6.1.4), which took 20 minutes approximately each time. Experimental infants received this stimulation programme from their third day of life until the day before discharge when the learning procedure took place.

(b) Learning experiment

This was conducted on the day before discharge in order that the tactile stimulation was given as much time as possible, within the infants' hospitalization, to exert any possible effect upon infant learning (see Figure 9.2.4.1).

A tape recording of the mother's voice was obtained using a Philips tape-recorder, microphone and tape. Mothers were set up with this equipment in a quiet room, within the neonatal unit and left there to tape their voice for a minimum of 1 minute, as indicated by the counter on the tape-recorder.

Their infants were with them in this room and the mothers were advised to speak, when they were being taped, as they "normally do" to their infant. If mothers felt they "had nothing to say", they were encouraged to engage in "motherese" or to say any nursery rhymes they knew.

Mothers were also told not to leave pauses in what they say when they are being taped. This was done to ensure that during the experiment when the tape was playing, as a reinforcer contingent upon the infant's sucking at/above his/her threshold pressure, the mother's voice (and not blank tape) was always produced. After the mother's voice was taped, the tape recorder was attached to the rest of the equipment (see Section 9.2.3).

Learning was assessed immediately before a feed as infants are usually more alert and keen to suck at this time than after a feed. Ten minutes immediately before the infants next feed, they were held by their mother who sat in a chair beside the equipment.

Infants were not left in their cots for the learning procedure as in pilot runs employing this procedure, great difficulty was found in getting the infant to suck at all and retain the dummy in her/his mouth if sucking was elicited.

As the experimenter needed to operate the computer, the mother was asked to hold the infant during the experiment. Mothers were informed not to speak, jiggle stroke or rock their infant, or react in any way to their infants behaviour, other than to steady the dummy if ever it appeared to be about to fall out.

These conditions were carried out (successfully), to ensure that it was the mother's taped voice alone that was a reinforcer or feature, which reacted contingently to the infant's sucking pressure (Kaye and Wells, 1980).

The mothers inserted a dummy (attached to pvc vacuum tubing and this to the pressure transducer which in turn was linked to the computer) into their infant's mouth.

Once the experimenter initiated the run of the computer programme, the infant's sucking pressure threshold was established (see section 9.2.3). Once this was computed, and the experimenter indicated to the computer to continue on in the program, the taped mother's voice was presented for 7 seconds contingently upon the infant reaching his/her threshold pressure.

If the infants' sucking did not reach the pressure threshold within 30 seconds, default occurred whereby the pressure was decreased by 5% of the already established threshold. If a number of defaults occurred, once a threshold that was 20% of the original threshold occurred, the experiment ended. This never occurred though as the maximum number of defaults shown by any infant was 1.

Following this a 1 second period occurred where no matter what pressure the infant sucked at, no stimulation was presented. This ensured that the stimulation i.e the taped voice, did not run continuously if the infant happened to be sucking at/above threshold pressure at the end of the stimulation phase.

Once this period was completed, it was again up to the infant to suck at/above threshold pressure to obtain the mother's taped voice.

After the mother's voice was presented for the seventh time the experiment was completed. Data was stored and retrieved from the floppy disc in the disc drive in a numerical format sub-divided according to the experimental phases.

Figure 9.2.4.1 PHOTO OF EXPERIMENTAL SITUATION

9.3 RESULTS

9.3.1 Instrumental Learning Results

9.3.1.1 Descriptive statistics

From the data in Tables 9.3.1.1.1 to 9.3.1.1.3 it is clear that:

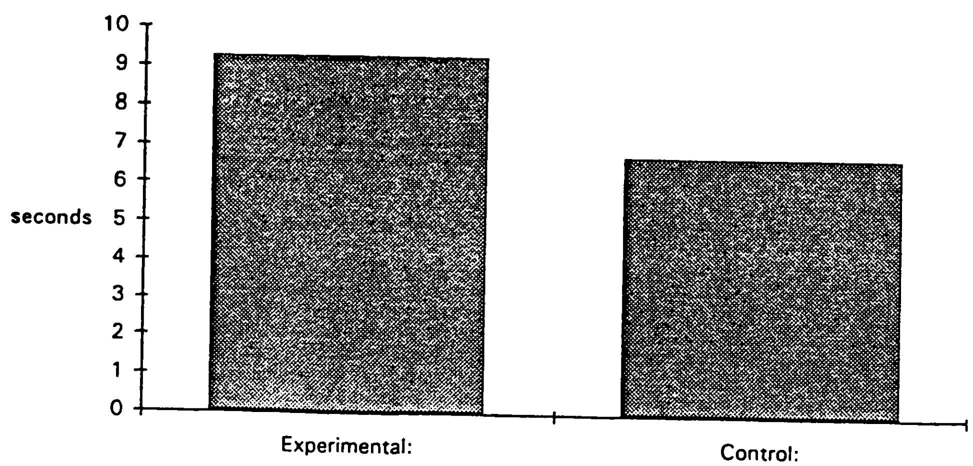
(1) On Overall Average Critical Phase Length, (duration of time spent before triggering stimulation), the control rather than the experimental sample shows the faster learning time. The difference between the groups though is quite small.

It is also visible that it was the low-risk group of the experimental sample that accounted for the longer OACPL the experimental, as compared to control sample showed (Table 9.3.1.1.1, Figure 9.3.1.1.1).

Table 9.3.1.1.1 OVERALL AVERAGE CRITICAL PHASE LENGTH (SECONDS) (OACPL)

	Mean	S.D.	N
Entire Population:	8.00	13.61	20
Experimental:	9.28	19.03	10
High risk:	2.83	2.01	6
Low risk:	18.95	29.53	4
Control:	6.72	5.05	10
High risk:	9.45	4.82	4
Low risk:	4.90	4.70	6
Overall High Risk:	5.48	4.65	10
Overall Low Risk:	10.52	18.86	10

Fig. 9.3.1.1.1 Mean Overall Average Critical Phase Length (OACPL)



(2) On Mean Percentage Increase in Sucking Pressure across the Waiting Phases of the Instrumental Learning Procedure, (% increase in sucking pressure during those times when sucking pressure could lead to stimulation onset, across the learning procedure), the experimental sample displays a much larger % increase than that of the controls. This applies equally to experimental as compared to control, high-risk and low-risk groups (Table 9.3.1.1.2, Figure 9.3.1.1.2).

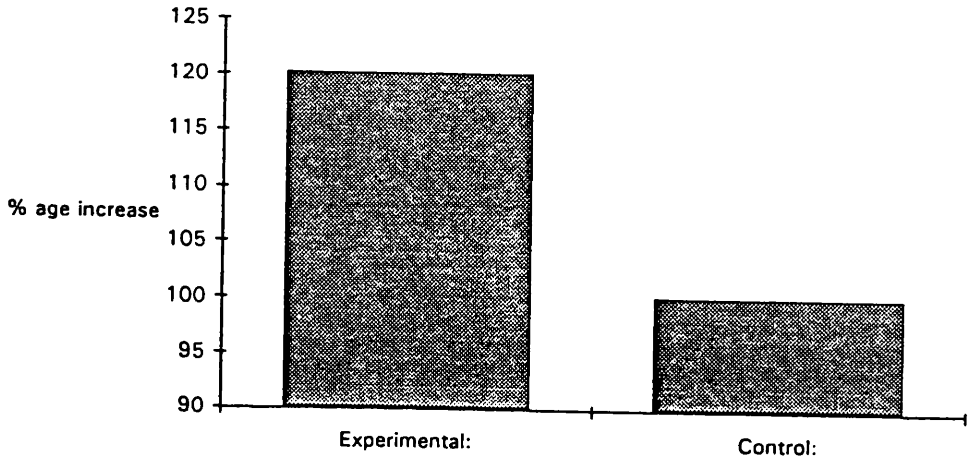
Table 9.3.1.1.2 MEAN PERCENTAGE INCREASE IN CRITICAL PHASE SUCKING PRESSURE (MCPER)

	Mean	S.D.	N
Entire Population:	110.24	27.81	20
Experimental:	120.24	34.66 *	10
High risk:	110.18	36.14	6
Low risk:	135.32	30.37	4
Control:	100.25	14.46 *	10
High risk:	104.87	11.66	4
Low risk:	97.16	16.33	6
Overall High Risk:	108.06	27.90	10
Overall Low Risk:	112.43	29.05	10

* The two highest scores in the experimental group were found to account for the higher standard deviation in this sample as compared to the control group.

When these scores were removed, along with the two highest scores in the control group, the standard deviations of the two groups were comparable (experimental s.d.= 18.57, control s.d.= 12.81).

Fig. 9.3.1.1.2 Mean Percentage Increase in Critical Phase Sucking Pressure (MCPER)



(3) On Mean Percentage Increase in Sucking Pressure across the Stimulation Phases of the Instrumental Learning Procedure (% increase of sucking pressure when its increase had no effect upon stimulation onset), there was little difference between the experimental and control samples. The latter showed the higher scores overall and across the high-risk and low-risk groups in comparison to the experimental sample (Table 9.3.1.1.3).

Table 9.3.1.1.3 MEAN PERCENTAGE INCREASE IN STIMULATION SUCKING PRESSURE (MSPER)

	Mean	S.D.	N
Entire Population:	106.45	32.38	20
Experimental:	102.09	29.59	10
High risk:	106.93	38.52	6
Low risk:	94.82	6.05	4
Control:	110.82	35.99	10
High risk:	105.35	14.03	4
Low risk:	114.46	46.62	6
Overall High Risk:	106.30	29.85	10
Overall Low Risk:	106.61	36.37	10

9.3.1.2 MANOVAs, Co-Variate analyses, ANOVAs and t-tests

As can be seen from the co-variate analyses below, age at time of learning assessment (analysed as a co-variate) was not found to have a significant bearing upon any of the 3 dependent variables of:

1. Overall Average Critical Phase Length (OACPL)

2. Mean Percentage Increase in Sucking Pressure across the Critical Phases of the Instrumental Learning Procedure (MCPER)

3. Mean Percentage Increase in Sucking Pressure across the Stimulation Phases of the Instrumental Learning Procedure (MSPER)

MANOVAs performed on the data revealed no significant differences between the experimental and control samples on these 3 dependent variables. Similarly, ANOVAs and post-hoc Scheffe t-tests found no significant differences between the risk groups (experimental high-risk and low-risk and control high-risk and low-risk) on these variables.

(1) Overall Average Critical Phase Length (OACPL)

MANOVA: Experimental vs Control with age at time of learning assessment as a co-variate

Source of Var	SS	DF	MS	F	Sig.F
WITHIN CELLS	349103.5	17	20535.5		
REGRESSION	11.6	1	11.6	.00	.98
CONSTANT	40261.9	1	40261.9	1.96	.17
CON	3276.0	1	3276.0	.16	.69

COVARIATE	B	Beta	Sd.Er.	t-Value	Sig.t
LAGE	.031	.005	1.32	.02	.98

COVARIATE	Lower -95%	CL- Upper
LAGE	-2.75	2.82

ANOVA: Risk groups

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Grps	3	70584.66	23528.22	1.33	.297
Within Grps	16	281807.33	17612.95		
Total	19	352392.00			

The value actually compared with Mean(J)-Mean(I)

is 93.8428 * Range * Sqrt(1/N(I) + 1/N(J)). No two groups are significantly different at the

$p < 0.05$ level.

(2) Mean Percentage Increase in Sucking Pressure across Critical Phases (MCPER)

MANOVA: Experimental vs Control with age at time of learning assessment as a co-variate

Source of Var	SS	DF	MS	F	Sig.F
WITHIN CELLS	1263814.8	17	74342.0		
REGRESSION	6286.0	1	6286.0	.0	.77
CONSTANT	8231575.5	1	8231575.5	110.7	.00
CON	188471.8	1	188471.8	2.5	.13

COVARIATE	B	Beta	Sd.Er.	t-Value	Sig.t
LAGE	-.73	-.070	2.51	-.29	.77

COVARIATE	Lower -95%	CL- Upper
LAGE	-6.04	4.57

ANOVA: Risk groups

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Grps	3	365765.28	121921.76	1.76	.194
Within Grps	16	1104135.66	69008.47		
Total	19	1469900.95			

The value actually compared with Mean(J)-Mean(I) is 185.7532 * Range * Sqrt(1/N(I) + 1/N(J)). No two groups are significantly different at the $p < 0.05$ level.

(3) Mean Percentage Increase in Sucking Pressure across Stimulation Phases (MSPER)

MANOVA: Experimental vs Control with age at time of learning assessment as a co-variate

Source of Var	SS	DF	MS	F	Sig.F
WITHIN CELLS	1889926.3	17	111172.1		
REGRESSION	64614.1	1	64614.1	.58	.45
CONSTANT	8506272.7	1	8506272.8	76.51	.00
CON	50398.1	1	50398.1	.45	.51

COVARIATE	B	Beta	Sd.Er.	t-Value	Sig.t
LAGE	-2.34	-.181	3.077	-.76	.45

COVARIATE	Lower -95%	CL- Upper
LAGE	-8.83	4.14

ANOVA: Risk groups

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Grps	3	93240.53	31080.17	.261	.851
Within Grps	16	1899406.41	118712.90		
Total	19	1992646.95			

The value actually compared with Mean(J)-Mean(I) is 243.6318 * Range * Sqrt(1/N(I) + 1/N(J)). No two groups are significantly different at the $p < 0.05$ level.

However, the a-priori matched subjects and independent (used for the same reasons discussed in chapter 6) t-tests showed that the experimental as compared to control infants, exhibited a larger mean increase in sucking pressure across the critical phases, from the beginning to end of the total instrumental learning session which closely approached significance ($t = 1.64$, $df = 9$, $p < 0.06$; $t = 1.68$, $df = 18$, $p < 0.055$, 1 tailed).

The larger standard deviation shown by the experimental, as compared to control infants, in this variable was found to be accounted for by very high scores from two infants. When removed from the sample (along with the two highest scores from the control group), the standard deviation of the experimental and control groups was comparable, but the significant difference was lost with this diminished population size ($t = 1.2$, $df = 14$, $p < 0.12$, 1 tailed).

A Kolmogorov-Smirnov 2 sample test was also performed comparing the experimental and control groups on this data. No significant difference was found between the two groups and this compromises further the aforementioned t-test results which are just non-significant.

Kolmogorov-Smirnov 2 sample test

Cases

10 Experimental

10 Control

–

20

Most extreme Differences

Absolute	Positive	Negative	K-S Z	1-tailed p
0.4000	0.1000	-0.4000	0.894	0.200

No significant differences between the experimental and control groups were found, using matched subjects and independent t-tests, in either OACPL ($t= 0.53$, $df= 9$, $p< 0.30$; $t= 0.41$, $df= 18$, $p< 0.34$, 1 tailed) or MSPER ($t= 0.59$, $df= 9$, $p< 0.56$; $t= 0.59$, $df= 18$, $p< 0.56$ 2 tailed). The latter variable being 2 tailed since it was used to judge the validity of MCPER as a measure of learning performance.

9.3.1.3 Pearson Correlations

Pearson correlations performed on the data showed the expected significant correlations between gestation and birthweight and Apgar at 1 minute. The later also correlated significantly with Apgar at 5 minutes, as expected, and no significant correlations were found between any of the 3 learning dependent variables with any measure/infant characteristic.

OACPL = Overall Average Critical Phase Length

MCPER = Mean % Increase in Sucking Pressure across Critical Phases from the beginning to end of the Learning Session

MSPER = Mean % Increase in Sucking Pressure across Stimulation Phases from the beginning to end of the Learning Session

BWGT = Birthweight AP1 = Apgar at 1 minute

GEST = Gestational Age AP5 = Apgar at 5 minutes

Table 9.3.1.3.1 PEARSON CORRELATIONS: LEARNING MEASURES

	OACPL	MCPER	MSPER	BWGT	GEST	AP1	AP5
OACPL	-	.48	-.03	.11	.20	.32	.12
MCPER	.48	-	-.41	.07	-.13	-.17	-.12
MSPER	-.03	-.41	-	-.00	.21	.24	.09
BWGT	.11	.07	-.00	-	.60*	.16	.01
GEST	.20	-.13	.21	.60*	-	.54*	.38
AP1	.32	-.17	.24	.16	.54*	-	.72**
AP5	.12	-.12	.09	.01	.38	.72**	-

9.3.2 Sucking Pressure Measures

9.3.2.1 Descriptive Statistics

From the data in Tables 9.3.2.1.1 and 9.3.2.1.2 and Figures 9.3.2.1.1 and 9.3.2.1.2, it is clear that the experimental and control samples were not that different in their average Sucking Pressure Threshold. However, the experimental sample does have a much larger Overall Average Sucking Pressure than the control sample and this applies especially to the high-risk infants.

Table 9.3.2.1.1 SUCKING PRESSURE THRESHOLD

	Mean	S.D.	N
Entire Population:	42.10	22.77	20
Experimental:	43.90	23.32	10
High risk:	46.66	11.46	6
Low risk:	39.75	37.07	4
Control:	40.30	23.31	10
High risk:	47.50	32.64	4
Low risk:	35.50	16.42	6
Overall High Risk:	47.00	20.69	10
Overall Low Risk:	37.20	24.76	10

Table 9.3.2.1.2 OVERALL AVERAGE SUCKING PRESSURE

	Mean	S.D.	N
Entire Population:	25.74	12.51	20
Experimental:	30.24	13.71	10
High risk:	33.33	11.12	6
Low risk:	25.60	17.60	4
Control:	21.25	9.89	10
High risk:	22.32	10.83	4
Low risk:	20.53	10.20	6
Overall High Risk:	28.93	11.84	10
Overall Low Risk:	22.56	12.96	10

Fig. 9.3.2.1.1 Mean Sucking Pressure Threshold (SPT)

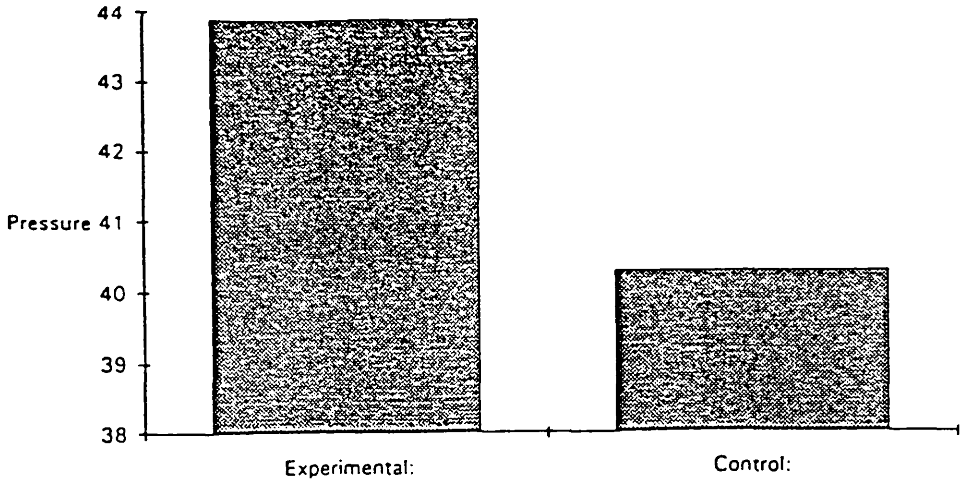
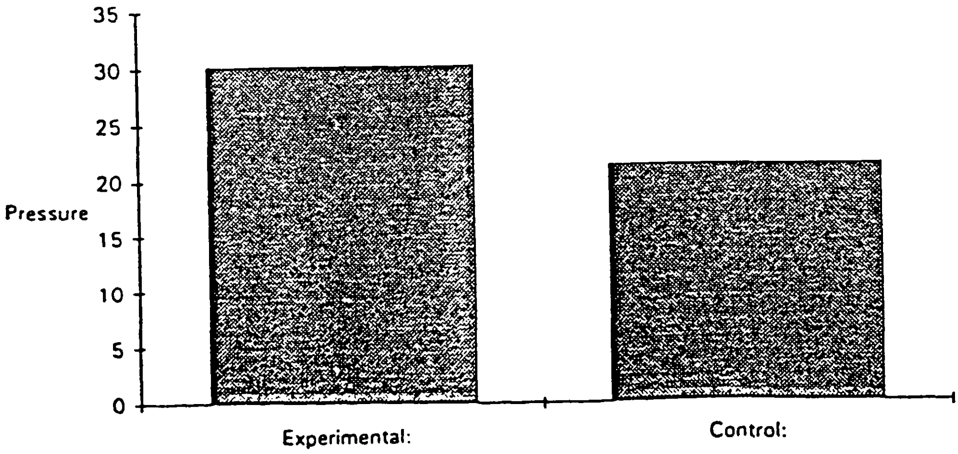


Fig. 9.3.2.1.2 Mean Overall Infant Average Sucking Pressure (OASP)



9.3.2.2 MANOVAs, Co-Variate analyses, ANOVAs and t-tests

A-priori matched subjects and independent t-tests conducted on the data showed that the experimental as compared to control infants, exhibited a larger, Overall Average Sucking Pressure ($t = 1.47$, $df = 9$, $p < 0.088$; $t = 1.68$, $df = 18$, $p < 0.055$, 1 tailed) which approached significance. No significant differences were found either between the experimental and control groups in the dependent variable threshold (THRES) ($t = 0.86$, $df = 9$, $p < 0.20$; $t = 0.35$, $df = 18$, $p < 0.36$, 1 tailed).

The MANOVAs also found no significant difference between the experimental and control samples in Overall Average Sucking Pressure.

Co-variate analyses conducted with the multi-variate analyses of variance below, found age at time of learning assessment to have no significant bearing upon either of the sucking pressure variables of:

1. Sucking Pressure Threshold established (THRES)

2. Overall Average Sucking Pressure (OAP).

The ANOVAs and post-hoc Scheffe t-tests, performed on the data of the risk groups also found no significant difference between any of the risk groups.

(1) Threshold Sucking Pressure (THRES)

MANOVA: Experimental vs Control with age at time of learning assessment as a co-variate

Source of Var	SS	DF	MS	F	Sig.F
WITHIN CELLS	9709.3	17	571.1		
REGRESSION	79.6	1	79.6	.14	.71
CONSTANT	9946.5	1	9946.5	17.42	.00
CON	82.25	1	82.2	.14	.70

COVARIATE	B	Beta	Sd.Er.	t-Value	Sig.t
LAGE	.0823	.0901	.22	.373	.71

COVARIATE	Lower -95%	CL- Upper
LAGE	-.38	.54

ANOVA: Risk groups

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Grps	3	525.21	175.07	.300	.824
Within Grps	16	9328.58	583.03		
Total	19	9853.80			

The value actually compared with Mean(J)-Mean(I) is 17.0739 * Range * Sqrt(1/N(I) + 1/N(J)). No two groups are significantly different at the $p< 0.05$ level.

(2) Overall Average Sucking Pressure (OAP)

MANOVA: Experimental vs Control with age at time of learning assessment as a co-variate

Source of Var	SS	DF	MS	F	Sig.F
WITHIN CELLS	257371.2	17	15139.4		
REGRESSION	1.6	1	1.6	.00	.99
CONSTANT	430112.5	1	430112.5	28.41	.00
CON	39757.9	1	39757.9	2.63	.12

COVARIATE	B	Beta	Sd.Er.	t-Value	Sig.t
LAGE	-.0118	-.0025	1.13	-.01	.99

COVARIATE	Lower -95%	CL- Upper
LAGE	-2.40	2.38

ANOVA: Risk groups

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Grps	3	55533.53	18511.17	1.22	.333
Within Grps	16	242249.41	15140.58		
Total	19	297782.95			

The value actually compared with Mean(J)-Mean(I) is 87.0074 * Range * Sqrt(1/N(I) + 1/N(J)). No two groups are significantly different at the $p < 0.05$ level.

9.3.2.3 Pearson Correlations

Pearson correlations performed on the data showed, as in Section 9.3.1.3 above, the expected significant correlations between gestation and birthweight and Apgar at 1 minute. The latter also correlated significantly with Apgar at 5 minutes, as expected, and the dependent variables, THRES and OAP showed significant positive correlations with each other, but not with any infant characteristic (Section 9.3.2.3).

None of the pressure measures correlated significantly with any of the learning measures (Table 9.3.2.3.1 and 9.3.2.3.2).

THRES = Sucking Pressure Threshold Established

OAP = Overall Average Sucking Pressure

GEST = Gestational Age

BWGT = Birthweight

AP1 = Apgar at 1 minute

AP5 = Apgar at 5 minutes

Table 9.3.2.3.1 PEARSON CORELLATIONS: SUCKING PRESSURE AND LEARNING MEASURES

	THRES	OAP	GEST	BWGT	AP1	AP5
THRES	-	.61*	-.10	.08	.35	.07
OAP	.61*	-	-.09	.12	.26	.18
GEST	-.10	-.09	-	.60*	.54*	.38
BWGT	.08	.12	.60*	-	.16	.01
AP1	.35	.26	.54*	.16	-	.72**
AP5	.07	.18	.38	.01	.72**	-

	THRES	OAP	MCPER	MSPER	OACPL
THRES	-	.61*	.13	.08	.50
OAP	.61*	-	.05	-.22	.07
MCPER	.13	.05	-	-.41	.48
MSPER	.08	-.22	-.41	-	-.03
OACPL	.50	.07	.48	-.03	-

1-tailed Signif: * - .01 ** - .001

9.3.3 Developmental Measures

9.3.3.1 Descriptive statistics and a-priori t-tests

As can be seen from Tables 9.3.3.1.1 and 9.3.3.1.2 and from the a-priori matched subjects and independent t-tests carried out, little difference occurred between the experimental and control samples on age at first suck of all feeds in a day ($t= 0.19$, $df=9$, $p< 0.41$; $t= 0.12$, $df= 18$, $p< 0.45$, 1 tailed) or age in days at discharge ($t= 0.91$, $df= 9$, $p< 0.14$; $t= 0.56$, $df= 18$, $p< 0.29$, 1 tailed).

Table 9.3.3.1.1 AGE AT FIRST ALL SUCK FEED

	Mean	S.D.	N
Entire Population:	31.80	22.07	20
Experimental:	31.20	18.12	10
High risk:	36.50	21.77	6
Low risk:	23.25	7.36	4
Control:	32.40	26.45	10
High risk:	59.75	19.03	4
Low risk:	14.16	6.67	6
Overall High Risk:	45.80	22.98	10
Overall Low Risk:	17.80	8.05	10

Table 9.3.3.1.2 AGE IN DAYS AT DISCHARGE

	Mean	S.D.	N
Entire Population:	38.80	25.99	20
Experimental:	35.50	21.04	10
High risk:	43.33	24.56	6
Low risk:	23.75	3.94	4
Control:	42.10	30.97	10
High risk:	73.00	26.52	4
Low risk:	21.50	5.64	6
Overall High Risk:	55.20	28.36	10
Overall Low Risk:	22.40	4.92	10

9.3.3.2 ANOVAs and post-hoc Scheffe t-tests

By dividing the experimental and control samples into high/low-risk groups, and performing ANOVAs and post-hoc Scheffe t-tests, the control high-risk group was found to be significantly ($p< 0.05$) older than the control and experimental low-risk groups on:

1. age in days at first suck of all feeds in a day

2. age in days at discharge.

Again however, all of the high/low-risk group results need to be interpreted cautiously due to the small cell number.

No other significant differences were found between any two of the risk groups on these two variables.

(1) Age in days at first suck of all feeds in a day

ANOVA: Risk groups

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Grps	3	5415.36	1805.12	7.51	.002
Within Grps	16	3843.83	240.23		
Total	19	9259.20			

The value actually compared with Mean(J)-Mean(I) is 10.9599 * Range * Sqrt(1/N(I) + 1/N(J)).

(2) Age in days at discharge

ANOVA: Risk groups

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Prob.
Between Grps	3	7503.61	2501.20	7.50	.002
Within Grps	16	5333.58	333.34		
Total	19	12837.20			

The value actually compared with Mean(J)-Mean(I) is 12.9102 * Range * Sqrt(1/N(I) + 1/N(J)).

9.3.3.3 Pearson Correlations

Pearson correlations performed on the data revealed significant positive correlations between gestational age and both birthweight and apgar at 1 minute, Apgars 1 and 5, and suck and discharge. Significant negative correlations were found between gestational age with both suck and discharge.

Table 9.3.3.1 PEARSON CORRELATIONS: DEVELOPMENTAL MEASURES

	GEST	BWGT	AP1	AP5	ALLSUCK	DISCH
GEST	-	.60*	.54*	.38	-.64**	-.65**
BWGT	.60*	-	.16	.01	-.72**	-.71**
APGAR1	.54*	.16	-	.72**	-.24	-.27
APGAR5	.38	.01	.72**	-	.08	-.06
ALLSUCK	-.64**	-.72**	-.24	.08	-	.95**
DISCH	-.65**	-.71**	-.27	-.06	.95**	-

1-tailed Signif: * - .01 ** - .001

9.3.4 CONCLUSIONS

1. Stroked infants did not show improved learning on an instrumental learning task compared with their matched controls. Their better performance (just non-significant) in terms of percentage increase in sucking pressure during those phases (critical) when sucking pressure controlled stimulus presentation is possibly due to some other feature such as greater alertness.

Though overall experimental as compared to control infants did not display better learning in terms of critical phase length, experimental infants were found to show better learning than their controls on this measure when only infants of high-risk were compared.

2. Over the course of the learning experiment, the sucking pressure (OAP) of the experimental infants was higher (just non-significant) than their controls, though stroked infants did not exhibit better sucking, at the begining of the instrumental experiment (in terms of greater sucking pressure threshold), than their controls.

3. The control high-risk group was found to be significantly older than the control and experimental low-risk groups on:

    1. age in days at first suck of all feeds in a day

    2. age in days at discharge.

    No other significant differences were found between any two of the risk groups on any of the other dependent variables.

4. Significant positive correlations occurred between gestational age and both birthweight and Apgar at 1 minute, Apgars 1 and 5, and suck and discharge, all of which were to be expected.

Similarly, the significant negative correlations found between gestational age with both suck and discharge, were also as would be expected.

No significant correlations occurred between any of the learning measures but the 2 pressure measures did show a significantly positive correlation with each other.

None of the learning or pressure measures were influenced significantly by age at learning procedure or correlated significantly with any infant characteristics.

9.4 DISCUSSION

9.4.1 Learning Performance

The better performance of the experimental as compared to control infants, which closely approached significance, on the instrumental learning task, in terms of mean percentage increase in critical phase pressure, agrees with the previous finding of enhanced cognitive development (i.e higher B.S.I.D. M.D.I.) at 16 months, in stroked as compared to non-stroked infants (see Chapter 6). Equally, it is in agreement with findings of improved cognitive performance in preterms given, as compared to those not given, supplemental tactile stimulation in various other studies (Rose et al., 1980; Field et al., 1986).

The larger standard deviation shown by the experimental, as compared to control sample, in mean percentage increase in critical phase pressure was shown to be accounted for by very high scores from two infants. As these infants were not the oldest (in gestational age) or heaviest (in terms of birthweight) infants in the sample, it remains unclear why they scored the highest in this variable.

The learning finding itself is supported within the experiment, by the lack of any significant difference between experimental and control infants in mean percentage increase in sucking pressure across the stimulation phases, (when sucking pressure had no bearing upon the stimulation).

This suggests that the difference between the experimental and control infants, in sucking pressure increase, was only noteworthy or close to significance, when such pressure controlled the onset of the reinforcer.

However, as the difference between the experimental and control infants only approached significance in this measure and since no significant difference was found between the groups in the other learning measure of overall average critical phase length, careful consideration has to be given to other factors that may account for the better experimental infant performance on the learning measure of mean percentage increase in critical phase pressure.

It is quite probable that learning ability (i.e speed of conditionability or information processing) is not directly being enhanced, rather some other variable which facilitates learning, is being enriched by the supplemental tactile stimulation.

As experimental and control infants were matched on their overall distributions of gender, gestation, birthweight or medical condition (Apgars), these could not have accounted for the results.

Equally, neither could age at learning assessment have accounted for the results, as the co-variate analyses which found this to have no significant bearing on the learning variables, revealed.

Significant improvements in responsivity (Siqueland, 1969), alertness (Rosenfield, 1980) and state organization (Field et al., 1986) have been found from other studies providing supplemental tactile stimulation to preterms and low birthweight infants.

It is conceivable thus, that improvements in such features, rather than learning ability per se, may account for the improved experimental infant learning performance in this study. A greater maternal visiting rate, has been found to be another resultant effect of supplemental tactile stimulation (Rosenfield, 1980) and this may equally underlie the learning improvement in this study by the imparting of greater multi-modal stimulation.

Given that maturation and organization of reflexes has also found to be facilitated by programmes of supplemental tactile stimulation (Rice, 1977; Macedo, 1984), a more mature and easily controlled sucking reflex may also underlie the improved learning performance in the experimental infants.

This notion is further supported by the finding that over the course of the whole learning experiment, experimental as compared to control infants had a significantly greater mean sucking pressure, despite no significant difference in their threshold pressures.

Finally, Levine's (1957a, 1957b) studies with animals which showed that early supplemental tactile stimulation enhanced their capacity to deal with stress and adaptive behaviour when under duress, may also be applicable to the present study.

If the learning experiment is seen as a stressful situation, the better learning performance of the experimental as compared to control infants, may be interpreted as the experimental infants being better able "to cope" with the situation than their matched controls.

How this improved "stress-coping" comes about however, remains to be determined. Future studies looking into the effects of supplemental tactile stimulation upon infant learning should thus also monitor such variables to determine whether these are also benefited.

As neither high-risk nor low-risk experimental infants were significantly better than their respective controls on any of the learning measures, it cannot be said that infants of high-risk as compared to low-risk groups, or vice-versa, benefit more from the tactile stimulation programme than the other group.

Equally, the argument for a "critical/sensitive period" existing for tactile stimulation programs to benefit preterm infant learning is also diminished because of this.

9.4.2 Sucking Pressure

The validity of the sucking pressure data can be seen by the fact that the two measures of sucking pressure, threshold pressure and overall average sucking pressure showed a significant positive correlation, as would be expected if threshold pressure was a valid representation of individual sucking pressure.

Equally, a valid comparison between experimental and control infants was performed as age at time of learning assessment was found to have no significant bearing upon either of the pressure measures.

Interestingly, though the more mature infants (i.e high birthweight and gestational age, low-risk) would have be expected to show a stronger sucking pressure, no significant correlations were found between the two pressure measures and the various infant characteristics (gestation, birthweight, Apgars, gender).

Upholding this, no significant differences were found either between the high-risk and low-risk samples in the two pressure measures.

The lack of any significant difference between the experimental and control infants in sucking pressure threshold, results in the null hypothesis being supported with regard to experimental infants displaying a better sucking ability than their matched controls.

Accelerations from tube to all-suck feeding, found in previous studies (Chapter 6) as well as the improvements in feeding brought about by other tactile stimulation studies (White and LaBarba, 1976; Rausch, 1981) may thus centre around sucking rate/organization or some other aspects of the digestive or feeding process.

The overall sucking pressure (i.e across the learning experiment as a whole) was higher though (approaching significance) in the experimental as compared to control infants.

This may be interpreted as a more adaptive behaviour, which ties in with the findings of Levine (1957b) that supplemental tactile stimulation enhances coping behaviour in rats. The mechanism through which this occurs though is unknown.

This difference in overall average sucking pressure occurred particularly when comparing high-risk experimental/control infants, which suggests that sucking pressure/adaptive behaviour or coping strategies, may be particularly benefited by supplemental tactile stimulation of preterms of younger gestations. However, no significant difference was found in overall average sucking pressure between those of high-risk and low-risk status within the experimental population, which would have upheld this notion.

Further research using the equipment employed or the Kron sucking device (Kron and Littman, 1971) could examine other parameters of sucking eg. burst length to determine whether some other feature of sucking, rather than pressure, is being affected by supplemental early tactile stimulation.

Dosage of barbituants given to mothers during labor, length of labor and type of delivery are factors that should also be controlled for in future studies as these have been found to adversely effect non-nutritive sucking patterns (Kron et al., 1966; Dubignon et al., 1969). Such factors may have effected this study though their influence on sucking pressure in preterms several weeks after their delivery is not known.

9.4.3 Developmental measures

Again, although stroked infants overall did not show significantly accelerated first sucking of all feeds in a day, discharge home or any overall benefit (these two variables combined), high-risk experimental infants were found to suck earlier (approaching significance) and be discharged home significantly earlier than their high-risk controls. The benefits of these have been discussed previously in Chapter 6.

The significant differences between the control high-risk sample and the experimental and control low-risk samples, is understandable given that the low-risk samples are more physiologically mature.

It is interesting thus that the high-risk experimental infants did not show significantly older ages than the low-risk groups, at first sucking of all feeds in a day or discharge. This could be interpreted as being in agreement with the pattern found in the first study (Chapter 6), that high-risk infants benefit from tactile stimulation more than those of low-risk since no significant differences were found between experimental and control low-risk groups on this variable.

However, the small cell numbers in these groups means that these results may not be representative of the infant population as a whole.

9.4.4 Validity of the data

The statistical normality of the sample can be seen in the significant positive correlations between gestational age and both birthweight and Apgar at 1 minute, Apgars 1 and 5, and suck and discharge, all of which are to be expected. Similarly, the significant negative correlations found between gestational age with both suck and discharge,(i.e the younger, more immature infants take longer to establish sucking and be discharged) were also, as would be expected.

As none of the learning or sucking pressure measures were influenced significantly by age at learning procedure or correlated significantly with any infant characteristics, no obvious bias to the data was found.

9.4.5 Conclusion

This study can be interpreted as showing that supplemental tactile stimulation, in the form of Tac-Tic, just about benefits infant performance on an instrumental learning task, within the neonatal period.

It is unclear though whether this benefit is due to enhanced learning ability or some other feature such as improved alertness.

CHAPTER 10

THE IMPACT OF A PROGRAMME OF TACTILE STIMULATION IN THE SPECIAL-CARE BABY UNIT, UPON INFANT BEHAVIOUR AND PARENTAL ANXIETY.

10.1 INTRODUCTION: Effects of Infant Care Within a Neonatal Unit upon the Parents

10.1.1 Parental Effects

For the parents of infants being cared for in a neonatal unit, the postpartum period is a particularly stressful and taxing time since their infant is being identified as "high-risk" and in need of "special care", (which may involve technological support of fundamental physiological functions such as respiration). In addition their infant is separated from them and this compounds further the initial stress of their infant being "too soon" and/or "too light" (low birthweight).

Immense anxiety, is experienced by such parents with regard to their infants' survival, health and development (Pederson et al., 1985; Silcock, 1984) as well as feelings of disappointment and failure being felt over not giving birth to the infant of their expectations, a healthy "bouncing" infant (Herzog, 1982).

It is thus no wonder that mothers with infants in neonatal units, eg. mothers of preterms, have been found to be suffer heightened anxiety at this time (Choi, 1973; Blumberg, 1980; Gennaro, 1985).

These mothers have been found to report higher levels of emotional distress and depressive symptomatology, more concerns about themselves and their baby, more difficulty in expressing affection towards their baby and greater dissatisfaction with their social support in comparison to mothers whose infants were only cared for in a postnatal ward (Bennett and Slade, 1991).

Gunn et al. (1983) found that mothers continue to have distressing memories of neonatal care years after their infant had been discharged and the more frequent and intrusive these memories are, the more emotionally distressed and dissatisfied with their infant, mothers were (Affleck et al., 1985, 1986).

Looking both at fathers and mothers, Minde et al. (1983) found that both parents interacted less with their infant if s\he was ill, while in a neonatal unit, possibly withdrawing from their infant to protect themselves from getting too close in case s\he dies, or from fear of harming her\him. Few other studies however, have examined the effects of infant neonatal care on fathers.

Such parents are also separated from their child during a time period that is recognised as highly important for bonding and the development of affectional ties (Kennell et al., 1975; Barnett et al., 1970).

This time period is also seen as important for early interaction and the development of a system of mutual interaction and optimal styles of interacting between parents and infant, which becomes increasingly reciprocal over time (Butterfield and Miller, 1984).

Parent-infant separation at this time has thus, understandably, been found to adversely affect later maternal attachment and behaviour (Kennell et al., 1975).

On top of this, premature high-risk infants have been found to be less alert, less responsive, less able to cope with environmental stimulation, unable to control erratic body movements, gasps, grunts or frequent shifts in state, and show irregular sleeping, feeding and social patterns (Field, 1977b; McGehee and Eckerman, 1983; Fish and Crockenberg, 1981).

In mother-infant feeding interactions, the premature, in comparison to fullterm infant, has been found to be less active and weaker motorically, with less developed rooting and sucking reflexes, fewer cries and startles and poorer hand to mouth facility (Brown and Bakeman, 1979).

As a consequence of these characteristics and the preterms' underlying poorer neurological maturation, behavioural organization and development of integrating systems (Howard et al., 1976) preterms, in comparison to fullterms are "less readable" as a social partner (McGhee and Eckerman, 1983) which along with parents of preterms, as compared to fullterms, being more active during later interactions, results in parent-preterm interactions being "unbalanced" (Thoman, 1975; Thomas and Chess, 1977).

It has been argued that this asynchrony within parent-preterm infant interactions, may be an attempt on the part of the parents to compensate for their infant's fragile condition and poor responding, by being more active to enhance their chance of eliciting a response from their infant (Als, 1981; DiVitto and Goldberg, 1979; Levy-Schiff et al., 1989).

Fathers, may exhibit this to a greater extent in that, in comparison to mothers (who were more involved in caretaking activity), they have been found to be more active in stimulating activity as well as in infant playing while their infant was in a neonatal unit (Levy-Schiff et al., 1989).

Preterms tend to be over-represented in populations with such problems as child abuse and failure to thrive (Vietze et al., 1980; Koops and Harmon, 1980; Schmitt and Kempe, 1975; Elmer and Gregg, 1967) and parent-preterm infant interaction has been seen to underlie these (Butterfield and Miller, 1984).

Difficulty on the part of the parents to adapt to their infant's characteristics and develop appropriate interactive behaviours has been argued by Butterfield and Miller (1984) to be a contributing factor to these problems.

Such early separation and parental difficulties in interacting with their preterm infant may also have consequences for eg. infant cognitive development, especially since environmental influences during infancy are mediated primarily via interactions with their parents (Fogel, 1977).

The importance of early interaction for cognitive development was illustrated by the studies of Cohen and Beckwith (1979) and Ramey et al. (1979), both of which found that certain features of early interaction eg. physical contact and amount of mutual gazing can predict cognitive ability at three years.

10.1.2 Intervention Programmes in the Neonatal Unit

Supplemental early tactile contact/interaction between parents and their infant in the neonatal unit may however prevent any such negative sequelae from arising by facilitating infant development and growth, assisting parents in adapting to their infant's characteristics and interaction behaviour as well as reducing parental anxiety.

The benefits of tactile stimulation programmes in facilitating infant growth and development have already been discussed (see Chapter 5).

10.1.2.1 General Intervention Programmes: Effects on Parents

Most hospital intervention programmes conducted with parents produce some significant effects. Even simple interventions, such as showing parents their infant being assessed using the Brazelton scale (Brazelton, 1973) have been found to enhance parental expectations of infant development (Widmayer and Field, 1981) and paternal involvement in infant care (Meyers, 1982).

Equally, presenting a 15 minute instructional film showing newborn competence and play/caretaking techniques to fathers, before infant discharge from the hospital was found to increase paternal involvement in newborn care and improve the quality of such care (Parke and Sawin, 1980). This supports Lynn's (1974) contention that increased exposure of males to newborns enhances their involvement in newborn care.

Little research though has investigated the effects on the parents, of stimulation intervention programmes with infants in neonatal units.

10.1.2.2 Supplemental Early Tactile Contact

For mothers however, the provision of simply extra, as compared to routine, contact during the postpartum period has been seen to improve mother-infant interaction in that extra contact mothers have been found to be more likely to:

1. breast feed longer (DeChateau and Wiberg, 1977)

2. display left-sided holding preferences (DeChateau, 1980)

3. have children with better language functioning (Ringler et al., 1975)

4. have a greater number of subsequent births (DeChateau, 1980)

and less likely to:

5. abuse or neglect their children (O'Connor et al., 1978).

Equally for fathers, supplemental tactile contact with their infant, having been present at the birth, has been found to lead to:

1. greater amounts of en-face behaviour and vocalization with their infants at 6 weeks postpartum

2. greater involvement in infant caretaking responsibilities

3. higher self-esteem

in comparison to control fathers who were present at the birth but did not receive extra contact with their infant (Keller et al., 1985).

Fathers who spent 30 minutes with their nude newborns, as compared to fathers not granted this early contact have been found to spend significantly more time playing with their infant at 3 months (Klaus, 1976 cited in Philips and Anzalone, 1978).

Similarly, fathers who undressed their infants and established eye-to-eye contact with their infants during the first few days of life displayed greater levels of caregiving activity during the first 3 months of life (Klaus and Kennell, 1982).

Akin to this, it has been found that, in general, fathers who received extra contact with their infant and were present at the birth, are typically more involved in infant care, when the experimental and control groups are each sub-divided into high-risk and low-risk, and tend to develop particularly strong attachments to their infants (Lang, 1972; Palkovitz, 1982), though Pannabecker et al. (1982) did not find this.

It was reported by Leonard (1976) however that being able to spend more time with and care for their infants, after birth, enabled them to feel closer to their infants.

Given the paucity of studies in this area though further research is needed to determine precisely what the effects are, of supplemental early tactile contact, between fathers and their infants in the neonatal unit.

10.1.2.3 Tactile Stimulation Programmes: Effects on Parents

Though not commonly examined, the effects of tactile stimulation programmes conducted with the infants in neonatal units, on the parents, as compared to control parents, include increased maternal visiting rate (Rosenfield, 1980) and led to homes being more stimulating at seven months (Solkoff and Matuszak, 1975).

The later effect probably arouse by highlighting the significance of stimulation for infant development, either directly or indirectly, to the parents, which subsequently effected their provision of stimulation for their infant.

Most stimulation programmes though, that have looked at the effects on the parents, as well as on the infants, have generally involved the parents in providing the supplemental stimulation to their infants.

In one such programme, mothers of preterms were trained in caretaking, sensorimotor, cognitive and interaction exercises, all of which were adapted from the Brazelton, Denver and Bayley scale items as well as from research on infant games (Field et al., 1980). The mothers and infants were visited in their homes biweekly, for 30 minutes at a time, from discharge for 4 months. For the subsequent 4 months, monthly instead of biweekly visits occurred.

In comparison to their controls, the experimental mothers displayed significantly more realistic expectations and desirable attitudes regarding their infants, rated their infants' temperament as less difficult and lived in more stimulating homes at 8 months (Field et al., 1980).

Along with these maternal effects, experimental infant weight gain and Bayley developmental scores were significantly higher than their controls (Field et al., 1980).

Programmes of tactile stimulation have been shown to assist the infant in the regulation of his\her states and behaviour (Field et al. 1986) and touch in itself has been recognised as an interactive behaviour (Stack, 1988), employed both to induce attention (Muir and Clifton, 1985) and reduce infant distress (Korner and Thoman, 1972; Korner, 1984; Stack, 1988).

Given that parent-infant interaction is impaired if parents feel unable to cope with or regulate their infant's behaviour (Kennedy-Schaper, 1982), such stimulation programmes (maybe especially if performed by the parents), could thereby enhance parent-infant interaction, and thus parental confidence as parents (Gordon, 1969) by improving the regulation of infant behaviour (Kennedy-Schaper, 1982).

This illustrates further the contribution programmes of tactile stimulation, within the early neonatal period, can make to improve parent-infant interaction both during and after neonatal care.

10.1.3 Parent Implemented Sensory Stimulation in the Neonatal Unit

In terms of tactile, or other sensory, stimulation programmes conducted in the neonatal unit, have predominantly used experimenters and/or mothers, but rarely involved fathers in the implementation of such sensory stimulation. The importance of involving fathers, as much as mothers, in the implementation of such programmes can be seen in terms of two factors:

(1) fathers may need early contact as much as mothers to establish attachment and/or optimal interaction behaviour

(2) given the stressful situation of the postpartum period when the infant is being cared for in a neonatal unit, mothers may better implement a sensory intervention programme, if their partner is also involved.

10.1.3.1 The Need for Early Father-Infant Contact

Though the necessity of early mother-infant contact has been acknowledged for bonding, optimal interaction later on and the prevention of later problems (Klaus and Kennell, 1976; Schmitt and Kempe, 1975), little attention has been paid to early father-infant contact.

Fathers however, have been identified as an object of attachment, providing distinctive and also reinforcing experiences akin to those of the mother (Lamb, 1981; Parke, 1979). While mothers have been found to engage in more nurturing and caregiving behaviours, fathers have been identified as more likely to play and stimulate their infants, (Belsky, 1979; Lamb, 1981), the deprivation of which may augment stimulation deprivation effects of neonatal units on infants even further.

Neonatal units however, have been found to exert an homogenizing effect on parental behaviours as it is an unfamiliar environment, parenting tasks are voluntary and both parents have equal opportunities to interact (Marton et al., 1981).

Social pressure and hospital practices (eg. encouraging the mother, but not both parents, to stay in overnight before the infant is discharged to adapt to the infant's cycles and behavioural patterns), may however render this point invalid.

Attitudes of the mother also affect father-infant involvement and caretaking, with fathers understandably being more keen to be involved with their infant and his\her caretaking if the mothers are supportive of this (Reiber, 1976; Strassberg, 1978).

Pederson (1980) though proposed that early tactile contact between father and infant enhances the father-infant relationship, as did Yogman (1982) who viewed it as more pertinent in the developing relationship than the father being present at birth.

Parke and O'Leary (1976) contended that opportunities for early interaction with infants may however be especially important for fathers as they may not be biologically or culturally "*primed*" to respond to infant cues. Thus, according to this argument, the earlier and the greater their interaction with their infant, the more attuned fathers would be to their infants signals.

Akin to this, fathers, according to Greenberg and Morris (1974), become "*engrossed*" with their newborns within the first 3 days (and often earlier) of their infant's birth. The capacity for such "engrossment", they argued, is an innate potential, released through presence at birth and sufficient early contact with their newborn.

They contended that this "*engrossment*" involves a "*sense of absorption*", a preoccupation, immense interest in and attention toward the infant, accompanied by an increased sense of self-esteem and feeling of self worth in the father (Greenberg and Morris, 1974).

This idea of an innate potential for "*engrossment*" is reinforced by the findings of Rodholm and Larsson, (1982) that males exhibit a stereotyped sequence of behaviour, as has been previously described for mothers and fathers (Rubin, 1982; Klaus et al., 1970) as well as studies showing the positive effects father presence at the birth (Philips and Anzalone, 1978).

Along another, kindred line of thought, Hines (1971) construed early tactile contact between father and infant as crucial in nurturing the development of "fatherliness", feelings which could be stultified if fathers are deprived of early physical contact with their infants.

Fathers, according to Hines (1971), might sense they are too "dangerous" to be in contact with their infant in the neonatal unit, if deprived of early contact, and such a perception may be perpetuated in their handling of their infant once s\he is discharged home.

Equally, Parke (1974, 1981) suggested that father's feelings of either inclusion in or exclusion from the evolving family relationship in the postpartum period effect both his adjustment to parenting and the subsequent fathering role he adopts.

Often though with preterm and other high risk infants, as a result of physical inability of the mother or transfer of the infant to another hospital from their mother, fathers are often required to play a primary role in decision making with regard to their infant's care (Levy-Schiff et al., 1989).

The use of fathers in providing supplemental tactile stimulation to their infants, especially in neonatal units, may thus be necessary to establish such interventions at an early date, while also imparting benefits on the fathers, father-infant interaction and infant development.

10.1.3.2 The Need for Partner Support

The presence of a supportive relationship with a male partner has previously been suggested as significant in alleviating depressive symptomatology in mothers of high risk infants (Paykel et al., 1980; O'Hara et al., 1983), and spouse support was found by Crnic et al. (1983a) as providing more global positive effects than either friendship or community support.

Social support in general, especially intimate, partner support (Crnic et al., 1983a), has been acknowledged as positively related to more secure infant attachment (Crockenberg, 1981) as well as acting as a buffer against the experience of stress (Cobb, 1976; Haggerty, 1980).

With regard to competent parenting, the importance of a positive marital or partner relationship has also been acknowledged by Belsky (1981) and it has also been suggested that via the support they provide the mothers, fathers can indirectly affect early mother-infant interactions (Herzog, 1979, 1982).

Maternal feeding competence of her infant (i.e sensitivity to infant feeding cues) has been found to be related to a more supportive partner while marital discord has been found to be related to higher levels of parental expression of negative affect to their infant (Pedersen et al., 1977).

Kunst-Wilson and Croenwett's (1981) assertion that the father's "..*potential role in childbirth has evolved from one of an unnecessary source of infection to an essential source of affection for both the mother and newborn*" (p202), is thus becoming increasingly generalized to early high-risk neonatal care.

Tactile intervention programmes, whereby both mothers and fathers provide supplemental sensory stimulation to their infant, make the intervention less stressing for the mother, due to their partner's support, and this may thus be a means of means of ensuring a more consistent and greater participation rate in such interventions.

Parents participating in these interventions are also showed a means of promoting their infant's development, which thereby enhancing parent-infant interaction (Kennedy-Schaper, 1982).

It is questionable however, whether both mothers and fathers (or anyone else for that matter), would bring about the same effects in their infant, even if using the same tactile stimulation procedure. In accordance with these ideas, this study set out to investigate:

1. the effects of a programme of tactile stimulation in the form of stroking (Tac-Tic) provided by parents to their infant in the neonatal unit, on anxieties and attitudes of both the mothers and fathers in comparison to control parents

2. whether the parents elicit the same reactions as each other, from the infants, when using the same stroking technique (Tac-Tic)

with the experimental hypotheses being that (a) the experimental parents would exhibit less anxiety than the control parents and that (b) no differences would occur in the reactions elicited by each parent when stroking her/his infant.

This was hypothesized as by performing the Tac-Tic stroking programme, both parents would be stroking their infant in the same way, using the same movements, in the same sequence, with only the pressure employed, (which would be extremely difficult, if not impossible, to match), differing.

It is also quite conceivable that some, if not all, of the effects brought about by tactile stimulation programmes are brought about by only some of the movements/strokes of any given tactile stimulation programme.

Thus, as no known tactile stimulation programme has investigated the effects, behavioural or physiological, of stroking the different areas of the body, this study also looked at:

3. the amount and kind of infant behavioural reactions elicited to "Tac-Tic" strokes across different areas of the body, by both mothers and fathers

with the experimental hypothesis that there would be quantitatively and qualitatively, differential reactions elicited by various bodily region strokes, with the more frequent reactions elicited corresponding to the bodily area being stroked.

10.2 METHOD

10.2.1 Design

This study set out to investigate the effects of an intervention programme of tactile stimulation in the form of stroking (Tac-Tic; Appendix 6.1.4), provided by parents to their infant in the neonatal unit. The three aspects considered were:

(1) The anxieties and attitudes of the experimental in comparison to control parents

(2) The frequency and kind of infant reactions, comparing those reactions elicited by strokes of different bodily areas

(3) The frequency and kind of infant reactions, comparing those reactions elicited when the mother as compared to the father is stroking the infant

(1) The effects of the tactile stimulation programme (Tac-Tic) on parents.

Modified versions of the Parental Anxieties and Attitudes Scale (P.A.A.S; Field, 1980), maternal and paternal versions (Appendix 10.2.1.1 and 10.2.1.2), were administered to experimental and control parents immediately before their infant was discharged from the neonatal unit. The original P.A.A.S. questionnaire (Field, 1980; Appendix 10.2.1.3) was altered to achieve 7 objectives:

1. to make its terminology less offensive.

Questions altered for this reason included:

Did you think that you looked physically unattractive (substituted for the word ugly) during your pregnancy ?

Were you ever afraid that the baby (substituted for the term it) might die before he / she was born ?

Were you aware of contraception (substituted for did you know how to avoid being pregnant)?

2. to acquire additional information on parental feelings on various aspects of neonatal care as well as other factors.

Questions added for this reason included:

Did your partner accompany you to prenatal classes ?

Would you have liked him to ?

Did you and your partner practice breathing techniques together ?

Would you have liked your partner to have stayed in the hospital on an overnight basis, if he had the opportunity ?

Do you think that your partner is a good support?

Do you find the technical equipment in the unit intimidating ?

Was the technical equipment explained well enough to you ?

Are you worried about being separated from your baby ?

Do you feel that you get adequate support from the hospital staff ?

Do you find it comforting to see pictures of other healthy infants who were once part of the unit ?

If encouraged, would you like to bring in your baby's own toys, mobiles etc.. ?

Do you often talk to your baby ?

Do you feel silly talking to your baby ?

When younger, were you often physically comforted by your own parents ?

Do you like bathing your baby ?

Did you think your partner helped you enough in the feeding, changing, bathing etc... of your baby ?

3. to make the questions more relevant for mothers of low-risk, high gestational age and relatively healthy infants who had uncomplicated pregnancies/births as well as those of high-risk infants and/or who had problem prenancies/births

Questions altered for this reason included:

Were you at any time alarmed for your own health (substituted for afraid you might die) during the birth?

Were you at any time alarmed for your baby's health (substituted for afraid the baby might die) during the birth ?

4. to remove extreme terms which are less likely to be admitted/recognised than less extreme equivalents

Questions altered for this reason included:

Does your baby's crying irritate you (substituted for make you mad) ?

Were your parents displeased (substituted for angry) about your being pregnant ?

5. to improve clarity of answer by using a yes/no answer to be circled procedure rather than the yes/no box to be ticked as often ticks cut across such boxes thereby making it difficult to determine whether the answer was a yes or a no.

6. to enhance its readability by placing the yes/no answer to be circled at the end of the question (i.e to the extreme right of the page) which follows standard reading practice as well as using partner instead of boyfriend/husband.

7. to create a compatible, paternal version of the questionnaire, enabling an examination of paternal feelings of anxiety, across thepregnancy, birth and neonatal period and based upon the P.A.A.S.

A diary (see Appendix 10.2.1.4), to fill any parent-infant activity they engaged in whenever they visited their infant, was also given to each experimental parent after the stroking procedure was performed.

This was intended to provide a greater amount of information, than that given in hospital records, on parental activities during their visits to the unit and to encourage both parents to interact more with their infant and engage in the listed activities eg. nappy change, stroking their infant and kissing their infant. Control parents did not receive the diary since it was considered a component of the overall intervention.

A questionnaire on the Tac-Tic stroking programme (see Appendix 10.2.1.5) was also specifically designed for and administered to the experimental parents to obtain information on how they felt about the Tac-Tic stroking procedure, with questions such as "did you enjoy the stroking ?".

A-priori, independent t-tests were used in the data analysis.

(2) The reactions elicited by the various Tac-Tic strokes, categorized according to bodily area stroked.

Infant Reaction booklets, consisting of record sheets (see Appendix 10.2.1.6) were created, which had, for each Tac-Tic stroke, a list of possible infant reactions (established by prior observations of infants during tactile stimulation and various other procedures eg. nappy change), which were the same for each stroke and a panel beside the list of reactions, for the reactions to be ticked if they occurred during the stroke that had just been performed.

Two sets of these booklets, one for when the father was the stroker and the other for when the mother was the stroker, were used by both of the parents and by the experimenter. The Tac-Tic strokes were categorized according to the bodily area they were performed upon (see Appendix 10.2.1.7), head, trunk or limb, and data was analyzed in terms of these 3 categories.

Infant reactions that occurred below a given (15%) frequency were removed from the data to facilitate more in-depth data analysis (see Appendix 10.2.1.8). A 3 (head/trunk/limb) x 6 (infant reactions) design was thus used.

As the data was non-parametric Cochran's Q and post-hoc Wilcoxon Matched-pairs Signed-ranks tests were employed for the data analysis.

(3) The reactions elicited by the various strokes, when the mother as compared to the father is the stroker.

With the Tac-Tic strokes and associated data already categorized according to the bodily area that the strokes were performed upon (Appendix 10.2.1.7), infant reaction data when the mother as compared to the father was the stroker were compared for each bodily area (head, trunk or limb).

A 2 (mother/father) x 3 (head/trunk /limb) x 6 (infant reactions) design was thus employed. As the data were non-parametric Wilcoxon Matched-pairs Signed-ranks tests were employed for the data analysis.

10.2.2 Subjects

All the subjects (n=30, 15e 15c) were infants cared for in the neonatal unit of the Queen Mother's Hospital, Yorkhill, Glasgow. Twelve of these infants were premature (n= 6e; 6c), the remainder were of low-birthweight, and none of the subjects suffered from any debilitating condition other than jaundice.

Experimental (n=15, 9m 6f) and control (n=15, 9m 6f) subjects were matched in their overall distributions of infant gender, gestational age, birthweight and general medical condition i.e Apgars (see Tables 10.2.2.1 to 10.2.2.4).

Experimental and control parents were not matched on any characteristic other than those of their infants, though parental age, socio-economic status (using the H.M.S.O. Classification of Occupations and Coding Index) and marital status data were collected, to ensure no large discrepancy occurred between the two samples on these features (see Tables 10.2.2.5 to 10.2.2.9).

1. Infant Characteristics

Table 10.2.2.1 GESTATIONAL AGE

	Mean	S.D	N
Entire Po	36.07	2.90	30
Experimental	36.00	2.82	15
Control	36.15	3.04	15

Table 10.2.2.2 BIRTHWEIGHT

	Mean	S.D	N
Entire Pop	2.59	0.81	30
Experimental	2.67	0.89	15
Control	2.50	0.71	15

Table 10.2.2.3 APGAR AT 1 MINUTE

	Mean	S.D	N
Entire Pop	7.44	2.08	30
Experimental	7.78	1.54	15
Control	7.07	2.51	15

Table 10.2.2.4 APGAR AT 5 MINUTES

	Mean	S.D	N
Entire Pop	9.00	0.67	30
Experimental	8.85	0.84	15
Control	9.15	0.36	15

Parental Characteristics

Table 10.2.2.5 PARENTAL AGE

	Mean	S.D	N
Entire Pop	29.10	5.73	28
Experimental	28.50	5.30	30
Mothers	27.93	5.25	15
Fathers	29.06	5.48	15
Control	29.80	6.21	26
Mothers	29.15	6.47	13
Fathers	30.46	6.13	13

* age of 2 pairs of control parents was not acquired as a consequence of missing data in their files

Table 10.2.2.6 PARITY1: LIVE BIRTHS

	Mean	S.D	N
Entire Pop	0.92	1.07	28
Experimental	0.93	1.14	15
Control	0.92	1.01	13

Table 10.2.2.7PARITY2: UNFINISHED PREG./STILLBIRTH

	Mean	S.D	N
Entire Pop	0.35	0.55	28
Experimental	0.26	0.58	15
Control	0.46	0.50	13

Table 10.2.2.8 MARITAL STATUS

	Mean	S.D	N
Entire Pop	1.30	0.59	60
Experimental	1.26	0.58	30
Control	1.33	0.60	30

1 = Married 2 = Single 3= Other

Table 10.2.2.9 SOCIO-ECONOMIC STATUS

	Mean	S.D	N
Entire Pop	2.62	0.64	24
Experimental	2.58	0.65	12
Control	2.66	0.63	12

1= Professional 2= Skilled 3= Non-Skilled Manual

10.2.3 Stimulation

see Section 6.2.3

The stimulation procedure was performed when the experimental infants were, on average 9 days old (s.d.= 2.3).

10.2.4 Materials

These consisted of the:

(1) Infant Reaction booklets (see Appendix 10.2.1.6), for the experimental sample only

The Infant Reaction booklets consisted of record sheets titled according to each of the strokes in the stroking procedure, with possible infant reactions listed out which were to be ticked if they occurred during the stroke being performed (i.e the stroke that was the title of the sheet).

There were 6 booklets in all titled according to the person filling the booklet in, followed by the name of the person performing the stroking procedure:

1. Experimenter-Mother

2. Experimenter-Father

3. Father-Father

4. Father-Mother

5. Mother-Mother

6. Mother-Father

All of the booklets were the same, consisting of recording sheets, each of which had one of the 17 strokes, according to the sequence from the be ginning to end of the stroking procedure, as a title.

Listed out on each of these sheets was a number of possible infant reactions elicited by the stroke being dealt with (i.e the stroke which is the title of the sheet and which has just been performed on the infant), each of which was to be ticked if it occurred during the relevant stroke.

(2) Parent-Infant activity diaries (see Appendix 10.2.1.4), for the experimental sample only

(3) Modified P.A.A.S. questionnaires (see Appendix 10.2.1.1 and 10.2.1.2) for both experimental and control parents

(4) Parental questionnaire on the Tac-Tic stroking programme (see Appendix 10.2.1.5)

10.2.5 Procedure

For the purposes of clarity, the procedure may be divided into 6 sections:

1. Initial Meeting

2. Demonstration of Stroking Procedure and Infant Reaction Recording

3. First Parent stroking infant with ongoing recording of infant reactions to each stroke by:

    (1) First parent

    (2) Experimenter

    (3) Second parent

    the later two of which were observers of the stroking.

4. Second parent stroking infant with ongoing recording of infant reactions to each stroke by:

    (1) Second parent

    (2) Experimenter

    (3) First parent

    the later two of which were observers of the stroking.

    Administration of the stroking questionnaire.

5. Diary recording

6. Final meeting

1. Initial Meeting

Parents were initially approached either in person or via a standard letter (see Appendix 10.2.1.9) left beside their infant's incubator/cot with follow-up meeting, as soon as was judged appropriate (infant off ventilation, parents adjusted to their infant's condition), to discuss the intervention programme and ask if they wished to participate. This meeting occurred, on average, 6 days after their infant was admitted to the unit.

Benefits of stroking programmes for both the infant (Rice, 1977; Macedo, 1984; Field, 1986) and parents (Rosenfield, 1980), the need for further research into such programmes to maximize their beneficial effects and the stroking procedure (see Chapter 5) and infant reactivity recording procedure adopted in this study, were all discussed with the experimental parents.

Altogether 21 couples were asked to participate in the experimental Tac-Tic programme:

(1) 4 couples (19.05 %) agreed initially but then dropped out due to irregular job hours

(2) 2 couples (9.52 %) refused to particpate

(3) 15 couples (71.43 %) agreed to participate.

Of the 19 control couples approached to fill-in questionnaires, 4 (21.05 %) failed to return the questionnaires.

A convenient date and time, as soon as possible after the first meeting, was then set with those parents who agreed to participate in the intervention.

With regard to the randomly selected controls, these parents were approached (on average 6 days after their infant had been admitted to the unit) either in person, or via a standard letter (see Appendix 10.2.1.10) with follow-up meeting by the experimenter, and asked if they would agree to meet the experimenter again, to complete a questionnaire, immediately before their infant was to be discharged.

2. Demonstration of Stroking Procedure and Infant Reaction Recording.

At the second meeting of the experimenter with the parents, (on average 2 days after the initial meeting) the experimenter demonstrated the Tac-Tic stroking procedure (Appendix 6.1.4.1) to the parents, outlining each of the strokes employed using a doll.

The Mother was then given an Infant Reaction booklet (consisting of reaction sheets for each stroke) to be used when she was performing the stroking (Mother-Mother booklet) and another to be used when the Father was performing the stroking (Mother-Father booklet).

Similarly, the Father was given an Infant Reaction booklet to be used when he was performing the stroking (Father-Father booklet) as well as one to be used when the Mother was performing the stroking (Father-Mother booklet).

The experimenter, with her Infant Reaction booklets, one of which was to be filled in when the Father was stroking his infant (Experimenter-Father booklet) and the other when the Mother was stroking her infant (Experimenter-Mother booklet), then read through each of the sheets in any given booklet (as all the booklets were the same in content), discussing what each reaction referred to (see Sections 3 and 4 below).

With each booklet, the procedure that was to be followed in filling it in, was also outlined. This consisted of working through the booklet according to the sequence of strokes (the order of which followed the order of strokes in the stroking procedure itself), ticking off on the appropriate sheet for each stroke, which reactions were elicited from the infant during that stroke.

When actually carrying-out the stroking, the parents were instructed to perform each stroke according the sequence, filling in the appropriate stroke sheet immediately after performing that stroke and then proceeding on to do the next stroke and again filling in the relevant stroke sheet and so on.

Similarly, the parents were instructed to fill in each stroke sheet, (taking not more than 1 minute to do this), immediately after the stroke which that sheet referred to, when observing the other parent stroke the infant.

It was also emphasized to the parents, that only infant reactions that occurred when a stroke was actually being performed (i.e not any reaction that occurred immediately before/after the stroke) were to be recorded for that stroke.

The average duration of this stroking and reaction recording was 25 minutes.

3. First Parent Stroking of Infant with ongoing Infant Reaction Recording.

Shortly after having the Stroking and Infant Reaction Recording explained, either the Mother or Father performed the stroking, with the other parent taking her/his turn at the stroking afterwards (this was counterbalanced).

The observing parent and experimenter stood overlooking the infant in her/his cot, as did the stroking parent.

Both the observing parent and experimenter held the appropriate Infant Reaction Recording booklet and a pen whilst the stroking parent had her/his nearby.

The stroking parent was instructed to remove all garments (other than nappy) from the infant and to place their infant on her/his side before beginning the Tac-Tic procedure. This took approximately 3 minutes. The experimenter then verbally guided the stroking parent through the sequence of strokes.

After each stroke, the stroking parent, observing parent and experimenter recorded on the appropriate stroke sheet what behavioural reactions they perceived the infant to display whist that stroke was taking place. This occurred for each stroke, with the stroking parent beginning again with the next stroke in the sequence.

4. Second Parent stroking infant with ongoing recording of infant reactions.

Once the first parent had completed the sequence of stroking, a brief time lapse occurred (mean= 4 minutes), for the infant to "recover" from the stroking procedure. After this, the second parent performed the stroking with the first parent now acting as the "observing parent" and the aforementioned procedure was repeated.

Across all the parent pairs, the order of which parent, father or mother, stroked first and second was counterbalanced.

When all this was completed, parents were asked to answer a few questions pertaining to the stroking procedure (see Appendix 10.2.1.5). The stroking questionnaire was administered both to experimental mothers and fathers, which they completed there and then (filled-in in approx. 2 minutes).

5. Diary Recording

Once both parents had completed the stroking procedure, they were both given a diary (Appendix 10.2.1.4) which consisted of daily sheets listing various parent-infant interaction activities.

They were asked to complete their diaries each day they visited the unit from that day on until their infant was discharged, ticking off any of the activities they engaged in, and the number of times they engaged in such activities.

Room was left at the end of each diary page to add any activity engaged in that was not listed and the diaries were kept in the unit, attached to the infant's feeding charts at the end of the cot/incubator.

6. Final Meeting

As soon as the infant was ready to be discharged all the parents, experimental and control, were met again by the experimenter and given the modified version ofthe P.A.A.S questionnaire (Field, 1980) with their confidentiality insured.

This meeting, occurred on average 6 and 7 days after the inital meeting for the experimental and control groups respectively.

Parents were issued separate forms of the questionnaire, Fathers the Paternal version (Appendix 10.2.1.1) and Mothers the maternal version (Appendix 10.2.1.2).

They were instructed to complete this questionnaire honestly and without assistance from their partner so that their individual experiences and perceptions of pregnancy, birth, and the neonatal unit, amongst other factors, as a Mother/Father could be collected.

These questionnaires were collected from the parents when they next visited the neonatal unit (usually the following day).

Finally, all parents were thanked for their assistance and co-operation.

10.3 RESULTS

10.3.1 What are the effects of the tactile stimulation programme (Tac-Tic) on parents?

10.3.1.1 Descriptive statistics and t-tests: P.A.A.S total

As can be seen from Table 10.3.1.1 and Figure 10.3.1.1, the controls overall have a slightly higher mean anxiety score than the experimental parents. This however is non-significant, as shown by the multivariate analysis of variance performed with socio-economic status as a co-variate (Section 10.3.1.2) and by the a-priori independent samples t-test ($t= 0.93$, $df= 54$, $p< 0.17$, 1 tailed).

TABLE 10.3.1.1 NEW MODIFIED PAAS TOTAL (NEWT)

	Mean	S.D	N
Entire Pop	12.17	4.27	56
Mothers	13.24	4.79	29
Fathers	11.03	3.35	27
Experimental	11.62	3.94	27
Mothers	13.07	4.35	14
Fathers	10.07	2.88	13
Control	12.68	4.56	29
Mothers	13.40	5.31	15
Fathers	11.92	3.64	14

10.3.1.2 MANOVA/Co-variate analysis: P.A.A.S total

Multivariate Analysis of Variance of Anxiety Total (NEWT) by Experimental/Control Condition (CON) with Socio-Economic-Status (SES) as a Co-variate.

Source of Var	SS	DF	MS	F	Sig.F
WITHIN CELLS	638.41	42	15.20		
REGRESSION	103.12	1	103.12	6.78	.013
CONSTANT	92.79	1	92.79	6.10	.018
CON	2.12	1	2.12	.14	.711

```
COVARIATE   B    Beta   Std. Err. t-Value   Sig. of t
SES        2.35 .372    .905      2.6       .013
COVARIATE    Lower -95%  CL- Upper
SES             .531       4.182
```

10.3.1.3 Descriptive statistics : P.A.A.S Sub-sections

By looking at experimentals in comparison to controls, across the 6 sub-section anxiety totals of the P.A.A.S, a more in-depth analysis was performed. Across sub-sections 1, 4, 5 and 6, the experimentals, as compared to controls, showed the lower anxiety total (Tables 10.3.1.3.1 to 10.3.1.3.6).

Table 10.3.1.3.1 NSP1: % NEW SECT1 PREG ATT TO SELF

	Mean	S.D	N
Entire Pop	27.03	17.53	56
Experimental	25.23	18.42	29
Mothers	27.23	17.61	14
Fathers	23.07	19.74	13
Control	28.70	16.80	27
Mothers	34.16	16.68	15
Fathers	22.85	15.40	14

Table 10.3.1.3.2 NSP2 % NEW SECT2 PREG ATT TO FETUS

	Mean	S.D	N
Entire Pop	20.53	17.40	56
Experimental	23.45	17.45	29
Mothers	27.38	18.02	14
Fathers	19.23	16.45	13
Control	17.81	17.21	27
Mothers	18.88	19.78	15
Fathers	16.66	14.61	14

Table 10.3.1.3.3 NSP3 % NEW SECT3 ATT TO LABOR AND BIRTH

	Mean	S.D	N
Entire Pop	23.43	14.95	55
Experimental	23.78	12.58	28
Mothers	25.00	11.75	14
Fathers	22.46	13.77	13
Control	23.09	17.15	27
Mothers	21.42	13.36	14
Fathers	24.76	20.66	14

Table 10.3.1.3.4 NSP4 % NEW SECT4 ATT TO POST-BIRTH

	Mean	S.D	N
Entire Pop	16.60	14.72	54
Experimental	13.66	12.36	27
Mothers	12.85	12.04	14
Fathers	14.52	13.13	13
Control	19.44	16.40	27
Mothers	21.42	17.03	14
Fathers	17.45	16.13	14

Table 10.3.1.3.5 NSP5 % NEW SECT5 ATT TO POSTPARTUM

	Mean	S.D	N
Entire Pop	15.05	8.53	55
Experimental	13.58	8.20	27
Mothers	15.08	8.55	14
Fathers	11.96	7.80	13
Control	16.46	8.74	28
Mothers	15.47	7.28	14
Fathers	17.46	10.18	14

Table 10.3.1.3.6 NSP6 % NEW SECT6 ATT TO PREG ONSET

	Mean	S.D	N
Entire Pop	17.60	13.34	56
Experimental	13.23	6.77	27
Mothers	13.26	6.78	14
Fathers	13.19	7.05	13
Control	21.67	16.47	29
Mothers	23.81	18.44	15
Fathers	19.39	14.40	14

10.3.1.4 P.A.A.S sub-sections: t-tests

No significant differences were found in 1 and 2-tailed (2-tailed tests performed on those sections that deal with the pre-intervention period, i.e. anytime before the post-birth period) t-tests conducted between experimentals and controls on sub-sections:

1 "Attitudes to self during pregnancy"
($t= 0.74$, $df= 54$, $p< 0.46$, 2 tailed)

2 "Attitudes to fetus during pregnancy"
($t= 1.22$, $df= 54$, $p< 0.44$, 2 tailed)

3 "Attitudes to labor/birth"
($t= 0.17$, $df= 53$, $p< 0.867$, 2 tailed)

4 "Attitudes post-birth"
($t= 1.47$, $df= 53$, $p< 0.07$, 1 tailed)

5 "Attitudes post-partum"
($t= 1.26$, $df= 53$, $p< 0.10$, 1 tailed).

A significant difference was found though between the experimental and control sample on sub-section 6 (Attitudes to pregnancy onset), with the control sample showing the significantly greater anxiety ($t= 2.48$, $df= 54$, $p< 0.02$, 2 tailed).

Independent t-tests conducted though revealed that the significant difference between experimental and control mothers, accounted for the overall experimental versus control significant difference in this sub-section as no significant difference was found between experimental as compared to control fathers on this ($t= 1.40$, $df= 25$, $p< 0.08$, 1 tailed).

10.3.1.5 Mothers

Comparing experimental versus control mothers ($t= 0.18$, $df= 27$, $p< 0.21$, 1 tailed) the experimental sample displayed a slightly, but not significantly lower P.A.A.S anxiety total score.

In sub-section 4 (attitudes post-birth), experimental mothers, as compared to control mothers, showed a lower anxiety score which approached significance ($t= 1.54$, $df= 26$, $p< 0.06$, 1 tailed), while in sub-section 6 (Attitudes to pregnancy onset) control mothers were found to have a significantly higher anxiety score than experimental mothers (t= , df=26, separate var., $p< 0.04$, 2 tailed). On any of the other sub-sections of:

1 "Attitudes to self during pregnancy"

($t= 1.09$, $df= 27$, $p< 0.28$, 2 tailed)

2 "Attitudes to fetus during pregnancy"

($t= 1.21$, $df= 27$, $p< 0.22$, 2 tailed)

3 "Attitudes to labor/birth"

($t= 0.75$, $df= 26$, $p< 0.46$, 2 tailed)

5 "Attitudes post-partum"

($t= 0.13$, $df= 26$, $p< 0.44$, 1 tailed).

no significant differences between experimental and control mothers occurred.

10.3.1.6 Fathers

On sub-section 5 (attitudes post-partum), experimental, as compared to control fathers displayed a lower anxiety score which approached significance ($t= 1.56$, $df= 25$, $p< 0.06$, 1 tailed). No significant differences between experimental and control fathers occurred though on any of the other sub-sections of:

1 "Attitudes to self during pregnancy"

($t= 0.03$, $df= 25$, $p< 0.96$, 2 tailed)

2 "Attitudes to fetus during pregnancy"

($t= 0.43$, $df= 25$, $p< 0.66$, 2 tailed)

3 "Attitudes to labor/birth"

($t= 0.34$, $df= 25$, $p< 0.62$, 2 tailed)

4 "Attitudes post-birth"

($t= 0.51$, $df= 25$, $p< 0.30$, 1 tailed)

6 "Attitudes to pregnancy onset"

($t = 1.40$, $df = 25$, $p < 0.08$, 1 tailed)

10.3.1.7 Overall: Mothers as compared to Fathers

Broken down into mothers and fathers, over the sample as a whole, mothers exhibited significantly higher anxiety scores than fathers ($t = 1.98$, $df = 54$, $p < 0.02$, 1 tailed).

10.3.1.8 Correlations

As can be seen from the Pearson correlations performed on the data, as expected:

1. gestational age correlated significantly with birthweight
2. birthweight correlated significantly and negatively, with both parity2 and SES.
3. marital status correlated significantly and negatively with parental age
4. original and new modified P.A.A.S totals correlated significantly with each other as well as with SES
5. Original and new modifed P.A.A.S totals correlated significantly and negatively with birthweight

AGE = Parental age PAR1 = Number of live births

PAR2 = Number of uncompleted pregnancies

GEST = Gestational age BWGT = Birthweight

AP1 = Apgar at 1 minute AP5 = Apgar at 5 minutes

ORIGT= Original P.A.A.S form anxiety total

NEWT = New modified P.A.A.S form anxiety total

SEX = Gender of infant MARIT= Marital status

SES = Socio-economic status

Table 10.3.1.8.1 CORRELATIONS

	AGE	PAR1	PAR2	GEST	BWGT	AP1
AGE	-	.284	.109	.376*	.363	.217
PAR1	.284	-	.027	-.011	.088	.035
PAR2	.109	.027	-	-.093	-.417*	.059
GEST	.376*	-.011	-.093	-	.818**	.261
BWGT	.363	.088	-.417*	.818**	-	.354
AP1	.217	.035	.059	.261	.354	-
AP5	.274	-.376*	.127	.457*	.327	.132
ORIGT	-.323	-.069	.143	-.317	-.484**	-.011
NEWT	-.414*	-.064	.117	-.397*	-.490**	-.042
SEX	.124	.330	-.337	.027	.229	-.315
MARIT	-.649**	-.207	.160	-.334	-.362	-.093
SES	-.237	.186	.496**	-.231	-.405*	-.032

	AP5	ORIGT	NEWT	SEX	MARIT	SES
AGE	.274	-.323	-.414*	.124	-.649**	-.237
PAR1	-.376*	-.069	-.064	.330	-.207	.186
PAR2	.127	.143	.117	-.337	.160	.496**
GEST	.457*	-.317	-.397*	.027	-.334	-.231
BWGT	.327	-.484**	-.490**	.229	-.362	-.405*
AP1	.132	-.011	-.042	-.315	-.093	-.032
AP5	-	-.095	-.109	.027	-.221	-.349
ORIGT	-.095	-	.957**	-.060	.198	.432*
NEWT	-.109	.957**	-	-.003	.305	.419*
SEX	.027	-.060	-.003	-	-.187	-.096
MARIT	-.221	.198	.305	-.187	-	.275
SES	-.349	.432*	.419*	-.096	.275	-

N of cases:40 1-tailed Signif: * - .01 ** -.001

10.3.1.9 STROKING QUESTIONNAIRE

As can be seen from Table 10.3.1.9 below, all the parents, both mothers (n=15) and fathers (n=15), of the experimental sample, enjoyed stroking their infant using the Tac-Tic stroking procedure.

The majority of this sample also felt (as indicated on the questionnaire) that their infants enjoyed it, that they would carry the Tac-Tic stroking programme out on a regular basis and that some strokes were "better", (in their eyes) than others. Over half of the sample also felt that the stroking procedure enhanced their confidence.

Out of those (n=21; 70 %) who found that some strokes were, in their subjective viewpoint, "better" than others, 36.6 % indicated head strokes, 36.36 % trunk strokes and 22.73 % limb strokes to be the "best", in terms of for the infant and her/his comfort.

Table 10.3.1.9Stroking Questionnaire: % Data

Question	Overall% Response	Maternal% Response	Paternal% Response
1	100	100	100
2	60	60	60
3	89.3	92.7	85.7
4	96.7	100	93.3
5	83.3	73.3	93.3

1 = Did you enjoy the stroking ?

2 = Did it make you feel more confident ?

3 = Do you think you would carry it out on a regular/daily basis ?

4 = Do you think your baby enjoyed the strokes ?

5 = Did you find some strokes better than others?

10.3.1.10 DIARIES

With regard to the diaries (filled in on a daily basis), as only 23.4% of them were completed (i.e from when the diary was given out up to the day of infant discharge, only activities on 23.4% of the days were filled in), this data was discarded as invalid.

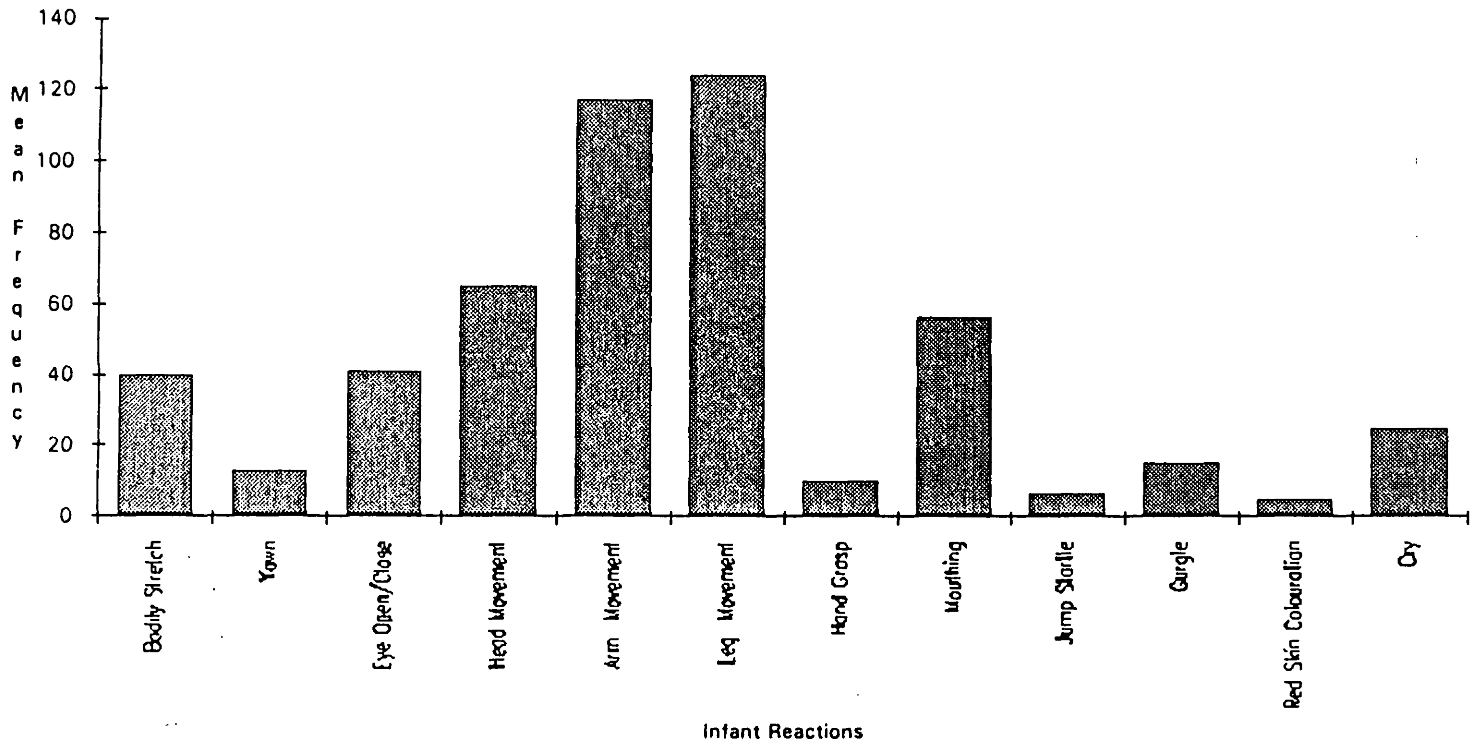
10.3.2 What are the most frequent reactions elicited by the various Tac-Tic strokes, categorized according to bodily area stroked, for each stroker?

In answering this question, any reaction, (seen at least by 2 out of the 3 individuals present), that occured with an overall mean frequency below 34 (below 15 % of the overall number of possible reactions i.e 221) was removed from the data, to facilitate more in depth data analysis (see Table 10.3.2.1).

Due to their infrequent occurence, both when the mother and the father stroked the infant, such reactions were seen as having little association to the stroking procedure (Tac-Tic), in comparison to the other reactions and were thus removed from the further data anlysis.

Those infant reactions removed from more in-depth data analysis included yawning, hand grasping, jump startle, gurgling, red skin colouration and crying, (see Table 10.3.2.1 and Figure 10.3.2.1). After this was completed, given the non-parametric nature of the data, Cochran's Q tests and post-hoc Wilcoxon matched-pairs signed-ranks tests were performed on the data to determine:

Figure 10.3.2.1 Mean Frequency of Infant Reactions



Question 10.3.2.1

Which reactions occurred significantly more than others to each bodily category of the Tac-Tic strokes (i.e head, trunk or limb strokes) ?

Question 10.3.2.2

Which bodily category of the Tac-Tic strokes (i.e head, trunk or limb) elicited significantly more reactions than the others ?

This was conducted for each stroker session (maternal (A) and paternal (B)) and wilcoxons were performed comparing each bodily category of the Tac-Tic strokes (head, trunk or limb) on overall (across both parents) number of reactions elicited. These tests were employed given the non-parametric nature of the data.

Table 10.3.2.1 Frequencies of Infant Reactions

STROKER	Mother	Father	Mean
Bodily Stretch	33	47	40
Yawn	14	12	13
Eye Open/Close	33	49	41
Head Movement	64	66	65
Arm Movement	111	124	117.5
Leg Movement	120	128	124
Hand Grasp	7	13	10
Mouthing	61	52	56.5
Jump Startle	7	6	6.5
Gurgle	10	20	15
Red Skin Colouration	7	2	4.5
Cry	18	32	25

10.3.2.1

Which reactions occurred significantly more than the others to each bodily category of the Tac-Tic strokes (i.e. head, trunk or limb strokes)

With regard to this question, it may be discussed in terms of both the stroking sessions performed by the mothers and those performed by the fathers, sub-divided into the bodily categories of the Tac-Tic strokes.

Overall, arm and leg movements were the most frequent reactions, and bodily stretch and eye opening/closing movements the least frequent, infant reactions across all the categories of Tac-Tic strokes, during both maternal and paternal stroking sessions (see Figures 10.3.2.1.A and 10.3.2.1.B).

Fig. 10.3.2.1.A Mean Frequency of Reactions across Bodily Category of Strokes with Mother as Stroker

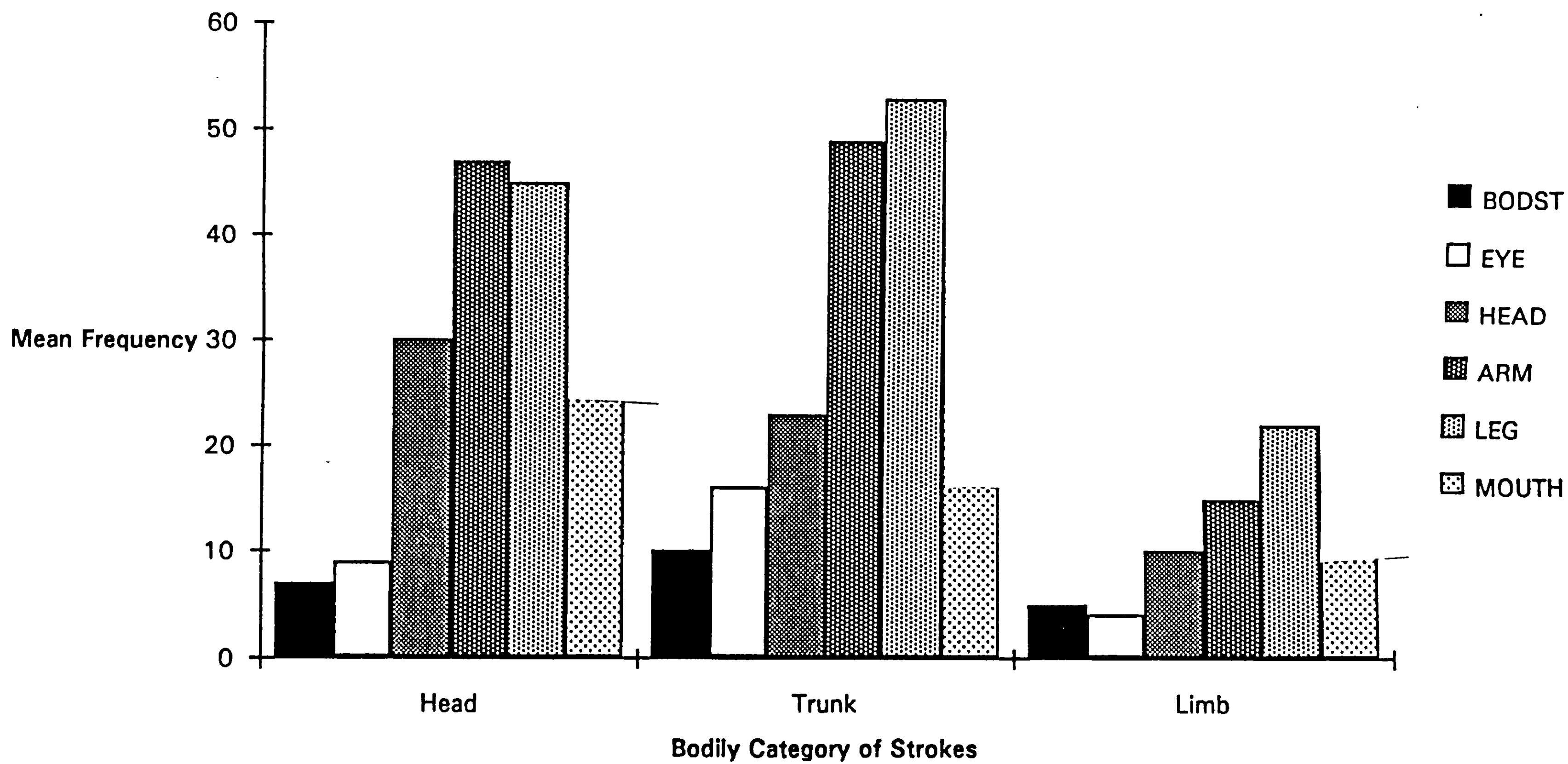
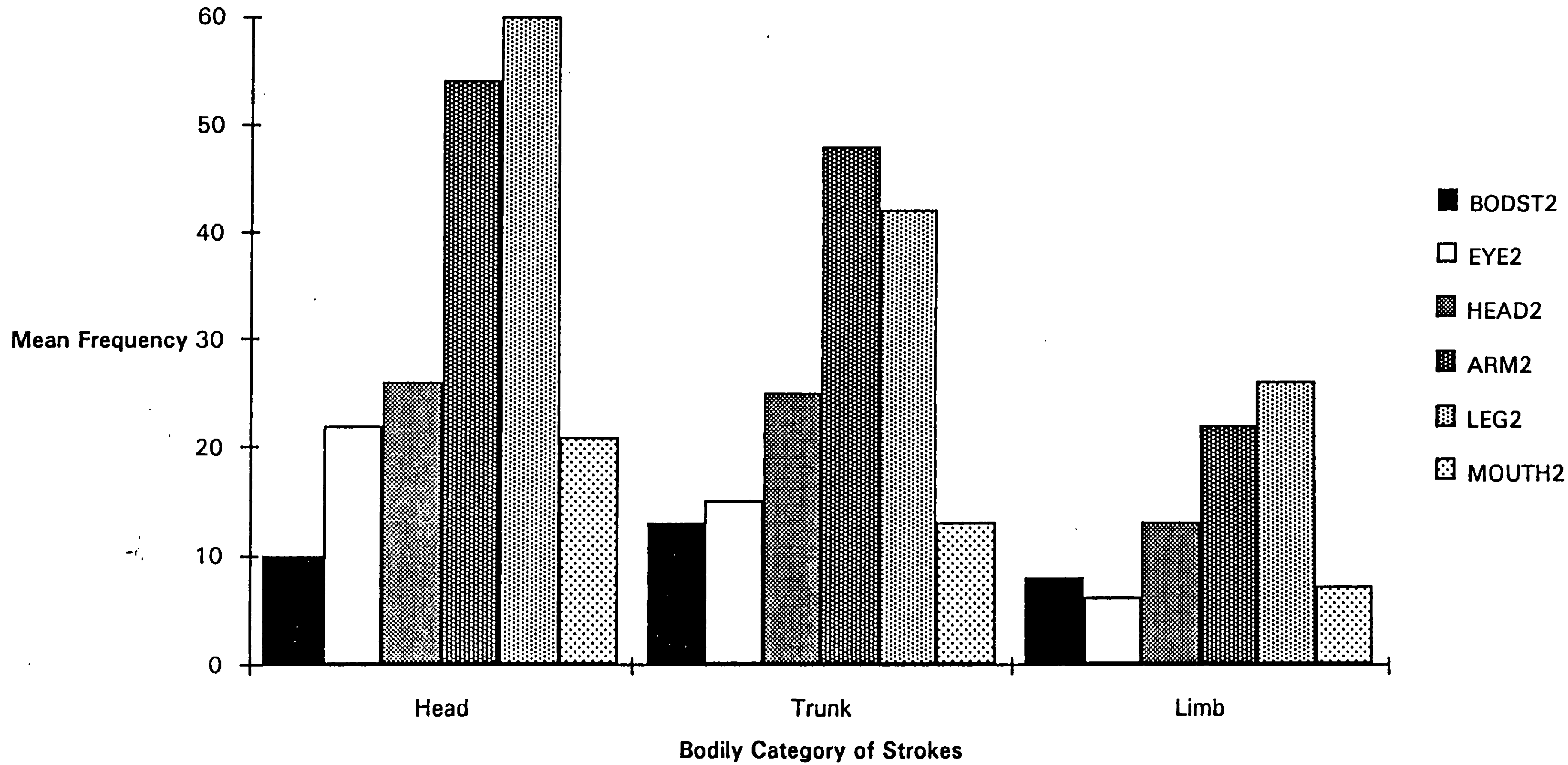


Fig. 10.3.2.1.B Mean frequency of Reactions across Bodily Category of Strokes with Father as stroker



10.3.2.1.A Mother as Stroker

Looking first at the stroking session where the mother stroked the infant, Cochran's Q tests indicate that within all the bodily categories of Tac-Tic strokes, head, trunk and limb, significant differences occurred between the number of the various reactions elicited (see (a) in sections A.1, A.2 and A.3).

A.1 Head Strokes Data

(a) Cochran's Q Test

0 = reaction was not seen
1 = reaction was seen by at least 2 of the 3 observers

= 0	= 1	Variable	
81	7	BODST	BODILY STRETCH
79	9	EYE	EYES OPEN/SHUT
58	30	HEAD	HEAD MOVEMENT
41	47	ARM	ARM MOVEMENT
43	45	LEG	LEG MOVEMENT
62	26	MOUTH	MOUTHING

Cases	Cochran Q	D.F.	Significance
88	92.23	5	.00

Post-hoc Wilcoxon tests performed on the head strokes reaction data (see (b)) revealed that:

1. head, arm, leg and mouthing movements all occured significantly more often than bodily stretch or eye opening/closing movements during head strokes

2. arm and leg movements occured significantly more often than either head or mouthing movements during head strokes

3. no significant differences were found in the occurence of arm as compared to leg movements, head as compared to mouthing movements and bodily stretch as compared to eye opening/closing movements during head strokes (Figure 10.3.2.1.A).

(b) Post-Hoc Wilcoxons

Significant differences

1. BODILY STRETCH vs HEAD MOVEMENT

```
     Mean Rank    Cases
         16.00        5  - Ranks  (HEAD Lt BODST)
         16.00       26  + Ranks  (HEAD Gt BODST)
                     81    Ties   (HEAD Eq BODST)
                    ---
                    112    Total

Z =   -3.29             2-tailed P =  .001
```

2. BODILY STRETCH vs ARM MOVEMENT

```
     Mean Rank    Cases
         21.50        1  - Ranks  (ARM Lt BODST)
         21.50       41  + Ranks  (ARM Gt BODST)
                     46    Ties   (ARM Eq BODST)
                    ---
                     88    Total

Z =   -5.37             2-tailed P =  .001
```

3. BODILY STRETCH vs LEG MOVEMENT

```
     Mean Rank    Cases
           .00        0  - Ranks  (LEG Lt BODST)
         19.50       38  + Ranks  (LEG Gt BODST)
                     50    Ties   (LEG Eq BODST)
                    ---
                     88    Total

Z =   -5.37             2-tailed P =  .001
```

4. BODILY STRETCH vs MOUTHING

```
     Mean Rank    Cases
        19.50        6  - Ranks  (MOUTH Lt BODST)
        19.50       32  + Ranks  (MOUTH Gt BODST)
                    74    Ties   (MOUTH Eq BODST)
                   ---
                   112    Total
Z =   -3.67             2-tailed P =  .001
```

5. EYES OPEN/SHUT vs HEAD MOVEMENT

```
     Mean Rank    Cases
         15.50        4  - Ranks  (HEAD Lt EYE)
         15.50       26  + Ranks  (HEAD Gt EYE)
                     82    Ties   (HEAD Eq EYE)
                    ---
                    112    Total

Z =   -3.50             2-tailed P =  .001
```

6. EYES OPEN/SHUT vs ARM MOVEMENT

Mean Rank	Cases		
20.50	1	- Ranks	(ARM Lt EYE)
20.50	39	+ Ranks	(ARM Gt EYE)
	48	Ties	(ARM Eq EYE)

	88	Total	

Z = -5.23 2-tailed P = .001

7. EYES OPEN/SHUT vs LEG MOVEMENT

Mean Rank	Cases		
20.50	2	- Ranks	(LEG Lt EYE)
20.50	38	+ Ranks	(LEG Gt EYE)
	48	Ties	(LEG Eq EYE)

	88	Total	

Z = -4.95 2-tailed P = .001

8. EYES OPEN/SHUT vs MOUTHING

Mean Rank	Cases		
20.00	6	- Ranks	(MOUTH Lt EYE)
20.00	33	+ Ranks	(MOUTH Gt EYE)
	73	Ties	(MOUTH Eq EYE)

	112	Total	

Z = -3.76 2-tailed P = .001

9. HEAD MOVEMENT vs ARM MOVEMENT

Mean Rank	Cases		
16.00	7	- Ranks	(ARM Lt HEAD)
16.00	24	+ Ranks	(ARM Gt HEAD)
	57	Ties	(ARM Eq HEAD)

	88	Total	

Z = -2.66 2-tailed P = .007

10. HEAD MOVEMENT vs LEG MOVEMENT

Mean Rank	Cases		
16.00	8	- Ranks	(LEG Lt HEAD)
16.00	23	+ Ranks	(LEG Gt HEAD)
	57	Ties	(LEG Eq HEAD)

	88	Total	

Z = -2.35 2-tailed P = .018

11. ARM MOVEMENT vs MOUTHING

Mean Rank	Cases		
20.00	30	- Ranks	(MOUTH Lt ARM)
20.00	9	+ Ranks	(MOUTH Gt ARM)
	49	Ties	(MOUTH Eq ARM)

	88	Total	

Z = -2.93 2-tailed P = .003

12. LEG MOVEMENT vs MOUTHING

Mean Rank	Cases		
21.00	30	- Ranks	(MOUTH Lt LEG)
21.00	11	+ Ranks	(MOUTH Gt LEG)
	47	Ties	(MOUTH Eq LEG)

	88	Total	

Z = -2.58 2-tailed P = .009

Non-Significant Findings

1. BODILY STRETCH vs EYES OPEN/SHUT

Mean Rank	Cases		
10.00	10	- Ranks	(EYE Lt BODST)
10.00	9	+ Ranks	(EYE Gt BODST)
	93	Ties	(EYE Eq BODST)

	112	Total	

Z = -.20 2-tailed P = .844

2. HEAD MOVEMENT vs MOUTHING

Mean Rank	Cases		
19.00	16	- Ranks	(MOUTH Lt HEAD)
19.00	21	+ Ranks	(MOUTH Gt HEAD)
	75	Ties	(MOUTH Eq HEAD)

	112	Total	

Z = -.71 2-tailed P = .473

3. ARM MOVEMENT vs LEG MOVEMENT

Mean Rank	Cases		
9.50	10	- Ranks	(LEG Lt ARM)
9.50	8	+ Ranks	(LEG Gt ARM)
	70	Ties	(LEG Eq ARM)

	88	Total	

Z = -.41 2-tailed P = .679

A.2 Trunk Strokes

(a) Cochran's Q Test

```
0 =  reaction was not seen
1 =  reaction was seen by at least 2 of the 3
     observers
```

= 0	= 1	Variable	
56	10	BODST	BODILY STRETCH
50	16	EYE	EYES OPEN/SHUT
43	23	HEAD	HEAD MOVEMENT
17	49	ARM	ARM MOVEMENT
13	53	LEG	LEG MOVEMENT
54	12	MOUTH	MOUTHING

Cases	Cochran Q	D.F.	Significance
66	123.18	5	.001

Post-hoc Wilcoxon tests performed on the trunk strokes reaction data (see (b) below) revealed that:

1. arm and leg movements occured significantly more often than either bodily stretch, eye opening/closing, head or mouthing movements during trunk strokes

2. no significant differences were found in the occurence of arm as compared to leg movements or head, mouthing, eye opening/closing and bodily stretch movements as compared to each other during trunk strokes (Figure 10.3.2.1.A)

(b) Post-Hoc Wilcoxons

Significant Findings

1. BODILY STRETCH vs ARM MOVEMENT

Mean Rank	Cases	
.00	0	- Ranks (ARM Lt BODST)
20.00	39	+ Ranks (ARM Gt BODST)
	27	Ties (ARM Eq BODST)
	--	
	66	Total

Z = -5.44 2-tailed P = .001

2. BODILY STRETCH vs LEG MOVEMENT

Mean Rank	Cases		
.00	0	- Ranks	(LEG Lt BODST)
22.00	43	+ Ranks	(LEG Gt BODST)
	23	Ties	(LEG Eq BODST)
	--		
	66	Total	

Z = -5.71 2-tailed P = .001

3. EYES OPEN/SHUT vs ARM MOVEMENT

Mean Rank	Cases		
20.00	3	- Ranks	(ARM Lt EYE)
20.00	36	+ Ranks	(ARM Gt EYE)
	27	Ties	(ARM Eq EYE)
	--		
	66	Total	

Z = -4.60 2-tailed P = .001

4. EYES OPEN/SHUT vs LEG MOVEMENT

Mean Rank	Cases		
23.00	4	- Ranks	(LEG Lt EYE)
23.00	41	+ Ranks	(LEG Gt EYE)
	21	Ties	(LEG Eq EYE)
	--		
	66	Total	

Z = -4.80 2-tailed P = .001

5. HEAD MOVEMENT vs ARM MOVEMENT

Mean Rank	Cases		
.00	0	- Ranks	(ARM Lt HEAD)
13.50	26	+ Ranks	(ARM Gt HEAD)
	40	Ties	(ARM Eq HEAD)
	--		
	66	Total	

Z = -4.45 2-tailed P = .001

6. HEAD MOVEMENT vs LEG MOVEMENT

Mean Rank	Cases		
.00	0	- Ranks	(LEG Lt HEAD)
15.50	30	+ Ranks	(LEG Gt HEAD)
	36	Ties	(LEG Eq HEAD)
	--		
	66	Total	

Z = -4.78 2-tailed P = .001

7. ARM MOVEMENT vs MOUTHING

Mean Rank	Cases		
20.00	38	- Ranks	(MOUTH Lt ARM)
20.00	1	+ Ranks	(MOUTH Gt ARM)
	27	Ties	(MOUTH Eq ARM)
	--		
	66	Total	

Z = -5.16 2-tailed P = .001

8. LEG MOVEMENT vs MOUTHING

Mean Rank	Cases		
21.00	41	- Ranks	(MOUTH Lt LEG)
.00	0	+ Ranks	(MOUTH Gt LEG)
	25	Ties	(MOUTH Eq LEG)
	--		
	66	Total	

Z = -5.57 2-tailed P = .001

Non-Significant Findings

1. BODILY STRETCH vs EYES OPEN/SHUT

Mean Rank	Cases		
14.50	12	- Ranks	(EYE Lt BODST)
14.50	16	+ Ranks	(EYE Gt BODST)
	56	Ties	(EYE Eq BODST)
	--		
	84	Total	

Z = -.660 2-tailed P = .509

2. BODILY STRETCH vs HEAD MOVEMENT

Mean Rank	Cases		
13.50	9	- Ranks	(HEAD Lt BODST)
13.50	17	+ Ranks	(HEAD Gt BODST)
	58	Ties	(HEAD Eq BODST)
	--		
	84	Total	

Z = -1.37 2-tailed P = .170

3. BODILY STRETCH vs MOUTHING

Mean Rank	Cases		
11.50	10	- Ranks	(MOUTH Lt BODST)
11.50	12	+ Ranks	(MOUTH Gt BODST)
	62	Ties	(MOUTH Eq BODST)
	--		
	84	Total	

Z = -.37 2-tailed P = .708

4. EYES OPEN/SHUT vs HEAD MOVEMENT

Mean Rank	Cases		
18.50	16	- Ranks	(HEAD Lt EYE)
18.50	20	+ Ranks	(HEAD Gt EYE)
	48	Ties	(HEAD Eq EYE)
	--		
	84	Total	

Z = -.58 2-tailed P = .561

5. EYES OPEN/SHUT vs MOUTHING

Mean Rank	Cases		
14.50	15	- Ranks	(MOUTH Lt EYE)
14.50	13	+ Ranks	(MOUTH Gt EYE)
	56	Ties	(MOUTH Eq EYE)
	--		
	84	Total	

Z = -.33 2-tailed P = .741

6. HEAD MOVEMENT vs MOUTHING

Mean Rank	Cases		
12.50	15	- Ranks	(MOUTH Lt HEAD)
12.50	9	+ Ranks	(MOUTH Gt HEAD)
	60	Ties	(MOUTH Eq HEAD)
	--		
	84	Total	

Z = -1.07 2-tailed P = .284

7. ARM MOVEMENT vs LEG MOVEMENT

Mean Rank	Cases		
5.50	3	- Ranks	(LEG Lt ARM)
5.50	7	+ Ranks	(LEG Gt ARM)
	56	Ties	(LEG Eq ARM)
	--		
	66	Total	

Z = -1.12 2-tailed P = .262

A.3 Limb Strokes

(a) Cochran's Q Test

```
0 =  reaction was not seen
1 =  reaction was seen by at least 2 of the 3
     observers
```

= 0	= 1	Variable	
28	5	BODST	BODILY STRETCH
29	4	EYE	EYES OPEN/SHUT
23	10	HEAD	HEAD MOVEMENT
18	15	ARM	ARM MOVEMENT
11	22	LEG	LEG MOVEMENT
25	8	MOUTH	MOUTHING

Case	Cochran Q	D.F.	Significance
33	41.80	5	.00

Post-hoc Wilcoxon tests performed on the limb strokes reaction data (see (b) below) revealed that:

1. arm and leg movements occured significantly more often than either bodily stretch or eye opening/closing movements during limb strokes

2. leg movements occured significantly more often than head, arm or mouthing movements during limb strokes

3. no significant differences were found in the occurence of arm as compared to head or mouthing movements or in head, mouthing, eye opening/closing and bodily stretch movements as compared to each other during limb strokes (Figure 10.3.2.1.A)

(b) Post-Hoc Wilcoxons

Significant Findings

```
1. BODILY STRETCH vs ARM MOVEMENT

     Mean Rank    Cases
          7.50        2  - Ranks (ARM Lt BODST)
          7.50       12  + Ranks (ARM Gt BODST)
                     19    Ties  (ARM Eq BODST)
                     --
                     33    Total

Z =   -2.35            2-tailed P =  .018

2. BODILY STRETCH vs LEG MOVEMENT

     Mean Rank    Cases
           .00        0  - Ranks (LEG Lt BODST)
          9.00       17  + Ranks (LEG Gt BODST)
                     16    Ties  (LEG Eq BODST)
                     --
                     33    Total

Z =   -3.62            2-tailed P =  .001

3. EYES OPEN/SHUT vs ARM MOVEMENT

     Mean Rank    Cases
          7.00        1  - Ranks (ARM Lt EYE)
          7.00       12  + Ranks (ARM Gt EYE)
                     20    Ties  (ARM Eq EYE)
                     --
                     33    Total

Z =   -2.69            2-tailed P =  .007

4. EYES OPEN/SHUT vs LEG MOVEMENT

     Mean Rank    Cases
           .00        0  - Ranks (LEG Lt EYE)
          9.50       18  + Ranks (LEG Gt EYE)
                     15    Ties  (LEG Eq EYE)
                     --
                     33    Total

Z =   -3.72            2-tailed P =  .001

5. HEAD MOVEMENT vs LEG MOVEMENT

     Mean Rank    Cases
           .00        0  - Ranks (LEG Lt HEAD)
          6.50       12  + Ranks (LEG Gt HEAD)
                     21    Ties  (LEG Eq HEAD)
                     --
                     33    Total

Z =   -3.05            2-tailed P =  .002
```

6. ARM MOVEMENT vs LEG MOVEMENT

Mean Rank	Cases		
5.00	1	- Ranks	(LEG Lt ARM)
5.00	8	+ Ranks	(LEG Gt ARM)
	24	Ties	(LEG Eq ARM)
	--		
	33	Total	

Z = -2.07 2-tailed P = .038

7. LEG MOVEMENT vs MOUTHING

Mean Rank	Cases		
8.50	15	- Ranks	(MOUTH Lt LEG)
8.50	1	+ Ranks	(MOUTH Gt LEG)
	17	Ties	(MOUTH Eq LEG)
	--		
	33	Total	

Z = -3.07 2-tailed P = .002

Non-Significant Results

1. BODILY STRETCH vs EYES OPEN/SHUT

Mean Rank	Cases		
7.00	8	- Ranks	(EYE Lt BODST)
7.00	5	+ Ranks	(EYE Gt BODST)
	29	Ties	(EYE Eq BODST)
	--		
	42	Total	

Z = -.73 2-tailed P = .463

2. BODILY STRETCH vs HEAD MOVEMENT

Mean Rank	Cases		
6.50	5	- Ranks	(HEAD Lt BODST)
6.50	7	+ Ranks	(HEAD Gt BODST)
	30	Ties	(HEAD Eq BODST)
	--		
	42	Total	

Z = -.50 2-tailed P = .610

3. BODILY STRETCH vs MOUTHING

Mean Rank	Cases		
7.50	7	- Ranks	(MOUTH Lt BODST)
7.50	7	+ Ranks	(MOUTH Gt BODST)
	28	Ties	(MOUTH Eq BODST)
	--		
	42	Total	

Z = .00 2-tailed P = 1.000

4. EYES OPEN/SHUT vs HEAD MOVEMENT

```
     Mean Rank    Cases
          5.00        2  - Ranks (HEAD Lt EYE)
          5.00        7  + Ranks (HEAD Gt EYE)
                     33    Ties  (HEAD Eq EYE)
                     --
                     42    Total

Z =   -1.48             2-tailed P =  .138
```

5. EYES OPEN/SHUT vs MOUTHING

```
     Mean Rank    Cases
          4.00        2  - Ranks (MOUTH Lt EYE)
          4.00        5  + Ranks (MOUTH Gt EYE)
                     35    Ties  (MOUTH Eq EYE)
                     --
                     42    Total

Z =   -1.01             2-tailed P =  .310
```

6. HEAD MOVEMENT vs ARM MOVEMENT

```
     Mean Rank    Cases
          5.00        2  - Ranks (ARM Lt HEAD)
          5.00        7  + Ranks (ARM Gt HEAD)
                     24    Ties  (ARM Eq HEAD)
                     --
                     33    Total

Z =   -1.48             2-tailed P =  .138
```

7. HEAD MOVEMENT vs MOUTHING

```
     Mean Rank    Cases
          2.50        3  - Ranks (MOUTH Lt HEAD)
          2.50        1  + Ranks (MOUTH Gt HEAD)
                     38    Ties  (MOUTH Eq HEAD)
                     --
                     42    Total

Z =    -.91             2-tailed P =  .361
```

8. ARM MOVEMENT vs MOUTHING

```
     Mean Rank    Cases
          6.00        9  - Ranks (MOUTH Lt ARM)
          6.00        2  + Ranks (MOUTH Gt ARM)
                     22    Ties  (MOUTH Eq ARM)
                     --
                     33    Total

Z =   -1.86             2-tailed P =  .061
```

B Father as Stroker

Looking at the stroking session where the father stroked the infant, Cochran Q tests indicate, that within all the bodily categories of Tac-Tic strokes, (head, trunk and limb), significant differences occur between the number of the various reactions elicited (see (a) in sections B.1, B.2, and B.3 below). This is similar with the results of maternal stroking (Figures 10.3.2.1.A and 10.3.2.1.B).

B.1 Head Strokes

(a) Cochran's Q Test

0 = reaction was not seen
1 = reaction was seen by at least 2 of the 3 observers

= 0	= 1	Variable
78	10	BODST2
66	22	EYE2
62	26	HEAD2
34	54	ARM2
28	60	LEG2
67	21	MOUTH2

Cases	Cochran Q	D.F.	Signif.
88	113.92	5	.001

Post-hoc Wilcoxon tests performed on the head strokes reaction data (see section (b) below) revealed that:

1. head, arm, leg and mouthing movements all occurred significantly more often than bodily stretches during head strokes

2. arm and leg movements occurred significantly more often than eye opening/closing, head or mouthing movements during head strokes

3. no significant differences were found in the occurrence of arm as compared to leg movements, or in head, mouthing and eye opening/closing movements as compared with each other and bodily stretches as compared to eye opening/closing movements during head strokes (Figure 10.3.2.1.B)

(b) Post-Hoc Wilcoxons

Significant Results

1. Bodily Stretch vs Head Movement

```
       Mean Rank     Cases
         16.50         9  - Ranks (HEAD2 Lt BODST2)
         16.50        23  + Ranks (HEAD2 Gt BODST2)
                      80    Ties  (HEAD2 Eq BODST2)
                      ---
                      112    Total

Z =    -2.15            2-tailed P =  .030
```

2. Bodily Stretch vs Arm Movement

```
       Mean Rank     Cases
         25.50         3  - Ranks (ARM2 Lt BODST2)
         25.50        47  + Ranks (ARM2 Gt BODST2)
                      38    Ties  (ARM2 Eq BODST2)
                      ---
                      88    Total
Z =    -5.41            2-tailed P =  .001
```

3. Bodily Stretch vs Leg Movement

```
       Mean Rank     Cases
           .00          0  - Ranks (LEG2 Lt BODST2)
         25.50         50  + Ranks (LEG2 Gt BODST2)
                       38    Ties  (LEG2 Eq BODST2)
                       ---
                       88    Total

Z =    -6.15            2-tailed P =  .001
```

4. Bodily Stretch vs Mouthing

Mean Rank	Cases		
18.00	11	- Ranks	(MOUTH2 Lt BODST2)
18.00	24	+ Ranks	(MOUTH2 Gt BODST2)
	77	Ties	(MOUTH2 Eq BODST2)

	112	Total	

Z = -1.91 2-tailed P = .055

5. Eye Open/Close vs Arm Movement

Mean Rank	Cases		
22.50	6	- Ranks	(ARM2 Lt EYE2)
22.50	38	+ Ranks	(ARM2 Gt EYE2)
	44	Ties	(ARM2 Eq EYE2)

	88	Total	

Z = -4.20 2-tailed P = .001

6. Eye Open/Close vs Leg Movement

Mean Rank	Cases		
23.50	4	- Ranks	(LEG2 Lt EYE2)
23.50	42	+ Ranks	(LEG2 Gt EYE2)
	42	Ties	(LEG2 Eq EYE2)

	88	Total	

Z = -4.87 2-tailed P = .001

7. Head Movement vs Arm Movement

Mean Rank	Cases		
17.50	3	- Ranks	(ARM2 Lt HEAD2)
17.50	31	+ Ranks	(ARM2 Gt HEAD2)
	54	Ties	(ARM2 Eq HEAD2)

	88	Total	

Z = -4.18 2-tailed P = .001

8. Head Movement vs Leg Movement

Mean Rank	Cases		
20.50	3	- Ranks	(LEG2 Lt HEAD2)
20.50	37	+ Ranks	(LEG2 Gt HEAD2)
	48	Ties	(LEG2 Eq HEAD2)

	88	Total	

Z = -4.68 2-tailed P = .001

9. Arm Movement vs Mouthing

Mean Rank	Cases		
20.00	36	- Ranks	(MOUTH2 Lt ARM2)
20.00	3	+ Ranks	(MOUTH2 Gt ARM2)
	49	Ties	(MOUTH2 Eq ARM2)

	88	Total	

Z = -4.60 2-tailed P = .001

10. Leg Movement vs Mouthing

Mean Rank	Cases		
24.00	43	- Ranks	(MOUTH2 Lt LEG2)
24.00	4	+ Ranks	(MOUTH2 Gt LEG2)
	41	Ties	(MOUTH2 Eq LEG2)

	88	Total	

Z = -4.95 2-tailed P = .001

Non-Significant Results

1. Bodily Stretch vs Eye Open/Close

Mean Rank	Cases		
19.50	13	- Ranks	(EYE2 Lt BODST2)
19.50	25	+ Ranks	(EYE2 Gt BODST2)
	74	Ties	(EYE2 Eq BODST2)

	112	Total	

Z = -1.69 2-tailed P = .089

2. Eye Open/Close vs Head Movement

Mean Rank	Cases		
14.50	13	- Ranks	(HEAD2 Lt EYE2)
14.50	15	+ Ranks	(HEAD2 Gt EYE2)
	84	Ties	(HEAD2 Eq EYE2)

	112	Total	

Z = -.33 2-tailed P = .741

3. Eye Open/Close vs Mouthing

Mean Rank	Cases		
20.00	19	- Ranks	(MOUTH2 Lt EYE2)
20.00	20	+ Ranks	(MOUTH2 Gt EYE2)
	73	Ties	(MOUTH2 Eq EYE2)

	112	Total	

Z = -.13 2-tailed P = .889

4. Head Movement vs Mouthing

Mean Rank	Cases		
18.00	18	- Ranks	(MOUTH2 Lt HEAD2)
18.00	17	+ Ranks	(MOUTH2 Gt HEAD2)
	77	Ties	(MOUTH2 Eq HEAD2)

	112	Total	

Z = -.14 2-tailed P = .882

5. Arm Movement vs Leg Movement

Mean Rank	Cases		
7.50	4	- Ranks	(LEG2 Lt ARM2)
7.50	10	+ Ranks	(LEG2 Gt ARM2)
	74	Ties	(LEG2 Eq ARM2)

	88	Total	

Z = -1.41 2-tailed P = .157

B.2 Trunk Strokes

(a) Cochran's Q Test

0 = reaction was not seen
1 = reaction was seen by at least 2 of the 3 observers

= 0	= 1	Variable
53	13	BODST2
51	15	EYE2
41	25	HEAD2
18	48	ARM2
24	42	LEG2
53	13	MOUTH2

Cases	Cochran Q	D.F.	Significance
66	89.10	5	.001

Post-hoc Wilcoxon tests performed on the trunk strokes reaction data (see section (b) below) revealed that:

1. arm and leg movements occured significantly more often than either bodily stretches, eye opening/closing, head or mouthing movements during trunk strokes

2. arm movements occured significantly more often than leg movements during trunk strokes

3. no significant differences were found in the occurrence of head, mouthing, eye-opening or closing and bodily stretch movements as compared to each other during trunk strokes (Figure 10.3.2.1.B)

(b) Post-Hoc Wilcoxons

Significant Results

```
1. Bodily Stretch vs Arm Movement

     Mean Rank    Cases
           .00        0  - Ranks (ARM2 Lt BODST2)
         18.00       35  + Ranks (ARM2 Gt BODST2)
                     31    Ties  (ARM2 Eq BODST2)
                     --
                     66    Total

Z =   -5.15            2-tailed P =  .001

2. Bodily Stretch vs Leg Movement

     Mean Rank    Cases
           .00        0  - Ranks (LEG2 Lt BODST2)
         15.00       29  + Ranks (LEG2 Gt BODST2)
                     37    Ties  (LEG2 Eq BODST2)
                     --
                     66    Total

Z =   -4.70            2-tailed P =  .001

3. Eye Movement vs Arm Movement

     Mean Rank    Cases
         23.00        6  - Ranks (ARM2 Lt EYE2)
         23.00       39  + Ranks (ARM2 Gt EYE2)
                     21    Ties  (ARM2 Eq EYE2)
                     --
                     66    Total

Z =   -4.28            2-tailed P =  .001

4. Eye Movement vs Leg Movement

     Mean Rank    Cases
         22.00        8  - Ranks (LEG2 Lt EYE2)
         22.00       35  + Ranks (LEG2 Gt EYE2)
                     23    Ties  (LEG2 Eq EYE2)
                     --
                     66    Total

Z =   -3.58            2-tailed P =  .001
```

```
5. Head Movement vs Arm Movement

     Mean Rank    Cases
           .00        0  - Ranks  (ARM2 Lt HEAD2)
         12.00       23  + Ranks  (ARM2 Gt HEAD2)
                     43    Ties   (ARM2 Eq HEAD2)
                     --
                     66    Total

Z =   -4.19             2-tailed P =  .001

6. Head Movement vs Leg Movement

     Mean Rank    Cases
         11.00        2  - Ranks  (LEG2 Lt HEAD2)
         11.00       19  + Ranks  (LEG2 Gt HEAD2)
                     45    Ties   (LEG2 Eq HEAD2)
                     --
                     66    Total

Z =   -3.24             2-tailed P =  .001

7. Arm Movement vs Leg Movement

     Mean Rank    Cases
          4.50        7  - Ranks  (LEG2 Lt ARM2)
          4.50        1  + Ranks  (LEG2 Gt ARM2)
                     58    Ties   (LEG2 Eq ARM2)
                     --
                     66    Total

Z =   -1.89             2-tailed P =  .058

8. Arm Movement vs Mouthing

     Mean Rank    Cases
         18.00       35  - Ranks  (MOUTH2 Lt ARM2)
           .00        0  + Ranks  (MOUTH2 Gt ARM2)
                     31    Ties   (MOUTH2 Eq ARM2)
                     --
                     66    Total

Z =   -5.15             2-tailed P =  .001

9. Leg Movement vs Mouthing

     Mean Rank    Cases
         16.00       30  - Ranks  (MOUTH2 Lt LEG2)
         16.00        1  + Ranks  (MOUTH2 Gt LEG2)
                     35    Ties   (MOUTH2 Eq LEG2)
                     --
                     66    Total

Z =   -4.54             2-tailed P =  .001
```

Non-Significant Results

```
1. Bodily Stretch vs Eye Open/Close

     Mean Rank    Cases
         19.00       21  - Ranks (EYE2 Lt BODST2)
         19.00       16  + Ranks (EYE2 Gt BODST2)
                     47    Ties  (EYE2 Eq BODST2)
                     --
                     84    Total

Z =    -.71            2-tailed P =  .473

2. Bodily Stretch vs Head Movement

     Mean Rank    Cases
       16.50       14  - Ranks (HEAD2 Lt BODST2)
       16.50       18  + Ranks (HEAD2 Gt BODST2)
                   52    Ties  (HEAD2 Eq BODST2)
                   --
                   84    Total

Z =    -.61            2-tailed P =  .537

3. Bodily Stretch vs Mouthing

     Mean Rank    Cases
       16.00       18  - Ranks (MOUTH2 Lt BODST2)
       16.00       13  + Ranks (MOUTH2 Gt BODST2)
                   53    Ties  (MOUTH2 Eq BODST2)
                   --
                   84    Total

Z =    -.78            2-tailed P =  .433

4. Eye Movement vs Head Movement

     Mean Rank    Cases
         15.00       10  - Ranks (HEAD2 Lt EYE2)
         15.00       19  + Ranks (HEAD2 Gt EYE2)
                     55    Ties  (HEAD2 Eq EYE2)
                     --
                     84    Total

Z =   -1.45            2-tailed P =  .144

5. Eye Movement vs Mouthing

     Mean Rank    Cases
          9.50        9  - Ranks (MOUTH2 Lt EYE2)
          9.50        9  + Ranks (MOUTH2 Gt EYE2)
                     66    Ties  (MOUTH2 Eq EYE2)
                     --
                     84    Total

Z =     .00            2-tailed P = 1.000
```

6. Head Movement vs Mouthing

Mean Rank	Cases		
12.00	16	- Ranks	(MOUTH2 Lt HEAD2)
12.00	7	+ Ranks	(MOUTH2 Gt HEAD2)
	61	Ties	(MOUTH2 Eq HEAD2)
	--		
	84	Total	

Z = -1.64 2-tailed P = .100

B.3 Limb Strokes

(a) Cochran's Q Test

0 = reaction was not seen
1 = reaction was seen by at least 2 of the 3 observers

= 0	= 1	Variable
25	8	BODST2
27	6	EYE2
20	13	HEAD2
11	22	ARM2
7	26	LEG2
26	7	MOUTH2

Cases	Cochran Q	D.F.	Significance
33	53.06	5	.001

Post-hoc wilcoxon tests performed on the limb strokes reaction data (see section (b) below) revealed that:

1. arm and leg movements occured significantly more often than bodily stretch, eye-opening or closing, head or mouthing movements during limb strokes

2. no significant differences were found in the occurence of leg as compared to arm movements, or bodily stretch, eye opening/closing, head or mouthing movements in comparison to each other during limb strokes (Figure 10.3.2.1.B)

(b) Post-Hoc Wilcoxons

Significant Results

```
1. Bodily Stretch vs Arm Movement

     Mean Rank    Cases
          8.50        1  - Ranks  (ARM2 Lt BODST2)
          8.50       15  + Ranks  (ARM2 Gt BODST2)
                     17    Ties   (ARM2 Eq BODST2)
                     --
                     33    Total

Z =   -3.07             2-tailed P =  .002

2. Bodily Stretch vs Leg Movement

     Mean Rank    Cases
           .00        0  - Ranks  (LEG2 Lt BODST2)
          9.50       18  + Ranks  (LEG2 Gt BODST2)
                     15    Ties   (LEG2 Eq BODST2)
                     --
                     33    Total

Z =   -3.72             2-tailed P =  .001

3. Eyes Open/Close vs Arm Movement

     Mean Rank    Cases
          9.50        1  - Ranks  (ARM2 Lt EYE2)
          9.50       17  + Ranks  (ARM2 Gt EYE2)
                     15    Ties   (ARM2 Eq EYE2)
                     --
                     33    Total

Z =   -3.30             2-tailed P =  .001

4. Eyes Open/Close vs Leg Movement

     Mean Rank    Cases
         11.50        1  - Ranks  (LEG2 Lt EYE2)
         11.50       21  + Ranks  (LEG2 Gt EYE2)
                     11    Ties   (LEG2 Eq EYE2)
                     --
                     33    Total

Z =   -3.73             2-tailed P =  .001
```

5. Head Movement vs Arm Movement

Mean Rank	Cases		
7.00	2	- Ranks	(ARM2 Lt HEAD2)
7.00	11	+ Ranks	(ARM2 Gt HEAD2)
	20	Ties	(ARM2 Eq HEAD2)
	--		
	33	Total	

Z = -2.20 2-tailed P = .027

6. Head Movement vs Leg Movement

Mean Rank	Cases		
.00	0	- Ranks	(LEG2 Lt HEAD2)
7.00	13	+ Ranks	(LEG2 Gt HEAD2)
	20	Ties	(LEG2 Eq HEAD2)
	--		
	33	Total	

Z = -3.17 2-tailed P = .001

7. Arm Movement vs Mouthing

Mean Rank	Cases		
9.00	16	- Ranks	(MOUTH2 Lt ARM2)
9.00	1	+ Ranks	(MOUTH2 Gt ARM2)
	16	Ties	(MOUTH2 Eq ARM2)
	--		
	33	Total	

Z = -3.19 2-tailed P = .001

8. Leg Movement vs Mouthing

Mean Rank	Cases		
10.00	19	- Ranks	(MOUTH2 Lt LEG2)
.00	0	+ Ranks	(MOUTH2 Gt LEG2)
	14	Ties	(MOUTH2 Eq LEG2)
	--		
	33	Total	

Z = -3.82 2-tailed P = .001

Non-Significant Results

1. Bodily Stretch vs Eye Open/Close

Mean Rank	Cases		
8.00	10	- Ranks	(EYE2 Lt BODST2)
8.00	5	+ Ranks	(EYE2 Gt BODST2)
	27	Ties	(EYE2 Eq BODST2)
	--		
	42	Total	

Z = -1.13 2-tailed P = .256

2. Bodily Stretch vs Head Movement

Mean Rank	Cases		
7.00	6	- Ranks	(HEAD2 Lt BODST2)
7.00	7	+ Ranks	(HEAD2 Gt BODST2)
	29	Ties	(HEAD2 Eq BODST2)
	--		
	42	Total	

Z = -.24 2-tailed P = .806

3. Bodily Stretch vs Mouthing

Mean Rank	Cases		
7.00	8	- Ranks	(MOUTH2 Lt BODST2)
7.00	5	+ Ranks	(MOUTH2 Gt BODST2)
	29	Ties	(MOUTH2 Eq BODST2)
	--		
	42	Total	

Z = -.73 2-tailed P = .463

4. Eyes Open/Close vs Head Movement

Mean Rank	Cases		
8.50	5	- Ranks	(HEAD2 Lt EYE2)
8.50	11	+ Ranks	(HEAD2 Gt EYE2)
	26	Ties	(HEAD2 Eq EYE2)
	--		
	42	Total	

Z = -1.31 2-tailed P = .187

5. Eyes Open/Close vs Mouthing

Mean Rank	Cases		
6.50	5	- Ranks	(MOUTH2 Lt EYE2)
6.50	7	+ Ranks	(MOUTH2 Gt EYE2)
	30	Ties	(MOUTH2 Eq EYE2)
	--		
	42	Total	

Z = -.50 2-tailed P = .610

6. Head Movement vs Mouthing

Mean Rank	Cases		
5.50	7	- Ranks	(MOUTH2 Lt HEAD2)
5.50	3	+ Ranks	(MOUTH2 Gt HEAD2)
	32	Ties	(MOUTH2 Eq HEAD2)
	--		
	42	Total	

Z = -1.12 2-tailed P = .262

```
7. Arm Movement vs Leg Movement

      Mean Rank     Cases
            .00         0   - Ranks  (LEG2 Lt ARM2)
           2.50         4   + Ranks  (LEG2 Gt ARM2)
                       29     Ties   (LEG2 Eq ARM2)
                       --
                       33     Total

Z =    -1.82               2-tailed P =   .067
```

10.3.2.2

Which bodily category of the Tac-Tic strokes (i.e head, trunk or limb) elicited significantly more reactions than the others

With regard to this question, the overall (both parent stroking sessions) reaction data was first converted into percentages of the maximum possible number of reactions, for each bodily category of Tac-Tic strokes.

This was done since there were a different number of strokes within each bodily category of the Tac-Tic strokes, (eg. number of head strokes = 8, trunk strokes = 6, limb strokes = 3; Appendix 10.2.1.7), and so a different number of reactions was possible for each of these categories. This was thus controlled for by converting each number of reactions into its percentage of the total possible number of reactions, for each bodily category of the Tac-Tic strokes (see Table 10.3.2.2.1 overleaf).

No significant difference was found though, by Wilcoxon matched-pairs signed-ranks tests, in the percentage number of reactions elicited by the head, trunk and limb categories of Tac-Tic strokes (see section 10.3.2.2.1).

Overall head strokes elicited the least percentage number of reactions, in comparison both to trunk and limb strokes which elicited virtually the same percentage number of reactions (see Table 10.3.2.2.1).

TABLE 10.3.2.2.1 TOTAL AND % NUMBER OF REACTIONS

	Head	Trunk	Limb
Total No.Reactions Possible Seen by Each Individual Parent:	48	36	18
Total No.Reactions Possible Seen by Mothers/Fathers Overall:	720	540	270
Total No. Reactions (Maternal):	164	163	64
Total No. Reactions (Paternal):	193	156	82
	Head	**Trunk**	**Limb**
Total No. of Reactions Possible Seen by both Parents:	1440	1080	540
	Head	**Trunk**	**Limb**
% No. of Reactions (Maternal):	22.77	30.18	23.70
% No. of Reactions (Paternal):	26.80	28.88	30.37
	Head	**Trunk**	**Limb**
% No. of Reactions (Overall):	24.79	29.53	27.03

10.3.2.2.1

Comparing Head vs Trunk vs Limb Strokes on percentage of total number of reactions elicited (as seen by at least 2 persons)

```
(1) Wilcoxon Matched-pairs Signed-ranks Test

     HPER    HEAD RESPONSE PERCENTAGE
with TPER   TRUNK RESPONSE PERCENTAGE

     Mean Rank     Cases
          5.75         6  - Ranks  (TPER Lt HPER)
          9.50         9  + Ranks  (TPER Gt HPER)
                       0    Ties   (TPER Eq HPER)
                      --
                      15    Total

Z =   -1.44             2-tailed P =  .147

(2) Wilcoxon Matched-pairs Signed-ranks Test

     HPER    HEAD RESPONSE PERCENTAGE
with LPER    LIMB RESPONSE PERCENTAGE

     Mean Rank     Cases
          7.75         4  - Ranks  (LPER Lt HPER)
          7.40        10  + Ranks  (LPER Gt HPER)
                       1    Ties   (LPER Eq HPER)
                      --
                      15    Total

Z =   -1.34             2-tailed P =  .177

(3) Wilcoxon Matched-pairs Signed-ranks Test

     TPER   TRUNK RESPONSE PERCENTAGE
with LPER   LIMB RESPONSE PERCENTAGE

     Mean Rank     Cases
          7.93         7  - Ranks  (LPER Lt TPER)
          7.07         7  + Ranks  (LPER Gt TPER)
                       1    Ties   (LPER Eq TPER)
                      --
                      15    Total

Z =    -.18             2-tailed P =  .850
```

10.3.3 What is the number of reactions elicited by the various categories of Tac-Tic strokes, when the mother as compared to the father is the stroker ?

To answer the question of whether, paternal as compared to maternal Tac-Tic stroking, elicited a different number of reactions across each of the bodily categories of Tac-Tic strokes, Wilcoxon matched-pairs signed- ranks tests were performed on the data (sections 10.3.3.1 to 10.3.3.3).

These tests found that no significant difference occured between the number of reactions elicited by maternal as compared to paternal Tac-Tic stroking across each of the bodily categories of the Tac-Tic strokes (see sections 10.3.3.1 to 10.3.3.3).

Overall, in fact there was a striking similarity, between maternal and paternal stroking sessions, in both the pattern (indicating similarity in reactions elicited) and frequency of infant reactions, for the 3 categories of Tac-Tic strokes.

10.3.3.1 Comparing Mother vs Father Head Strokes on Number of Reactions elicited (as seen by at least 2 persons)

```
Wilcoxon Matched-pairs Signed-ranks Test
     MHEAD   TOTAL HEAD MOVEMENTS BY MUM
with DHEAD   TOTAL HEAD MOVEMENTS BY DAD

     Mean Rank    Cases
          5.38        4  - Ranks  (DHEAD Lt MHEAD)
          7.72        9  + Ranks  (DHEAD Gt MHEAD)
                      2    Ties   (DHEAD Eq MHEAD)
                     --
                     15    Total
     Z =    -1.67            2-tailed P =   .093
```

10.3.3.2 Comparing Mother vs Father Trunk Strokes on Number of Reactions elicited (as seen by at least 2 persons)

```
Wilcoxon Matched-pairs Signed-ranks Test
     MTRUNK  TOTAL TRUNK MOVEMENTS BY MUM
with DTRUNK  TOTAL TRUNK MOVEMENTS BY DAD

     Mean Rank     Cases
        7.63         8   - Ranks (DTRUNK Lt MTRUNK)
        8.43         7   + Ranks (DTRUNK Gt MTRUNK)
                     0     Ties  (DTRUNK Eq MTRUNK)
                     --
                     15     Total
Z =     -.05            2-tailed P =  .954
```

10.3.3.3 Comparing Mother vs Father Limb Strokes on Number of Reactions elicited (as seen by at least 2 persons)

```
Wilcoxon Matched-pairs Signed-ranks Test
     MLIMB   TOTAL LIMB MOVEMENTS BY MUM
with DLIMB   TOTAL LIMB MOVEMENTS BY DAD

     Mean Rank     Cases

          5.42         6   - Ranks (DLIMB Lt MLIMB)
          8.36         7   + Ranks (DLIMB Gt MLIMB)
                       2     Ties  (DLIMB Eq MLIMB)
                      --
                      15     Total

Z =     -.90            2-tailed P =  .363
```

10.3.4 Correlations

Pearson correlations were performed on the percentage number of reactions (% number of total reactions possible) overall and for each bodily category of Tac-Tic strokes (i.e head, trunk and limb), across both maternal and paternal stroking sessions, marked down as seen by each of the parents and the experimenter.

Percentage data was used since there are a different number of strokes within each bodily category of the Tac-Tic strokes, (eg number of head strokes = 8, trunk strokes= 6, limb strokes=3), and so a different number of reactions is possible for each of these categories. This is thus controlled for by converting each number of reactions into its percentage of the total possible number of reactions, for each bodily category of the Tac-Tic strokes (see Table 10.3.2.2.1 above).

Significant positive correlations were found in the percentage number of reactions, seen by the experimenter mother and father, across all the 3 categories of Tac-Tic strokes (head/trunk/limb), during both the maternal (see section 10.3.4.1) and paternal (see section 10.3.4.2) stroking sessions.

This suggests a great similarity between the mother, father and experimenter, in the number of reactions each of them saw, across both all the bodily categories of Tac-Tic strokes (head/trunk/limb) and the 2 stroking sessions (maternal/paternal), implying validity in the reaction data.

Equally the non-significant results of Wilcoxons performed on this data between each of the parents as well as the experimenter, across the maternal and paternal stroking sessions, supports this (see sections 10.3.4.1.1 and 10.3.4.2.1).

Pearson correlations between the number of occurrences of each reaction seen by the experimenter, mother and father, in both the maternal and paternal infant-stroking sessions, were calculated for each reaction. This was done to determine inter-rater reliability in the perception of each reaction.

The summary table of the correlations (section 10.3.4.3) shows that no reaction was had an overall mean correlation below r= 0.40.

10.3.4.1 Maternal Stroking Session

PDM =% number of reactions seen by the father during maternal stroking of the infant

PMM = % number of reactions seen by the mother during maternal stroking of the infant

PEM = % number of reactions seen by the experimenter during maternal stroking of the infant

(a) Overall the strokes

Correlations:	PDM	PMM	PEM
PDM	1.0000	.7900**	.8229**
PMM	.7900**	1.0000	.8798**
PEM	.8229**	.8798**	1.0000

N of cases: 42 1-tailed Signif:* - .01 ** - .001

(b) Head Strokes Only

Correlations:	PEM	PDM	PMM
PEM	1.0000	.8906**	.9205**
PDM	.8906**	1.0000	.9182**
PMM	.9205**	.9182**	1.0000

(c) Trunk Strokes Only

Correlations:	PEM	PDM	PMM
PEM	1.0000	.8551**	.8675**
PDM	.8551**	1.0000	.7012*
PMM	.8675**	.7012*	1.0000

(d) Limb Strokes Only

Correlations:	PEM	PDM	PMM
PEM	1.0000	.7986**	.8632**
PDM	.7986**	1.0000	.7971**
PMM	.8632**	.7971**	1.0000

N of cases: 14 1-tailed Signif:* - .01 ** - .001

10.3.4.1.1 Wilcoxon Matched-pairs Signed-ranks Tests

(a) Father with Experimenter (i.e the 2 observers) PDM with PEM

Mean Rank	Cases	
20.18	14	- Ranks (PEM Lt PDM)
19.90	25	+ Ranks (PEM Gt PDM)
	3	Ties (PEM Eq PDM)
	--	
	42	Total

Z = -1.5002 2-tailed P = .1336

(b) Father (observer) with Mother (stroker) PDM with PMM

Mean Rank	Cases	
20.88	16	- Ranks (PMM Lt PDM)
18.50	22	+ Ranks (PMM Gt PDM)
	4	Ties (PMM Eq PDM)
	--	
	42	Total

Z = -.5293 2-tailed P = .5966

(c) Mother (stroker) with Experimenter (observer) PEM with PMM

Mean Rank	Cases	
16.26	21	- Ranks (PMM Lt PEM)
18.29	12	+ Ranks (PMM Gt PEM)
	9	Ties (PMM Eq PEM)
	--	
	42	Total

Z = -1.0899 2-tailed P = .2757

10.3.4.2 Paternal Stroking Session

PDD = % number of reactions seen by the father during paternal stroking of the infant

PMD =% number of reactions seen by the mother during paternal stroking of the infant

PED = % number of reactions seen by the experimenter during paternal stroking of the infant

(a) overall the strokes

Correlations:	PDD	PMD	PED
PDD	1.0000	.7369**	.7654**
PMD	.7369**	1.0000	.6432**
PED	.7654**	.6432**	1.0000

N of cases: 42 1-tailed Signif:* - .01 ** - .001

(b) Head Strokes Only

Correlations:	PED	PMD	PDD
PED	1.0000	.5199	.8590**
PMD	.5199	1.0000	.6844*
PDD	.8590**	.6844*	1.0000

(c) Trunk Strokes Only

Correlations:	PED	PDD	PMD
PED	1.0000	.7616**	.8749**
PDD	.7616**	1.0000	.8312**
PMD	.8749**	.8312**	1.0000

(d) Limb Strokes Only

Correlations:	PED	PDD	PMD
PED	1.0000	.7152*	.6793*
PDD	.7152*	1.0000	.8487**
PMD	.6793*	.8487**	1.0000

N of cases: 14 1-tailed Signif:* - .01 ** - .001

10.3.4.2.1 Wilcoxon Matched-pairs Signed-ranks Tests

(a) Mother with Experimenter (i.e the 2 observers) PMD with PED

Mean Rank	Cases	
19.32	14	- Ranks (PED Lt PMD)
19.60	24	+ Ranks (PED Gt PMD)
	4	Ties (PED Eq PMD)
	--	
	42	Total

Z = -1.4502 2-tailed P = .147

(b) Mother (observer) with Father (stroker) PMD with PDD

Mean Rank	Cases		
18.00	12	- Ranks	(PDD Lt PMD)
18.75	24	+ Ranks	(PDD Gt PMD)
	6	Ties	(PDD Eq PMD)
	--		
	42	Total	

Z = -1.8381 2-tailed P = .066

(c) Father (stroker) with Experimenter (observer) PED with PDD

Mean Rank	Cases		
16.87	19	- Ranks	(PDD Lt PED)
20.32	17	+ Ranks	(PDD Gt PED)
	6	Ties	(PDD Eq PED)
	--		
	42	Total	

Z = -.1964 2-tailed P = .844

10.3.4.3 Reaction Correlations

Table 10.3.4.3 Reaction Correlations

Stroker:	Mother		Father	
Reaction	Mean	Range	Mean	Range
Bodily Stretch	0.58	0.35-0.83	0.55	0.31-0.87
Eyes open/close	0.41	0.05-0.95	0.51	0.13-0.89
Head movement	0.57	0.29-0.83	0.55	0.15-0.84
Arm movement	0.69	0.13-0.88	0.45	0.01-0.85
Leg movement	0.54	0.36-0.79	0.67	0.40-0.89
Mouthing	0.46	0.07-0.70	0.65	0.20-0.94

10.3.5 CONCLUSIONS

A The effects of the tactile stimulation programme (Tac-Tic) on parental anxiety.

A.1 In terms of anxiety, overall this was not significantly lower in the experimental as compared to control parents.

A.2 Experimental as compared to control parents were found to show significantly lower anxiety in their attitudes to pregnancy onset

A.3 Looking just at attitudes postpartum, experimental, as compared to control, fathers displayed nearly significant ($p < 0.06$) lower anxiety

A.4 In terms of attitudes post-birth, experimental, as compared to control, mothers were found to show nearly significant ($p < 0.06$) lower anxiety

A.5 All of the experimental sample enjoyed carrying out the Tac-Tic strokes on their infant and the majority of the sample (all of the fathers), felt that their infant enjoyed the strokes and that they would carry out the stroking procedure on a regular basis.

A.6 Most of the experimental parents felt that some of the strokes (particularly the head or trunk strokes) were, in what they judged, "better" for their infants than others.

B.1 The reactions that occured to each bodily category of the Tac-Tic strokes (i.e head, trunk or limb strokes).

B.1.1 In all the bodily categories of Tac-Tic strokes, (i.e head, trunk and limb), within both maternal and paternal stroking sessions, significant differences occurred in the number of the various reactions elicited.

B.1.2 Across head, trunk and limb bodily categories of strokes, for both maternal and paternal stroking sessions, arm and leg movements were significantly the most frequent of infant reactions.

B.1.3 For head strokes only, head and mouthing movements (as well as arm and leg movements) occurred significantly more often than, either bodily stretch or eye open/close movements during maternal stroking and bodily stretch movements only during paternal stroking

B.1.4 For both trunk and limb strokes, arm and leg movements were the only reactions that occurred significantly more than any of the others.

B.1.5 Bodily stretch and eye opening /closing movements were the least frequent reactions, across all categories of Tac-Tic strokes, during both maternal and paternal stroking sessions.

B.1.6 There was a striking similarity, between maternal and paternal stroking sessions, in the pattern and frequency of infant reactions, for the 3 categories of Tac-Tic strokes.

B.2 The amount of reactions elicited by each bodily category of the Tac-Tic strokes (i.e head, trunk or limb) over both maternal and paternal stroking sessions.

B.2.1 No significant differences were found between the percentage of all possible reactions elicited by head, trunk or limb strokes in comparison to each other.

C The number of reactions elicited by the various categories of Tac-Tic strokes, when the mother as compared to the father is the stroker.

C.1 No significant difference occured in the number of infant reactions, elicited by maternal as compared to paternal Tac-Tic stroking across each of the bodily categories of the Tac-Tic strokes.

D Validity of the data

D.1 Significant positive correlations were found between the experimenter, father and mother in number of reactions seen overall and across each of the bodily categories of Tac-Tic strokes, in both maternal and paternal stroking sessions.

D.2 The mean inter-rater correlations for each reaction, within both maternal and paternal stroking sessions, were quite similar. No reaction had a mean inter-rater correlation below r= 0.40 or above r= 0.70. The overall mean inter-rater reaction correlation was r= 0.55.

D.3 The new modified P.A.A.S scores showed significant positive correlations with totals derived from only those questions belonging to the original P.A.A.S.

10.4 DISCUSSION

The most prominent findings of this study were that:

10.4.1 Arm and leg movements are the most common reactions to Tac-Tic stroking.

10.4.2 A striking similarity exists between maternal and paternal Tac-Tic stroking, in the pattern and frequency of infant reactions elicited.

10.4.3 No significant differences were found in the type or percentage of all possible reactions elicited by head, trunk or limb Tac-Tic strokes, in comparison to each other.

10.4.4 Although overall anxiety, as measured by the P.A.A.S, was not significantly lower in experimental as compared to control parents, postpartum anxiety was found to be (nearly $p< 0.06$) significantly lower in experimental as compared to control fathers and post-birth anxiety was found to be (nearly $p< 0.06$) significantly lower in experimental as compared to control mothers.

10.4.5 Parents enjoyed performing the Tac-Tic stroking procedure on their infant and felt they would continue to perform the stroking procedure, on their infant, in the future.

10.4.1 Arm and leg movements: the most common reactions to Tac-Tic stroking

Arm and leg movements were found to be the most common reactions to the Tac-Tic strokes across all of the three bodily categories of these strokes (head, trunk and limb), on account of possibly either simple nervous stimulation or the moro reflex.

Given that only reactions seen by at least two of the three individuals (experimenter and the 2 parents) present were included in the data analysis, as well the significant correlations found between these individuals in the frequency of reactions seen across all the 3 bodily categories of the Tac-Tic strokes, these data can be taken to be quite valid.

In agreement with this finding Scafidi et al. (1990) found that during the tactile stimulation segments of their stimulation programme, preterms experienced more multiple limb movements than during the kinaesthetic segments of their programme. They concluded that the tactile stimulation was more arousing and activating than the kinaesthetic segments of their programme.

Stroking has previously been found to elicit motoric arousal effects in low-birthweight preterms (Oehler et al., 1988). This, in conjunction with significantly greater weight gain in the stroked as compared to non-stroked preterms, has been interpreted as reflecting increased metabolic efficiency (Scafidi et al., 1986).

Repeated experience of sequenced stroking though, has been argued to elicit less aroused infant reactions as the infant habituates to the stroking (Korner, 1979).

Stimulation of nerves alone on the other hand may account for the elicited arm and leg movements given the poor neurological and behavioural organization of preterm and low birth weight infants.

Another perspective on the arm and leg movements found to be elicited by the stroking, is that they reflect not behavioural arousal or disorganization, but the elicitation of the moro reflex.

This reflex is characterized by the spreading open of both arms and legs, in an embracing movement, as if to catch hold of something, (Fogel and Melson, 1988). Dropping of the baby's head, slightly but abruptly, usually elicits this reflex (Fogel and Melson, 1988) and this can be seen as a behaviour which decreases the distance between caretaker and infant.

The moro reflex, on the part of the child, thus can be seen as an "attachment behaviour" (Bowlby, 1969), seeking out greater proximity between caretaker and child. It is possible that this reflex may also occur in response to a proximity seeking or "attachment behaviour" on the part of the caretaker.

Given that the Tac-Tic stroking elicited reactions akin to those of the moro reflex, such stroking may be argued to represent an adult attachment or proximity seeking behaviour.

The abundance of tactile stimulation in mother-infant interactions (Day, 1982; Dunbar, 1977), the importance of tactile stimulation or "contact comfort" over food in early monkey infant-mother dyads (Harlow, 1958, 1959a, 1959b), as well as the seemingly innate patterns of touching infants for the first time by mothers (Rubin, 1982) lend further support to this notion of touching and stroking as "innate attachment behaviours".

Such actions as arm and leg movements could however be reflections of the infant's state as it has been found (Fogel and Hannan, 1985; Legerstee et al., 1990) that infants display a configuration of facial, arm and hand actions to express affective states. Open hand, eye gazing, arm extension and vocalization formed a "behavioural organization", according to Legerstee et al., (1990), during 9-15 week old infant-active mother interaction.

Behavioural organizations such as these, according to Legerstee et al., (1990), may "*..induce the parents to respond to the infant in a certain way*" (p783), and this ties in with the aforementioned "attachment behaviour" theory.

This view of stroking as an "attachment behaviour" needs to be investigated however, possibly by, for example, comparing infant monkey preference for being stroked as compared to being touched or comparing the reactions of infants who are touched and also stroked in various ways to determine which elicits the most attachment behaviour.

More subtle infant reactions such as twitches, degree of mouth opening and so on, which could not be picked up using the present procedure, could be assessed by videotaping parents performing the stroking programme and then analyzing these videos. These reactions might reveal other differences between the various strokes in terms of their behavioural effects.

If this was conducted over time, it would also be possible to record whether infants had "habituated" to the stroking sequence, showing less aroused/vigorous responses the greater the number of times that they had experienced the stroking procedure. One year-olds have been found to show a tactile recognition memory (Gottfried and Rose, 1980) but no data exists on this in premature newborns.

Equally, parental reactions while performing the strokes, could be collected using such a procedure. Comparing their reactions while stroking as compared to while routine contact of their infant might reveal greater parental responsivity or interaction during stroking as compared to routine contact of their infant.

This then may, over time, contribute towards the improved social and cognitive development found in the long-term, in stroked infants of other studies (Kramer et al., 1975; Rose et al., 1980; Koniak-Griffin and Luddington-Hoe, 1987).

Finally, by investigating what the physiological effects of infant behavioural reactions during Tac-Tic stroking are, an attempt can be made to relate such reactions to the physiological improvements (eg. weight gain) stroked infants display (Jay, 1982; White and LaBarba, 1976).

10.4.2 Maternal and Paternal Tac-Tic stroking

As hypothesized, no significant difference was found between maternal and paternal stroking in either the kind or number of infant reactions elicited.

This was expected as both parents were provided with a systematic, sequenced stroking programme (Tac-Tic) and were both shown and instructed in the same way, what to do.

This thus supports the reliability of the Tac-Tic procedure, in that the same pattern and frequency of reactions were exhibited, when the Tac-Tic procedure was performed by two different people, the mother and father of the infant. It also supports the argument for a greater number of tactile intervention programmes in the future to involve the father as well as the mother, in infant stroking. Programmes of tactile stimulation usually either involve the experimenter or the mother providing the stimulation (Rice, 1977; Field et al., 1986; Macedo, 1984).

But, given that this study showed that both parents appear to be eliciting the same infant reactions, at least in an overt behavioural sense, fathers may just as well bring about, as many and/or as great benefits in infant development as mothers/experimenters.

This though supposes that such overt behavioural reactions are reflections of underlying effects, which yet remains to be determined.

However, with fathers as well as mothers providing the stimulation, the father-infant, as well as mother-infant, relationship could also be benefited. Early tactile contact and interaction, between father and infant, has previously been deemed as essential by Pederson (1980) and Parke and O'Leary (1976) for the father-infant relationship, as well as possibly enhancing paternal "engrossment" (Greenberg and Morris, 1974) and feelings of "fatherliness" (Hines, 1971).

Furthermore, the findings from the stroking questionnaire administered to all the experimental parents, revealed that all the parents enjoyed, and the vast majority felt their infant enjoyed, the Tac-Tic stroking programme.

Thus, this stroking procedure was obviously a positive, pleasant means of parent-infant interaction, which may be of particular benefit in a neonatal unit setting, where parents feel inhibited in interacting with their infant, due to their infants vulnerable and "at risk" health status.

10.4.3 Head, trunk or limb Tac-Tic strokes, in comparison to each other

In that the same pattern and frequency of reactions were elicited by the three categories of bodily strokes (head, trunk and limb), this suggests that they were equally effective in eliciting such overt behavioural reactions. Stroking of any one of the three body regions, thus was not more effective in eliciting overt behavioural reactions, in terms of either kind or frequency.

Neither were reactions corresponding to bodily area being stroked, significantly more frequent than other reactions, except for arm/leg movements during limb strokes, which were the most frequent reactions elicited within the other two bodily categories of strokes (head and trunk) as well.

A more precise and detailed examination, using video recordings of the stroking sessions, however might show this by detecting more subtle infant reactions, which vary significantly across the three bodily categories of Tac-Tic strokes. For example, opening or closing of the hand, a behaviour which Papousek and Papousek (1977) found in infants to be related to affective state (closing reflecting distress, opening relaxation).

Looking at more than just the three general body areas of head, trunk and limb, may also reveal that stroking of a particular body area is more effective than stroking of other areas, in eliciting certain or all, overt behavioural reactions.

The need for a more a detailed investigation into this is underlined by the findings of the stroking questionnaire.

The very high percentage of parents (83%) who felt that some strokes (predominantly head (36.36%) or trunk (36.36%) as compared to limb (22.73%) were better, in the sense of being perceived as more pleasurable for their infants, than others is suggestive that strokes may indeed vary in their effectiveness.

Again, a combined behavioural and physiological investigation into the effects of the various Tac-Tic strokes, across different areas of the body, is needed to determine whether strokes perceived as more effective (in the sense of, for example, pleasurable, reaction inducing) exert more/longer beneficial physiological effects (eg. heightened tcpo2) than other strokes.

10.4.4 Experimental as compared to Control parents: P.A.A.S Results

The lack of a significant finding of lower anxiety in experimental as compared to control parents could be due to methodological problems.

Firstly, the P.A.A.S questionnaire, despite it being modified, may not have been appropriate for this investigation as the questions predominantly referred to the pre-natal and natal periods, thereby dealing with anxieties experienced prior to when the intervention in this study began.

As a consequence, the intervention carried out could not effect the total P.A.A.S anxiety score.

The fact that experimental as compared to control fathers displayed (nearly significant p <0.06) lower postpartum period (when the intervention took place) anxiety, suggests that the intervention may indeed have had an effect on anxiety experienced, at least by fathers.

Given a larger sample and a more appropriate questionnaire, experimental parents, both fathers and mothers, may show a significantly lower level of anxiety experienced.

The nearly significant (p< 0.06), lower post-birth period anxiety found in experimental as compared to control mothers is also suggestive of an intervention effect, given that some of it's questions are equally applicable to the postpartum period (eg. Are you happy about being a mother ?, Do you think your partner is a good support ?).

10.4.5 The Stroking Questionnaire

Given that all the experimental parents enjoyed performing the Tac-Tic stroking procedure on their infant and felt that they would continue to perform the stroking procedure on their infant, this stroking procedure represents a positive way of encouraging parent-infant interaction in the neonatal unit and home.

The simplicity of the stroking movements, the proximity of the stroker and infant, the relaxed pace of stroking, as well as the pleasant way in which the infant reacts to the strokes all contribute to making Tac-Tic stroking a pleasant experience for the stroker.

As mothers of preterms, in comparison to fullterms, have been found to show less tactile and ventral contact with their infants (Leifer et al., 1972), stroking programmes could serve as a positive means of removing this behavioural discrepancy from "normal" mother-infant interaction, thereby enhancing mother, as well as father-infant interaction.

CHAPTER 11

AN INVESTIGATION INTO THE ATTITUDES OF THE MEDICAL AND NURSING PROFESSIONS TOWARDS PSYCHOLOGICAL INTERVENTIONS IN THE NEONATAL UNIT.

11.1 INTRODUCTION: Psychology and Medicine

The collaboration of psychology and medicine, specifically developmental psychology and pediatrics, has long been recognised as essential for the advancement of both disciplines, as well as for the greater care of premature and other high-risk infants.

However, the discipline of pediatrics has tended to strictly adhere to the medical model of illness, viewing disease and illness in general as arising from a problem in biological functioning, not taking into consideration the social and behavioural factors at play (Engel, 1977). By ignoring the psychological dimension of health and illness, pediatricians miss out on a fuller understanding of the relationship between pre and peri-natal casualty and later behavioural problems and psychopathologies (Kagan, 1965).

Pediatricians have tended to focus on immediate solutions to problems in the prevention and care of illness without referring to developmental or behavioural theories, seeing these as outside of their field of concern (Senn, 1975). Their concern, laying purely with biological issues with little if any attention being paid to the effects of child rearing practices, environments and so on.

As a discipline, pediatrics has, like others, for economic reasons of time, funding, competition, excellence and identity, protected its "territory" from invasion from other related disciplines (Brazelton, 1981).

As a consequence, pediatricians and child psychiatrists or psychologists, have in the past, struggled against communicating with and understanding each other (Brazelton, 1981).

Yet, according to Freemount-Smith (1978), "*Nowhere in science, is the value of and the need for combined operations more evident than in medicine. Nowhere in medicine is the multidiscipline approach more essential than in the problems of early infancy, where the psychosomatic unity of the infant is recognised but the mother-infant dichotomy is imposed by the subculture of the traditional hospital*" (p10).

Over recent years though, there has been a growth in the conceptual interchange between the disciplines and much interdisciplinary work has already been conducted in the area of child psychosomatics.

Such interdisciplinary research enables one to see problems from the perspective of others and solve such problems from a broader conceptual base than that of a single discipline. Along with this, the learning of new techniques of diagnosis, treatment and assessment as well as the validation of one's approach through subjecting it to the scrutinized testing of another discipline, has also emerged from such interdisciplinary work.

Many areas of child development relevant to pediatrics, have been explained and understood to a greater depth, as a consequence of such collaborative work between pediatricians and child psychologists (Kagan, 1980).

The development and treatment of hyperactivity, child abuse and eating disorders are examples of such areas.

The value of an interdisciplinary approach to any medical or health problem is beginning to be acknowledged though universities, scientific societies and scientific literature still tend to isolate the disciplines and fail to provide adequate interdisciplinary channels of communication (Freemont-Smith, 1978). However within pediatricians, a collaborative research interest in the psychological dimension of childhood illness remains to be established.

Along with this there is a need to foster collaborative research links between psychology and the nursing profession, which suffers from the same problems as the collaboration between medical-psychology, who are at the forefront of child care in the hospitals. One of the primary ways of accomplishing both of these aims, is through the training of future pediatricians and nurses.

11.1.1 Nurse Training

Looking first at the training of nurses, nursing teaching institutions have long been seen as guilty of neglecting the communication of research, including that of a psychological nature, to such students (Turner, 1981).

In hospitals, the basis of care planning depends on nursing knowledge as influenced by current theory and results of theory testing and according to Turner (1981), only by increased exposure to research and its applications can the nurse be aware of appropriate nursing care practices. Thus, the inclusion of research, including psychological research, within the curriculum of schools of nursing, is seen as essential by Turner (1981), for the optimal training of nurses.

Nurses have been found to acknowledge the role and significance of psychology in their training. In a study by Peck and Jennings (1989), nursing students were found to perceive psychology as significantly more well linked into their overall training than even chemistry or biology.

Given that nurses regard psychosocial skills as indicative of caring behaviour, which is seen as characterizing nursing, and that nursing is currently being redefined as a "*human science*" (Chipman, 1991), it is understandable that psychology has become, and seen by nursing students to be, a necessary component of their training.

11.1.2 Medical Training

The inadequacy of the psychology, as well as other behavioural science modules, in medical training has been recognised as far back as 1968. The then U.K commission on medical education acknowledged that far too little attention had been paid to the study of the behavioural sciences and their application to medical care. They recommended that psychology should be taught systematically to medical students to foster in them an understanding of its methodology content as well as its relation to medicine.

Changes have occurred though since then, the majority of these being positive with a greater number of hours, more diverse approaches and a broader content in the teaching of psychology to medical students (Weinman, 1989). Overall, the mean duration of psychological teaching was 42.8 hours in the 27 out of the 30 medical schools in Britain that were surveyed (Weinman, 1989).

This represents nearly a 3 fold increase in the hours of psychology taught to present day medical students, compared to 1968 where 15 hours was the mean duration of psychological teaching to medical students (Carstairs et al., 1968).

As established earlier though, more needs to be done if collaborative research between psychology and medicine, particularly child development pediatrics, is to be enhanced.

The conflict between the role of doctor as clinician, a "craftsman" who dwells on what he knows, and researcher, one who is more collective in his/her outlook, dwelling on the unknown or puzzling (Hetherington, 1983) needs to be resolved.

Equally, the problems outlined by the General Medical Council in 1987 need to be addressed i.e the lack of teaching staff, inadequately placed curriculum time and insufficient resources for behavioural science teaching.

Psychological interventions in the medical setting and collaborative research between psychology and medicine should be dealt with in the psychology curriculum of medical students. In general though, the effects of stress on illness and doctor-patient communication are the primary foci of such a curriculum, along with the topics of information processing and psychophysiology (Weinman, 1989).

Furthermore, the negative effects of the medical training in itself need to be corrected to ensure an optimal working relationship between psychology and medicine. Medical education has been construed as a professional socialization experience that not only involves the acquisition of knowledge and skills but also attitudes, values and a sense of ethics (Knight, 1981).

Depressing, dehumanizing, rigid and even abusive have all been terms used to describe the education of medical students (Pfifferling, 1980; Knight, 1981).

In a study by Wolf et al. in 1989, medical students were found to perceive themselves as becoming more cynical, more concerned with making money but also more concerned for patients during their medical training.

In another study though humanitarian attitudes have been found to decrease through medical school, accompanied by an increase in cynicism (Eron, 1955, 1958).

Such increased cynicism and decreased humanitarianism may inhibit acknowledgment and understanding of the psychological dimension of any illness or treatment as well as working against an optimal working research relationship with psychologists.

11.1.3 Conclusion

For any psychological intervention to be carried out in a hospital setting, the co-operation of both medical and nursing staff is fundamental.

It thus becomes imperative to discover the attitudes of such professions to psychology and its medical interventions, in order that:

1. such interventions can be tailored to suit those professions thereby promoting a positive working relationship between psychologists and doctors/nurses
2. any deficiency in current medical/nursing training, in terms of psychological input, or approach to psychological research can be corrected

This study set out to investigate and compare medical and nursing (student and staff) attitudes to psychology and psychological interventions in the neonatal unit.

It was hypothesized that:

1. the medical as compared to nursing profession (students and staff), as a consequence of their cynical and less humanistic, training, would display less positive attitudes towards psychological interventions

2. medical and nursing staff, as a consequence of their greater experience, would exhibit more favourable attitudes towards psychological interventions than medical and nursing students

3. medical students would show less favourable attitudes towards psychological interventions the further on they were in their study whereas nursing students would not.

11.2 METHOD

11.2.1 Design

This study set out to investigate attitudes within the Medical and Nursing professions, from the level of student right up to staff, towards Psychological interventions in the neonatal unit.

An attitude questionnaire, Attitudes Towards Psychological Intervention (A.T.P.I.Q see Appendix 11.2.1) was designed and given out to Medical and Nursing students and neonatal unit staff.

An independant/between subjects design was employed here with each of the 2 conditions (Medical vs Nursing professions) broken down into 2 groups (Staff, Student) and these into 3 levels (Novice, Intermediate, Advanced) according to their level of experience i.e a 2 x 2 x 3 design.

Analysis of attitude occured within/between each level of the design and across:

(a) gender

(b) age

(c) hospital (staff only)

to determine whether these had a bearing upon the attitude in question.

11.2.2 Subjects

Undergraduate Nursing (year 1 - year 4, n=80) and Medical (years 1, 4 and 5, n=159) students, along with staff (n=49), from the neonatal units of 4 Strathclyde region hospitals

(a) Queen Mother's, Glasgow

(b) Bellshill Maternity, Bellshill

(c) Paisley Maternity, Paisley

(d) Rutherglen Maternity, Rutherglen.

All subject participation was on a voluntary basis, with students being approached with the questionnaires upon entering/leaving lectures, other than year 5 Medical students who were contacted by post as they no longer attended university lectures. Staff were given the questionnaires while at work in the hospital.

A breakdown of all the subjects according to:

(a) Staff/Student

(b) Medical/Nursing profession

(c) Level of training

(d) Gender

(e) Hospital

in terms of age, is detailed in the tables overleaf.

Table 11.2.1.1 AGE

	MEAN	S.D.	N	M	F
Entire Population:	21.87	4.79	288	96	192
OVERALL STUDENT:	20.24	2.72	239	87	152
NURSING:	19.57	2.75	80	7	73
Novice level:	19.00	0.00	32	3	29
Intermed.level:	20.33	4.91	21	3	18
Advanced level:	19.66	1.92	27	1	26
MEDICAL:	20.58	2.65	159	80	79
Novice level:	19.18	1.04	33	16	17
Intermed.level:	20.31	2.49	73	36	37
Advanced level:	21.83	3.02	53	28	25
OVERALL STAFF:	29.81	4.79	49	9	40
NURSING:	29.74	5.06	35	0	35
Novice level:	27.80	4.45	15	0	15
Interm./Adv.level:	31.20	5.10	20	0	20
MEDICAL:	30.00	4.20	14	9	5
Overall **NURSING PROF.:**	22.34	5.74	126	7	119
Overall **MEDICAL PROF.:**	21.50	3.87	162	89	73
STUDENT NOVICE LEVEL:	19.09	0.74	65	19	46
STAFF NOVICE LEVEL:	27.80	4.45	15	0	15
OVERALL NOVICE LEVEL:	20.72	3.95	80	19	61
STUDENT INTERMED.LEVEL:	20.31	3.16	94	39	55
STAFF INTERMED.LEVEL:	31.20	5.10	20	0	20
OVERALL INTERM. LEVEL:	22.22	5.46	114	39	75

Table 11.2.1.1 AGE CONT'D

	MEAN	S.D.	N	M	F
STUDENT ADVANCED LEVEL:	21.10	2.87	80	29	51
STAFF ADVANCED LEVEL:	30.00	4.20	14	9	5
OVERALL ADVANCED LEVEL:	22.42	4.43	94	38	56
OVERALL MALE:	21.79	4.33		96	
OVERALL FEMALE:	21.91	5.01			192

Table 11.2.1.2 AGE BY HOSPITAL

	AGE				
	MEAN	**S.D.**	**N**	**M**	**F**
HOSPITAL 1	30.81	5.61	11	0	11
HOSPITAL 2	27.72	4.12	11	3	8
HOSPITAL 3	30.52	4.66	17	4	13
HOSPITAL 4	29.80	4.73	10	2	8

11.2.3 Materials

(a) The A.T.P.I.Q. attitude questionnaire (see Appendix 11.2.1)

11.2.4 Procedure

The questionnaire (A.T.P.I.Q.) was given out to all Bachelor of Nursing students (years 1-4) and to year 1 and year 4 Medical students before their lectures. They were given time (15 minutes) at the end of their lecture to complete it and it was collected from all the students after their lecture.

The instructions given were to complete the questionnaire as far as possible and that this was not a test of knowledge but rather a tool to measure attitudes.

As year 5 Medical students did not have class lectures, those who had completed their neonatal unit practical experience were sent the questionnaire with a covering letter (see Appendix 11.2.1.2) and stamped addressed envelope.

Medical and Nursing staff in the 4 hospitals were given the questionnaires while at work, to be completed there whenever possible and collected the following day.

11.2.4.1 Scoring of A.T.P.I.Q.

The A.T.P.I.Q. was scored using items 1 to 5, 8, 11, 13 and 14.

Items 6, 7, 9, 10, 15 and 16 were discarded in the data analysis because of a variety of reasons.

Item 6 was too ambiguious, in that crying could be either a poor/good indicator of improved health depending on the reasons behind the crying.

Item 7 was not sufficently clear as subjects were unsure whether they were to rate the features in order of importance to the parents, infant or staff (indicated by verbal communication when handing back the questionnaire).

Items 9 and 10 had a poor response rate.

Item 15 also had a very poor response rate and item 16 was ambiguous in that, according to comments written on the questionnaire, subjects felt it varied across individuals.

The remaining items were scored using a points system where:

the 1 point was awarded to the least positive response towards Psychological intervention on any question and with another 1 point being added to every more positive response.

For example, item 1 scored between 1 (least positive) to 7 (most positive) while item 2 scored between 1 (least positive) to 3 (most positive).

Item 8 was given the same score as the number circled as this reflects that those who are most annoyed by disruptions are less likely to be positive about intervention programmes which generally involve some change to the current working environment.

Item 11 was scored such that the highest score was awarded to the "no" response as this reflects awareness of the need for interventions to take place.

The highest total score possible was 148 whilst the minimum was 29, the neutral score being 88.5 points. From each of these total scores 29 was subtracted, to shift the scale from 29-148 to 0-119 and then the total scores were converted into percentages of the highest possible total (119) by dividing each score by 199 and multiplying by 100.

11.3 RESULTS

11.3.1 Introduction

Means and standard deviations were calculated on the attitude questionnaire data according to:

1. Gender

2. Status (Hospital Neonatal Unit Staff or University Student)

3. Level of Status within the Staff or Student Hierarchy i.e Novice, Intermediate or Advanced

4. Profession (Medical/Nursing)

5. Level of Status within the Staff or Student Hierarchy, in either the Medical or Nursing Profession

6. Hospitals (n=4) from which the attitude scores were taken

For 1-5 see Tables 11.3.2.1 to 11.3.4.4.1,Figures 11.3.2.1, 11.3.3.1 and 11.3.4.3.1 and for 6 see Table 11.3.5.1).

11.3.2 Gender, Age and Attitude Score

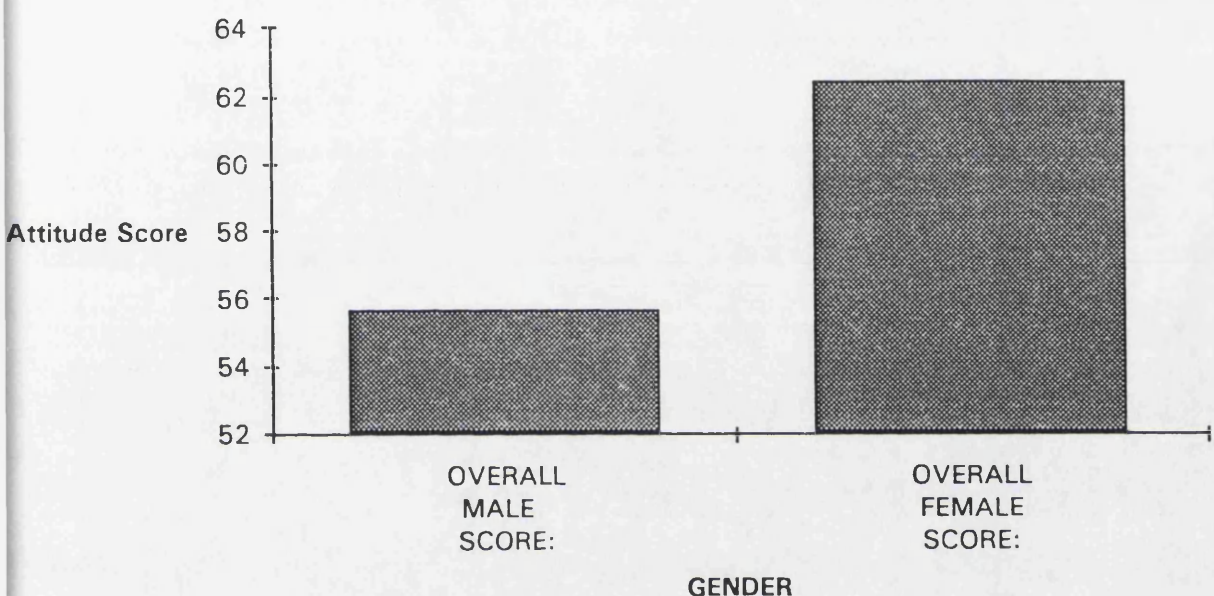
As can be seen from Table 11.3.2.1 and the independent t-test ($t= 4.88$, $df= 286$, $p< 0.001$, 2 tailed), overall (staff and students combined) females exhibited significantly more positive (i.e higher) attitude score towards psychological interventions within neonatal units than males.

Age though, was found to have no bearing upon attitude towards psychological interventions within neonatal units, the obtained non-significant correlation of -.0683 suggesting this.

Table 11.3.2.1 GENDER AND ATTITUDE SCORE

	MEAN	S.D.	N
OVERALL MALE SCORE:	55.68	9.64	96
OVERALL FEMALE SCORE:	62.42	11.67	192

Figure 11.3.2.1 Gender and Mean Attitude Score



11.3.3 Profession and Attitude Score

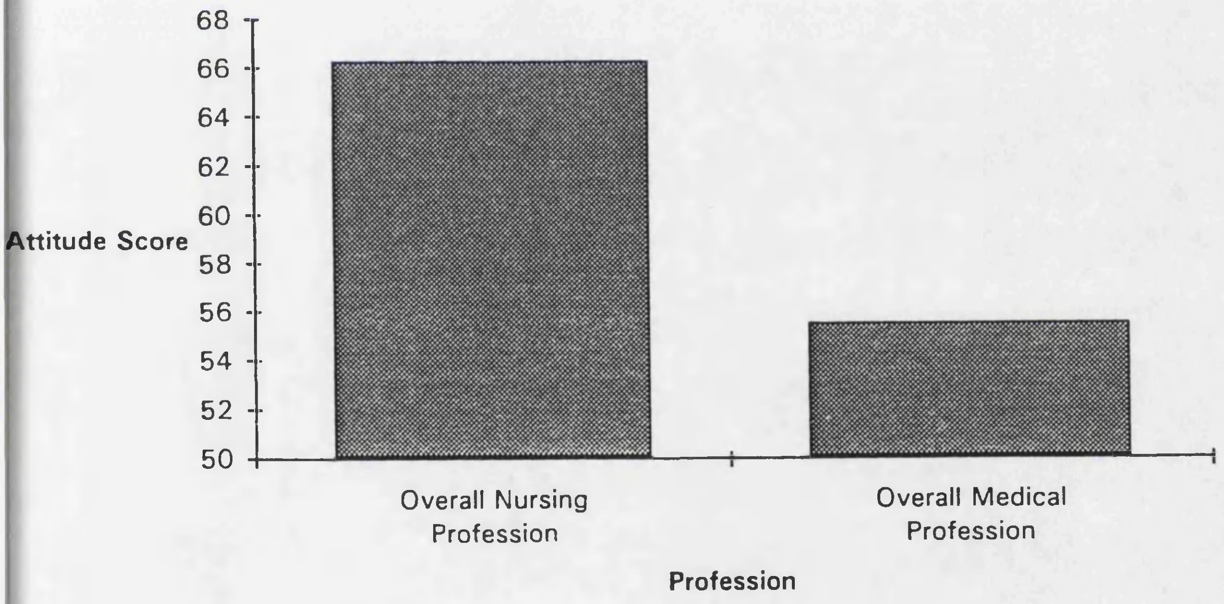
Dividing the population as a whole into either the professions of Medicine or Nursing (Table 11.3.3.1), the latter, as compared to the former profession was found to show significantly more positive (i.e higher) attitude scores towards psychological interventions within neonatal units. The multivariate analysis of variance (MANOVA), along with the a-priori independent t-test, ($t= 8.92$, $df= 286$, $p< 0.001$, 2 tailed), indicated this and showed that this was not due to a gender effect.

The first experimental hypothesis that the medical as compared to nursing profession (students and staff), would display less positive attitudes towards psychological interventions in the neonatal unit was thus supported.

Table 11.3.3.1 MEDICAL VS NURSING PROFESSION ATTITUDE SCORES

	MEAN	S.D.	N	M	F
Overall NURSING PROF.:	66.23	9.54	126	7	119
Overall MEDICAL PROF.:	55.46	10.63	162	89	73

Figure 11.3.3.1 Mean Attitude Scores of the Medical and Nursing Professions



MANOVA (1): Attitude Scores by Profession (Medical/Nursing) & by Gender

Source of Var	SS	DF	MS	F	Sig.F
Within Cells	29201.5	284	102.8		
Constant	318111.9	1	318111.9	3093.8	.00
Profession	1251.3	1	1251.3	12.1	.00
Gender	330.5	1	330.5	3.2	.07
Prof. by Gender	310.3	1	310.3	3.0	.08

Looking just at neonatal unit staff according to the Medical/Nursing profession division (Table 11.3.3.2), gender was found to account for the significantly higher (more positive) attitude scores shown by the Nursing (t= 4.83, df= 47, p< 0.001, 2 tailed) as compared to the Medical staff, (MANOVA (2)).

Given the higher number of females within the Nursing as compared to Medical staff (Table 11.3.3.2) and the fact that females were already found to show significantly higher attitude scores than males (section 11.3.2 above), this was not a surprising finding.

Table 11.3.3.2 MEDICAL VS NURSING NEONATAL UNIT STAFF ATTITUDE SCORES

	MEAN	S.D.	N	M	F
Overall STAFF:	67.67	11.13	49	9	40
NURSING:	71.68	8.15	35	0	35
MEDICAL:	57.64	11.49	14	9	5

MANOVA (2): Attitude Scores by Staff (Doctor /Nurse) & by Gender

Source of Var	SS	DF	MS	F	Sig.F
Within Cells	3557.7	46	77.3		
Constant	112293.0	1	112293.0	1451.8	.00
Staff	195.5	1	195.5	2.5	.11
Gender	420.9	1	420.9	5.4	.02
Staff by Gender	.0	0	.	.	.

Interaction could not be worked out due to all the nurses being female.

Examining student attitude scores according to the Medical/Nursing profession dichotomy (Table 11.3.3.3), gender though was not found (MANOVA (3)), to account for the significantly higher attitude scores of the Nursing as compared Medical students (t= 7.29, df= 237, p< 0.001, 2 tailed).

Table 11.3.3.3 MEDICAL VS NURSING STUDENT ATTITUDE SCORES

	MEAN	S.D.	N	M	F
Overall STUDENT:	58.64	10.94	239	87	152
NURSING:	65.23	7.83	80	7	73
MEDICAL:	55.32	10.80	159	80	79

MANOVA (3): Attitude Scores by Student (Medical /Nursing) and by Gender

Source of Var	SS	DF	MS	F	Sig.F
Within Cells	23002.2	235	97.8		
Constant	305504.6	1	305504.6	3121.1	.00
Student	1127.6	1	1127.6	11.5	.00
Gender	203.3	1	203.3	2.0	.15
Stud. by Gender	291.5	1	291.5	2.9	.08

11.3.4 Level of Training and Attitude Score

Dividing the subject sample into level of experience in terms of student (little experience) and neonatal unit staff (more experienced) (Table 11.3.4.1), it can be seen from the MANOVA performed (MANOVA (4)) that neonatal unit staff, as expected, show significantly higher (i.e more positive) attitude scores towards psychological interventions in neonatal units), than students (t= 5.24, df= 286, p< 0.001, 1 tailed).

This thus supports the second experimental hypothesis that medical and nursing staff, as a consequence of their greater experience, would exhibit more favourable attitudes towards psychological interventions than medical and nursing students.

The MANOVA (MANOVA (4)) however, indicates that this significantly higher staff as compared to student score, is underpinned by a status (staff/student) and gender (male/female) interaction effect.

Given the higher female as compared to male attitude scores, (Section 11.3.2), it is understandable that an interaction effect would occur comparing one gender of either student/staff status with the opposite gender in the other status.

The interaction effect though also indicates, as a-priori t-tests show, that the significant difference between staff and students found occurs, unexpectedly, with females only ($t= 0.69$, $df= 94$, $p< 0.24$, 1 tailed, (males only), $t= 5.51$, $df= 190$, $p< 0.001$, 1 tailed, (females only).

Table 11.3.4.1 STUDENT VS STAFF ATTITUDE SCORES

	MEAN	S.D.	N	M	F
Entire Population:	60.18	11.47	288	96	192
Overall STUDENT:	58.64	10.94	239	87	152
Male:	55.90	9.69	87	-	-
Female:	60.21	11.33	152	-	-
Overall STAFF:	67.67	11.13	49	9	40
Male:	53.55	9.38	9	-	-
Female:	70.85	8.84	40	-	-

MANOVA (4) : Attitude Scores by Status (Staff /Student) and by Gender

Source of Var	SS	DF	MS	F	Sig.F
Within Cells	31257.8	284	110.0		
Constant	375212.3	1	375212.3	3409.0	.00
Status	445.4	1	445.4	4.0	.04
Gender	3025.1	1	3025.1	27.4	.00
Stat. by Gender	1094.7	1	1094.7	9.9	.00

11.3.4.1 Students Only

Looking only at students, (Table 11.3.4.1.1), no significant differences were found in attitude scores between the 3 levels of novice, intermediate and advanced study (Novice vs Intermediate: t= 0.94, df= 157, p< 0.35, 2 tailed; Novice vs Advanced: t= 1.66, df= 134.7, p< 0.09, separate variance, 2 tailed; Intermed. vs Advanced: t= 0.70, df= 172, p< 0.48, 2 tailed).

The MANOVA performed on this data (MANOVA (5)) indicates that within the student subject sample no significant interaction occured between gender and level of experience in attitude score.

Table 11.3.4.1.1 ATTITUDE SCORES ACROSS STUDENT LEVELS OF STUDY

	MEAN	S.D.	N	M	F
Overall STUDENT:	58.64	10.94	239	87	152
STUD. NOVICE LEVEL:	60.18	7.71	65	19	46
STUD. INTERMED. LEVEL:	58.64	11.53	94	39	55
STUD. ADVANCED LEVEL:	57.38	12.35	80	29	51

MANOVA (5): Attitude Scores by Overall Student Level (Novice/Intermediate/Advanced) and by Gender

Source of Var	SS	DF	MS	F	Sig.F
Within Cells	15830.2	155	102.1		
Constant	468941.2	1	468941.2	4591.5	.00
OSLevel	16.2	1	16.2	.16	.69
Gender	342.0	1	342.0	3.35	.06
OSLev. by Gender	80.6	1	80.6	.79	.37

11.3.4.2 Staff Only

Across levels of staff, an interesting pattern is visible (Table 11.3.4.2.1) with those in the advanced level displaying significantly lower attitude scores than those of either intermediate or novice levels (Novice vs Intermediate: t= 1.88, df= 33, p< 0.06, 2 tailed; Novice vs Advanced: t= 2.90, df= 27, p< 0.001, 2 tailed; Intermed. vs Advanced: t= 4.73, df= 19.3, p< 0.001, separate variance, 2 tailed).

The MANOVA conducted suggested this (MANOVA (6)) with an F which approached significance and again showed the prevalent pattern of a significant gender difference in attitude scores (females scoring higher, Table 11.3.4.2.1).

No significant difference was found in attitude scores between those of intermediate and novice levels. Due to the small number of staff after dividing them into medical (n=14) or nursing (n=35) staff, their attitude scores were not compared across the hierarchy levels.

Table 11.3.4.2.1 ATTITUDE SCORES ACROSS LEVELS OF STAFF

	MEAN	S.D.	N	M	F
Overall STAFF:	67.67	11.13	49	9	40
STAFF NOVICE LEV.:	68.80	9.14	15	0	15
STAFF INTERMED. LEV.:	73.85	6.77	20	0	20
STAFF ADVANCED LEVEL:	57.64	11.49	14	9	5

MANOVA (6): Attitude Scores by Staff Level (Novice /Intermediate/ Advanced) and by Gender

Source of Var	SS	DF	MS	F	Sig.F
Within Cells	3339.1	45	74.2		
Constant	87081.3	1	87081.3	1173.5	.00
StaffLevel	414.1	2	207.0	2.7	.07
Gender	420.9	1	420.9	5.6	.02
StaffLev by Gender	.0	0	.	.	.

Interaction could not be worked out due to all the novice and intermediate staff being female.

11.3.4.3 Nursing Students Only

Novice nursing students (Table 11.3.4.3.1, Figure 11.3.4.3.1) were found to show significantly less positive attitudes (lower scores) than intermediate or advanced nursing students (Novice vs Intermediate: t= 3.25, df= 51, p< 0.001, 2 tailed; Novice vs Advanced: t= 3.27, df= 57, p< 0.001, 2 tailed; Intermed. vs Advanced: t= 0.27, df= 46, p< 0.78, 2 tailed).

No significant difference occurred between those of intermediate and advanced level of study. Gender was not found to have a significant interaction effect with nursing student level, but as with the subject sample overall (Section 11.3.2) a significant difference occurred in attitude scores within gender (MANOVA (7)).

Table 11.3.4.3.1 ATTITUDE SCORES ACROSS LEVELS OF NURSING STUDENTS

	MEAN	S.D.	N	M	F
NURSING STUDENTS:	65.23	7.83	80	7	73
Novice level:	61.34	7.71	32	3	29
Intermed.level:	68.14	7.04	21	3	18
Advanced level:	67.59	6.80	27	1	26

MANOVA (7): Attitude Scores by Nursing Student Level (Novice/Intermediate/Advanced) & by Gender

Source of Var	SS	DF	MS	F	Sig.F
Within Cells	3645.8	74	49.2		
Constant	76923.0	1	76923.0	1561.3	.00
Level	214.6	2	107.3	2.1	.12
Gender	384.4	1	384.4	7.8	.00
Lev. by Gender	111.6	2	55.8	1.1	.32

11.3.4.4 Medical Students Only

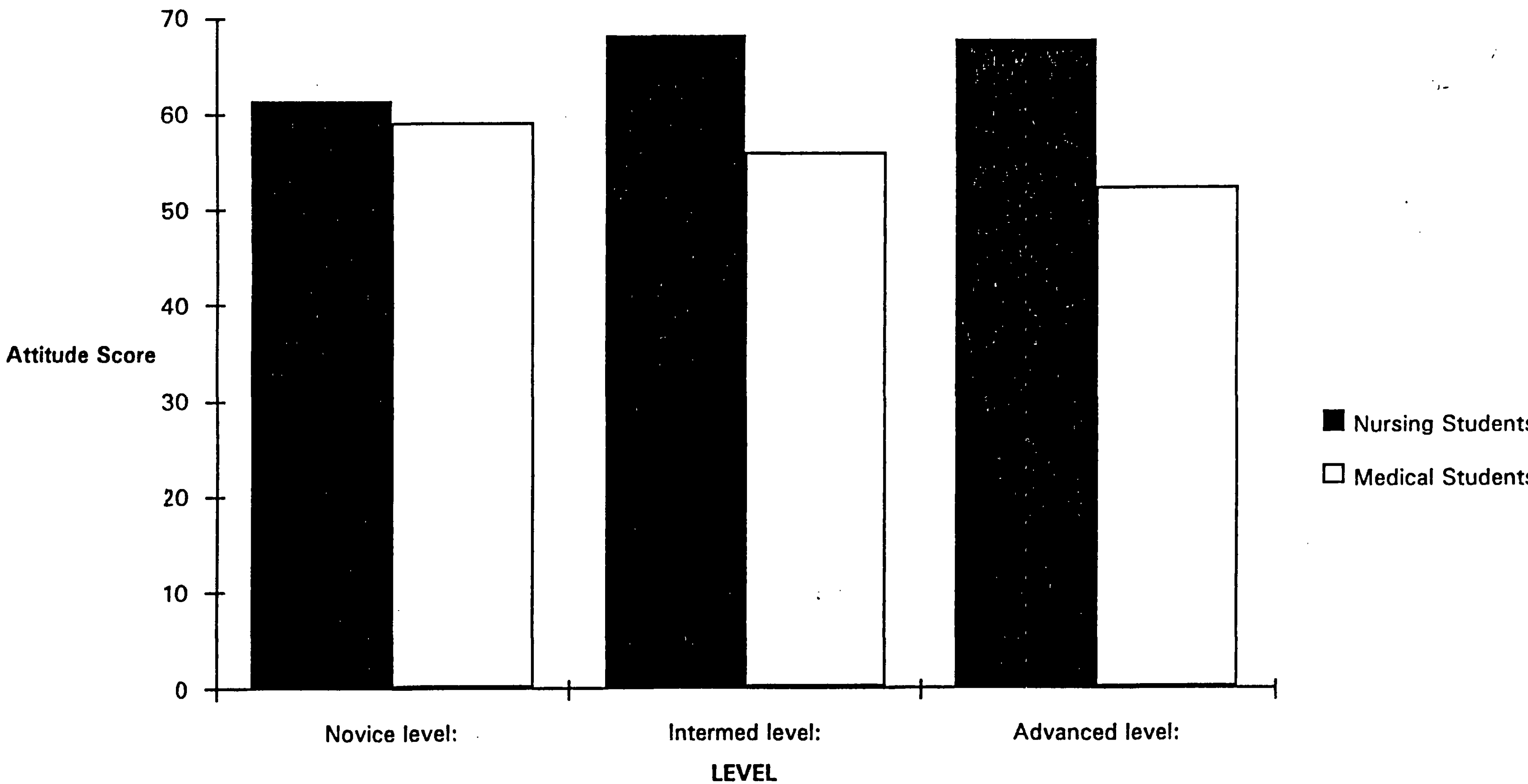
As expected, unlike nursing students, medical students exhibited a gradient of significant drops in attitude score from novice to advanced levels of study (Table 11.3.4.4.1, Figure 11.3.4.3.1).

This is thus in support of the third experimental hypothesis that medical, but not nursing students would show less favourable attitudes towards psychological interventions, the further on they were in their study.

Table 11.3.4.4.1 ATTITUDE SCORES ACROSS LEVELS OF MEDICAL STUDENTS

	MEAN	S.D.	N	M	F
MEDICAL STUDENTS:	55.32	10.80	159	80	79
Novice level:	59.06	7.66	33	16	17
Intermed.level:	55.91	11.14	73	36	37
Advanced level:	52.18	11.27	53	28	25

Figure 11.3.4.3.1 Mean Attitude Scores across Student Level



A-priori, independent, 1-tailed t-tests found significant differences between:

1. Novice as compared to Advanced Students

   ($t= 3.08$, $df= 84$, $p< 0.001$, 1 tailed)

2. Intermediate as compared to Advanced Students

   ($t= 1.84$, $df= 124$, $p< 0.03$)

and a difference approaching significance between:

3. Novice as compared to Intermediate Students

   ($t= 1.47$, $df= 104$, $p< 0.07$, 1 tailed).

These differences were suggested by a MANOVA performed on the data (MANOVA (8)). This MANOVA also indicated that no significant interaction effect occurred between gender and medical student level in attitude scores. However, in disagreement with the prevalent pattern of higher (more positive) attitude scores in females as compared to males, no significant difference was found by the MANOVA (MANOVA (8)) between male and female medical students in their attitude scores.

MANOVA (8): Attitude Scores by Medical Student (Novice/Intermediate/Advanced) and by Gender

Source of Var	SS	DF	MS	F	Sig.F
Within Cells	17093.3	153	111.7		
Constat	443327.6	1	443327.6	3968.1	.00
Level	1004.3	2	502.1	4.4	.01
Gender	.9	1	.9	.0	.92
Lev. by Gender	324.3	2	162.1	1.4	.23

11.3.5 Attitude Scores across Hospitals

No significant differences were found in staff attitude scores (Table 11.3.5.1) between the four hospitals sampled (MANOVA (9), t-tests below).

Table 11.3.5.1 ATTITUDE SCORES ACROSS THE HOSPITALS

	MEAN	S.D.	N	M	F
HOSPITAL 1	68.81	10.80	11	0	11
HOSPITAL 2	68.45	10.58	11	3	8
HOSPITAL 3	66.41	13.74	17	4	13
HOSPITAL 4	67.70	8.11	10	2	8

MANOVA (9): Staff Attitude Scores by Hospital

Source of Var	SS	DF	MS	F	Sig.F
Within Cells	5902.5	45	131.1		
Constant	216208.2	1	216208.2	1648.3	.00
HOSPITAL	48.19	3	16.0	.1	.94

T-tests : Attitude Scores Between Hospitals

	t	df	2 tailed p<
Hospital 1 vs Hospital 2	0.08	20	0.93
Hospital 1 vs Hospital 3	0.49	26	0.62
Hospital 1 vs Hospital 4	0.27	19	0.79
Hospital 2 vs Hospital 3	0.42	26	0.67
Hospital 2 vs Hospital 4	0.18	19	0.85
Hospital 3 vs Hospital 4	0.27	25	0.79

11.3.6 Conclusions

1. Females showed significantly more positive attitude scores towards psychological intervention than males in neonatal units.

2. The Nursing, as compared to Medical profession was found to show significantly more positive attitude scores towards psychological interventions within neonatal units.

   Within the staff sample though, this difference was found to be affected by an underlying gender difference between the Nursing vs Medical staff (Nursing staff consisted solely of females).

   However, this did not account for the significant Nursing vs Medical discipline difference in the student sample.

3. Neonatal unit staff, as compared to students, were found to have significantly more positive attitude scores towards psychological interventions in neonatal units.

   This significant difference though was underpinned by a gender (male/female) interaction effect, such that the significant difference between staff and students was found to occur only with females.

4. With the student sample, no significant differences were found in attitude scores between novice, intermediate and advanced levels of study.

   Nursing novice students were found to show significantly less positive attitudes towards psychological intervention in neonatal units, than intermediate or advanced nursing students, with no significant difference between those of intermediate and advanced level of study.

Medical students, as expected, displayed a significant decrease in attitude scores from novice /intermediate to advanced levels of study with a difference approaching significance between novice as compared to intermediate level students.

5. Across levels of neonatal unit staff, significantly lower attitude scores were found in those of the advanced as compared to those of either the intermediate or novice levels.

6. No significant differences were found in attitude scores between the staff of the 4 hospitals sampled.

11.4 DISCUSSION

11.4.1 Attitudes of Medical vs Nursing Profession

The first experimental hypothesis that those of the medical as compared to nursing profession would harbour less favourable attitudes towards psychological interventions, was supported by the results.

The nursing profession as a whole (students and neonatal unit hospital staff), as compared to the medical profession (students and neonatal unit hospital staff), was found to show significantly more positive attitude scores towards psychological interventions within neonatal units.

Given the cynicism nurtured in the training of medical personnel, it is not surprising that they would be very sceptical, and thus less accepting than the nurses of the valuable role and need for psychological interventions in the neonatal unit.

The training of nurses, on the other hand, centres around the notion of "caring" for patients, both in a physical and psychological sense, thereby accounting for their more positive attitudes towards psychology.

Within the staff (but not student) sample though, this difference between the professions was found to be based upon a gender difference. Overall (both students and staff) females exhibited significantly more positive attitude scores towards psychological interventions in neonatal units, than males.

This was found to account for the significant attitude difference between the medical and nursing professions in neonatal unit staff sample (nursing staff consisting solely of females, whereas medical staff had an approximate equal number of males and females), as the co-variate analysis revealed.

Thus, once the effect of gender was controlled for, no significant difference was found between medical as compared to nursing staff attitudes towards such psychological interventions.

Possibly, gender was not found to account for the significant difference amongst medical as compared to nursing students in their attitudes towards psychological interventions, since the students (except for year 4 nurse and year 5 medical students) had very little practical experience, and thus were formulating their attitudes on the basis of their training and general knowledge alone.

The neonatal unit staff on the other hand had practical experience which may have rendered more positive the attitudes of the medical personnel towards psychological interventions in the neonatal unit, in that they more readily identified the need for such interventions. Equally the small number of males within the staff sample may have accounted for the finding.

The question of why females overall possessed significantly more positive attitudes towards psychological interventions than the males is probably due to the vastly higher number of males coming from the medical (less positive towards psychological intervention) as compared to the nursing (more positive towards psychological intervention) profession.

11.4.2 Attitudes of Staff vs Students

Looking at the second experimental hypothesis that medical and nursing staff, as a consequence of their greater experience, would exhibit more favourable attitudes towards psychological interventions than medical and nursing students, this was also supported in this study.

However, this significant staff-student difference in attitudes towards psychological interventions, was underpinned by a gender (male/female) interaction effect, such that the significant difference between staff and students was found to occur only with females. This could have arisen due to the higher number of females as opposed to males, amongst both staff and students.

Interestingly, across the levels of neonatal unit staff, significantly less positive attitude scores towards psychological interventions, were shown by those of the advanced, as compared to intermediate or novice levels. Possibly, the older form of training, experienced by the more advanced staff, accounted for this, given that it incorporated less psychology/behavioural science than the training of more recent years.

The lack of any significant differences in attitude scores across the hospitals reveals that hospital to which staff belonged did not affect, to any significant degree, their attitudes towards psychological interventions in the neonatal unit. Equally age was found to have no significant relationship to attitude towards psychological interventions in the neonatal unit.

Given that staff were found to show significantly more positive attitudes than students, age would though be expected to be related to attitude scores. However, the larger number of students as compared to staff may have prevented this from being revealed through statistical tests.

11.4.3 Attitudes of Medical vs Nursing students

With regard to the third experimental hypothesis that medical students would show less favourable attitudes towards psychological interventions, the further on they were in their study, whereas nursing students would not show this pattern, was also supported.

Medical students displayed a significant decrease in attitude scores, reflecting less positive attitudes towards psychological interventions, from novice and intermediate to advanced levels of study, with a difference approaching significance between novice as compared to intermediate level students.

On the other hand, nursing novice students showed significantly less positive attitudes towards psychological intervention in neonatal units, than intermediate or advanced nursing students, with no significant difference between those of intermediate and advanced level of study.

These results are understandable in that medical students have been found to become more cynical and less humanistic as their training advances (Eron, 1955, 1958; Weinman, 1989).

As the training of nurses involves psychosocial skills, with psychology perceived as well linked into their training (Peck and Jennings, 1989), in what's been increasingly recognised as a "human science" (Chipman, 1991), it is logical that the more the training received in this, as well as in general neonatology, the greater the appreciation of the role and value of psychological interventions in neonatal units.

The resultant implications are that, for psychological interventions to take place in a greater number of neonatal unit, with an optimal collaborative working research relationship between psychologists and physicians, alterations need to occur in the training of such physicians.

Alterations whereby humanitarianism is nurtured, rather than diminished (Eron, 1955, 1958), cynicism discouraged and a recognition of the value of inter-disciplinary research entrenched, need to occur in medical training.

From the results it is clear that this is not required in the training of nurses, who were found to be quite welcoming to psychological interventions, in the neonatal unit at least. Greater nurse training in research methodology and skills though, proposed as required by Turner (1981), would also ultimately enhance inter-disciplinary research, including that of a psychological nature, conducted in the neonatal unit.

In sum, this study set out to investigate whether, and if so where, there were any unco-operative attitudes towards psychological interventions in the neonatal unit, amongst medical and nursing personnel from the level of student to neonatal unit staff. It identified the medical profession as being in particular need of further psychological education, as well as intervention during training, to minimize the development of cynicism and decrease in humanitarianism.

Additional versions of the questionnaire used, examining attitudes to various aspects of psychological intervention programmes i.e time consumption, financial expenditure and so on, could pave the way for designing more "medically-friendly" psychological interventions.

As a consequence, such programmes would be more likely to get passed by hospital ethical committees more often and have a greater chance of becoming a component of routine medical care.

CHAPTER 12

FINAL CONCLUSIONS

This research set out with a number of questions which will now be revisited.

12.1 Does the "Tac-Tic" programme of supplemental tactile stimulation benefit premature infants in both their short-term and long-term development ? (Chapters 6, 8 and 9)

Across all the studies, the trend was for the experimental, as compared to control infants, to exhibit the younger ages in the variables:

(1) age at first suck of all feeds in a day

(2) age at removal from care in an incubator to care in a cot

(3) age at discharge.

However, the experimental sample was only significantly younger across the final two variables in the first study. In one of the other studies (extension study; Chapter 6) the experimental sample was found to be significantly younger than the control sample in the first variable only.

In the remaining studies which looked at these variables (Chapters 8 and 9) no significant differences were found between the experimental and control samples on these variables. This variance in the significance of effects across the different studies suggests that the effects of the stroking may be dependent upon the sample of infants used.

As noted previously, premature infants are not a homogenous population. Differences in gestational age, birthweight and medical complications may determine how effective any stroking programme is in benefiting preterms on any particular variable.

This is particularly worthy of note since in one study (Chapter 9) high-risk experimental infants were found to first suck all their feeds earlier than the high-risk control group. This difference though was not significant between the low-risk experimental and control samples.

Subtle factors such as variations in pressure of touch used during stroking may also have accounted for the variance in the significance of the results across studies.

The experimental infants also showed a short-term benefit in their better (approaching significance) performance on an instrumental conditioning task than their controls. The benefit in the task performance of the experimental infants may have occurred through an enhancement in their responsivity, alertness and/or state control, benefits in these variables having been found in other programmes of tactile stimulation.

Equally, benefits in these variables may also underlie the significantly higher mental development scores found in experimental as compared to control infants at 15 months. Along with this the significantly higher scores of the experimental as compared to control infants on the behavioural measures of Test-Affect-Extraversion, Activity, Auditory-Visual-Awareness and Social Orientation, could also have contributed to their higher mental development scores.

Elevated parental expectations and the "Hawthorne effect" were recognised as possibly producing the higher experimental scores on these characteristics.

No significant differences were found between the experimental and control samples in long-term motor development. This was not surprising given the discrepant findings of other programmes of tactile stimulation on this measure.

12.2 Does this programme compromise the health of ventilated preterms cared for in neonatal intensive care units ? (Chapter 7)

Tac-Tic was not found to compromise the health of ventilated preterms as no significant increase in heart rate or respiration rate and no significant decrease in tcpo2 occurred during the stroking, all of which would have been indicative of infant distress. After the stroking heart rate in fact decreased significantly though respiration rate was found to increase along with this.

In sum, the stability of the heart rate and tcpo2 measures, before, during and after the stroking is suggestive of improved viability and physiological regulation.

It was thus concluded that the modified version of the stroking does not harm these infants, but may in fact, as with non-ventilated preterms, be beneficial to their development. Further research is needed though before incporating the stroking procedure into the routine care of ventilated infants.

12.3 Are the immediate physiological effects of the tactile stimulation programme in preterms different from those of maternal touching ? (Chapter 7)

No significant differences were found in heart rate, respiration rate or tcpo2, between maternal touching and the Tac-Tic stimulation. However within the maternal touching but not experimenter stroking session, a pattern of decreasing tcpo2 and increasing heart rate (indicitive of distress) was found.

Maternal touching was thus interpreted as having less of a regulating influence than the experimenter stroking.

12.4 What are the immediate gastric effects of this programme in preterms ? (Chapter 8)

A significantly larger drop in gastric ph was found to be occur as a consequence of Tac-Tic stroking. This was interpreted as reflecting a more suitable or prepared stomach environment for digestion than that of the controls. No differences though were found in the short-term measures of daily average weight-gain or food intake between the experimental and control samples.

This may be due weight-gain being monitored only for the duration of the infant's hospitalization, since studies which found benefits in these measures have tended to look at weight-gain over longer periods of time (Schanberg and Field, 1987; Rice, 1977).

Given that preterms in neonatal units receive little positive tactile stimulation or stroking (Blackburn, 1979), it was contended that they may associate such stimulation with feeding which generally includes much positive tactile contact (Day, 1982).

This association was proposed to account for the significant drop in ph and possibly the weight-gain benefits found in studies by other authors. Further validation though of this contention is required.

12.5 What behavioural reactions in the preterm are elicited by this programme and do these vary according to the bodily area being stroked ? (Chapter 10)

Limb reactions (arm and leg movements) were found to be the most common infant reactions elicited by the stroking and this applied to whatever area of the body (head/trunk/limb) was stroked. These reactions were viewed as possibly reflecting the elicitation of the moro reflex and thereby be of significance for attachment.

More precise examination of infant-reactions during stroking programmes, eg. using video-recording, is called for so that more discrete reactions can be detected. These may hold the key for understanding how programmes of tactile stimulation exert their benefits.

12.6 Is parental anxiety and behaviour affected by their involvement in a programme of preterm tactile stimulation ? (Chapter 10)

Both maternal and paternal anxiety during the time period when the intervention was carried out was found to be reduced in the experimental (Tac-Tic stroking intervention) as compared to control (non-intervention) sample.

Parental behaviour was not investigated so no conclusions can be made with regard to whether increased parent-infant interaction accounted for the reduced anxiety in the experimental maternal and paternal samples.

Experimental parents were also found to elicit the same infant-reactions during their individual stroking sessions and to enjoy as well as feeling that their infants enjoyed, this stroking procedure. This suggests that future programmes should employ both fathers and mothers to provide the stimulation rather than just mothers alone.

12.7 What are the attitudes of the medical and nursing professions towards psychological interventions in the neonatal unit ? (Chapter 11)

It was very clear from the results that the nursing profession on the whole (both at student and staff level), had more positive attitudes towards psychological interventions in the neonatal unit than the medical profession. Females overall were also found to be more positive towards such interventions than males.

Differences in the training of nursing as compared to medical personnel, more so than the gender difference, were seen to account for the significant attitude difference of the professions.

The results found in this study illuminate the necessity for psychology, and it's relevance to the medical sphere, to to be taught in more practical ways to medical students.

12.8 Does tactile stimulation benefit high-risk preterms more than those of low-risk ? (Chapters 6, 8 and 9).

As cell numbers were very small when the experimental and control samples were sub-divided to answer this question, it still unclear whether or not those of high-risk benefit more from the Tac-Tic stroking than those of low-risk. Though the pattern of the data suggested this to be true, only the results in study 1 (chapter 6) showed this to be statistically significant.

Variations in the exact gestational age and birthweight used to sub-divide the experimental and control samples into low-risk and high-risk groups, as well as variations in the physical characteristics of samples in the different studies, may also have accounted for the lack of complete consistency in statistical outcome.

12.9 Implications

The implications of this research are manifold.

(1) The Tac-Tic programme of tactile stimulation represents a means of combatting the poorer cognitive and social development found in premature as compared with fullterm populations (Holmes et al., 1988; McGhee and Eckerman, 1983).

(2) The Tac-Tic programme is a cost-effective procedure which can reduce the cost of keeping premature infants in hospital by accelerating their sucking ability, thermoregulation and discharge from the hospital.

(3) The programme serves as an enjoyable means of enhancing both maternal and paternal-infant interaction and reducing parental anxiety in the highly-charged hospital setting where the infant receives little positive tactile contact (Gottfried et al., 1981).

The programme may also be an effective means of enhancing parent-infant interactions where a disturbance has occurred in early infancy eg. in fostered/adopted infants and those hospitalised for long periods of time. Also it may have applications for other patient groups and may assist in comforting those who cannot interact such as stroke and coma patients (Autton, 1989).

(4) Future research in this area could investigate:

(a) the association between positive tactile stimulation and feeding that was proposed to underlie the significantly larger ph drop found after stroking (experimental sample) as compared to after a control period of time (control sample) in the gastric study (Chapter 8).

This association was also proposed to underlie the larger weight-gain findings in stroked as compared to non-stroked infants in other studies.

(b) the benefits in alertness, state control and/or attention duration proposed to underlie the better cognitive task performance found in experimental as compared to control infants in the instrumental conditioning study (Chapter 9).

(5) As the modified version of the Tac-Tic programme had no negative effects on physiological measures of ventilated preterms, there is now a valid arguement for further research using this programme with ventilated preterms.

(6) By finding:

(a) a significant similarity between paternal and maternal stroking-induced reactions in the infant

(b) reduced anxiety in both parents as a consequence of the programme

(c) that both parents enjoyed stroking their infant

this research suggests the use of both fathers and mothers in future intervention programmes.

(7) the medical profession has been identified as a population where greater awareness of the significance of psychological research is required, in order that intervention programmes and collaborative medical-psychological research in the neonatal unit can take place.

To conclude, this research has examined a number of aspects of the Tac-Tic stimulation programme and has demonstrated that there is considerable scope for future investigation and promotion of intervention with preterm infants using structured tactile stimulation.

REFERENCES

Adams, J., Hayes, J. and Hopson, B. (1976) *Transition*. London: Robertson.

Adamson-Macedo, (1991) Stroking, emotion and cognition: 11 years on. *Newsletter of the Association of Paediatric Chartered Physiotherapists, August,* 6-14.

Ader, R. (1969) Effects of early experience on subsequent emotionality and resistance to stress. *Psychological Monographs, 73*, 2.

Adkinson, C.D. and Berg, W.K. (1976) Cardiac deceleration in newborns: Habituation, dishabituation and offset responses. *Journal of Experimental Child Psychology, 21,* 46-60.

Affleck, G., Terran, H., Allen, D. and Gershman, K. (1986) Perceived social support and maternal adaptation during the transition from hospital to home: Care of high risk infants. *Infant Mental Health Journal, 7,* 6-18.

Affleck, G., Terran, H. and Gershman, K. (1985) Cognitive adaptations to high risk infants: The search for meaning, mastery and protection from future harm. *American Journal of Mental Deficiency, 89,* 653-656.

Ainsworth, M.D.S. (1972) Attachment and dependency: A comparison. In J.L. Gewirtz (Ed.) *Attachment and dependency.* Washington D.C.: Wiley.

Als, H. (1981) The behaviour of the premature infant. Paper presented at the *Caring for Special Babies Conference, University of N.Carolina, Chapel Hill,* May 11.

Altman, G., Das, G.D. and Anderson, W.Y. (1968) Effects of handling on the morphological development of the rat brain: An exploratory study. *Developmental Psychobiology, 1,* 10-20.

Ambrose, A., (1969) *Stimulation in early infancy.* London: Academic Press.

American Academy of Pediatrics (1977) *Standards and recommendations for hospital care of newborn infants.* Springfield Ill.: American Academy of Pediatrics Publications.

Amiel-Tison, C. (1968) Neurological evaluation of maturity of newborn infants. *Archives of Disease in Childhood, 43,* 89-93.

Anagnostakis, D., Petmezakis, J., Messaritakis J. et al. (1980) Noise pollution in neonatal units: A potential health hazard. *Acta Pediatrica Scandanavia, 69,* 771.

Anderson, J. (1986) Sensory intervention with the premature infant in the neonatal unit. *American Journal of Occupational Therapy, 40,* 19-27.

Anderson, G.C. and Vidyasagar, D. (1979) Development of non-nutritive sucking in premature infants from 1-7 days post-birth. *Birth Defects, 15,* 145-171.

Andre-Thomas and Autgarden, S. (1953) Les deux marches. *Presse Med., 61,* 582-584.

Apgar, V. (1953) A proposal for a new method of evaluation of the newborn infant. *Current Research in Anaesthesia and Analgesia, 32,* 260-267.

Apgar, V. and James, L.S. (1962) Further observations on the newborn scoring system. *Pediatric Clinics of North America, 13,* 645-650.

Autton, N. (1989) *Touch: An exploration.* London: Darton, Longman and Todd.

Avery, G.B. and Fletcher, A.B. (1981) Nutrition. In G.B. Avery (Ed.), *Neonatology: Pathophysiology and management of the newborn.* Philadelphia: Lippincott.

Bachrach, U. (1973) *Functions of naturally occuring polyamines*. New York: Academic Press.

Bakeman, R. and Brown, J.V. (1980) Early interaction: Consequences for social and mental development at three years. *Child Development, 41*, 437-447.

Bakketels et al., (1977) Cited in D.M. Reed and F.J. Stanley (Eds.) *The epidemology of prematurity*. Baltimore: Urban and Schwarzenberg.

Bakwin, H. (1949) Emotional deprivation in infants. *Journal of Pediatrics, 35*, 512-521.

Barnard, K.E. (1972) The effects of stimulation on the duration and amount of sleep and wakefulness in preterm infants. *PhD thesis, University of Washington, Washington D.C.*, microfilm no. 1938.

Barnard, K.E. and Bee, H.L (1983) The impact of temporally patterned situations on the development of preterm infants. *Child Development, 54*, 1156-1167.

Barnett, C., Leiderman, P.H., Grobstein, R. and Marshall, K. (1970), (Eds.), Neonatal separation: The maternal side of interactional deprivation. *Pediatrics, 45*, 197-205.

Barrera, M.E. and Maurer, D. (1981) Recognition of mother's photographed face by the three-month-old infant. *Child Development*, 52, 714-716.

Barrera, M.E., Rosenblum, P.L. and Cunningham, C.E. (1986) Early home intervention with low-birthweight infants and their parents. *Child Development, 51*, 437-447.

(1987) Corrected and uncorrected Bayley scores: Longitudinal developmental patterns in low and high birthweight preterm infants. *Infant Behaviour and Development, 10*, 337-346.

Bass, C.A., Smith, J.S. and Ducker, D.A. (1986) The use of a computer-linked monitoring system for the continuous collection of physiological and environmental data from neonates undergoing intensive care (p40-48). In P. Rolfe (Ed.) *Neonatal physiological measurement*. London: Butterworth.

Bayley, N. (1968) Behavioural correlates of mental growth: Birth to 36 years. *American Psychologist, 23,* 1-17.

(1969) *Bayley scales of infant development.* New York: Psychological Corporation.

Bayley, N. and Schaefer, E.S. (1964) Correlations of maternal child behaviours with the development of mental abilities: Data from the Berkeley growth study. *Monographs of the Society for Research in Child Development, 29,* (Whole No. 97).

Beckwith, L. (1971) Relationship between attributes of mothers and their infants' I.Q. scores. *Child Development, 42,* 1083-1097.

Bell, E.F., Neidich, G.A., Cashore, W.J. et al (1979) Combined effect of radiant warmer and phototherapy on insensible water loss in low-birthweight infants. *Journal of Pediatrics, 94,* 810.

Bell, R. and Costello, N. (1964) Three tests for sex differences in tactile sensitivity in the newborn. *Biologica Neonatorium, 7,* 335-347.

Bell, R., Reisner, G. and Linn, T. (1961) Recovery from electrodermal shock as a function of infantile stimulation. *Science, 1,* 1428.

Belsky, J. (1979) Mother-father-infant interaction: A naturalistic observation study. *Developmental Psychology, 16*, 601-607.

Benjamin, J. (1978) In A. Montagu (1978) *Touching: The human significance of the skin.* New York: Harper and Row.

Bennett, E.L., Diamond, M., Krech, D. and Rosenzweig, M.R. (1964) Chemical and anatomical plasticity in the brain. *Science, 146,* 610-619.

Bennett, D.E. and Slade, P. (1991) Infants born at risk: Consequences for maternal post-partum adjustment. *British Journal of Medical Psychology, 64,* 159-172.

Bensel, and Paxson, (1977) Cited in S.L. Friedman and M. Sigman (Eds.) *Preterm birth and psychological development.* New York: Academic Press.

Berendes, H. (1963) Prematurity. *Transactions of the New England Obstetrical and Gynecological Society, 7,* 205-206.

Berg, W.K. and Berg, K.M. (1987) Psychophysiological development in infancy: State, startle and attention (p238-317). In J.D. Osofosky (Ed.) *Handbook of infant development (2nd Ed.).* New York:

Bernbaum, J., Pereira, G.R., Watkins, J.B. and Peckham, G.J. (1983) Nonnutritive sucking during gavage feeding enhances growth and maturation in premature infants. *Pediatrics, 71,* 41-45.

Bernstein, L. (1952) A note on Christie's experimental naivete and experiential naivete. *Psychological Bulletin, 49,* 38-40.

Berry, M., Bradley, P.H., and Borges, S. (1978) Environmental and genetic determinants of connectivity in the central nervous system (p133-148). In M.A. Corner, R.E. Baker, N.E. Pol, D.F. Swaab and H.B.M. Ulyings (Eds.) *Maturation of the nervous system, progress in brain research (Vol. 48)*. Amsterdam: Elsevier.

Bess, F.H., Peck, B.F. and Chapman, J.J (1979) Further observations on noise levels in infant incubators. *Pediatrics, 63,* 100-106.

Birns, B. (1965) Individual differences in human neonates responses to stimulation. *Child Development, 36,* 249-256.

Birns, B., Blank, M. and Bridger, W.H. (1966) The effectiveness of various soothing techniques on human neonates. *Psychosomatic Medicine, 28,* 316-322.

Bjere, I. and Hansen, E. (1976) Psychomotor development and school adjustment of 7 year old children with low birthweight. *Acta Paediatrica Scananavica, 65,* 88-96.

Blackburn, S. (1979) The effects of caregiving activities in the neonatal unit on the behaviour and development of premature infants. *PhD thesis, University of Washington, Seattle.*

Bloom, B. (1964) *Stability and change in human characteristics.* New York: Wiley.

Blumberg, N. (1980) Effects of neonatal risk, maternal attitude and cognitive style on early postpartum adjustment. *Journal of Abnormal Psychology, 89,* 139-150.

Bobath, B. (1972) The neurodevelopmental approach to treatment in physical therapy sevices. In P.Pearson and C. Williams, (Eds.), *Developmental disabilities.* Illinois: Thomas, Springfield.

Bogen, H. (1967) Conditioning gastric secretions (p231-236). In Y. Brackbill and G.G. Thompson (Eds.) *Behaviour in infancy and early childhood.* New York: The Free Press.

Bolles, R.C. (1972) Reinforcement, expectancy and learning. *Psychological Review, 79,* 394-407.

Bovard, G.W. (1958) Effects of early handling on the viability of the albino rat. *Psychological Review, 65,* 257-271.

Bovard, E.W. and Newton, D.G. (1953) Systematic early handling and prolonged experience with the mother as developmental variables in the male albino rat. *Animal Care Panel Process, 6,* 67-74.

Bower, T.G.R. (1974) *Development in infancy (2nd Ed.).* San Francisco: W.H. Freeman.

Bowes, W.A., Brackbill, Y., Conway, E. and Steinschneider, A. (1970) The effects of obstetrical medication on the fetus and infant. *Monographs of the Society for research into Child Development, Serial No. 137,* 35.

Bowlby, J. (1969) *Attachment and loss. Vol.1 Attachment.* New York: Basic Books.

Brachfeld, S., Crolberg, S. and Soloman, J. (1980) Parent-infant interaction in free play at 8 and 12 months: effects of prematurity and immaturity. *Infant Behaviour and Development, 3,* 289-305.

Brackbill, Y. (1973) Continuous stimulation reduces arousal level: Stability of the effect over time. *Child Development, 44,* 43-46.

Brackbill, Y. and Fitzgerald, H.E. (1969) Development of the sensory analyzers during infancy (p173-208). In *L.P. Lipsitt and H.W. Reese, Advances in child development and behaviour (Vol.4).* New York: Academic Press.

Brackbill, Y. et al. (1973). Cited in R.H. Woodson (1983) Newborn behaviour and the transition to extrauterine life. *Infant Behaviour and Development, 6,* 139-144.

Bradley, R. (1982) The HOME inventory: A review of the first 15 years (p87-100). In W. Frankenburg, N. Anastasiow and A. Fandal, (Eds.), *Identifying the developmentally delayed child.* Baltimore: University Park Press.

Bradley, R.H., Caldwell, B.M., Rock, S.L., Barnard, K.E., Gray, C. et al. (1989) Home environment and cognitive development in the first 3 years of life: A collaborative study involving 6 sites and 3 ethnic groups in North America. *Developmental Psychology, 25,* 217-235.

Brake, S.C., Fifer, W.P., Alfasi, G. and Fleischman, A. (1988) The first nutritive sucking responses of premature newborns. *Infant Behaviour and Development, 11,* 1-19.

Brazelton, T.B (1973) *The neonatal behavioural assessment scale.* Philadelphia: Lippincott.

(1981) Working with other disciplines (p65-67). In K. Bloom (Ed.), *Prospective issues in infancy research.* New Jersey: Erlbaum.

Bridger, W.H. (1962) Sensory discrimination and autonomic function in the newborn. *Journal of American Acadamy of Child Psychiatry, 1*, 67-82.

(1965) In U. Bronfenbrenner and M.A. Mahoney (Eds., 1975) *Influences in human development*. Hillsdale, Illinois: Dryden Press.

Bridger, W.H. and Riesen, M. (1959) Psychophysiological studies of the neonate: An approach toward the methodological and theoretical problems involved. *Psychosomatic Medicine, 21*, 265-276.

Brody, S. (1951). Cited in S. Brody (1956) *Patterns of mothering*. New York: International Universities Press.

(1956) *Patterns of mothering*. New York: International Universities Press.

Brooker, H. (1955) The effect of amount of early handling on weight gain in the albino rat. *PhD theis, University of Toronto, Toronto.*

Brousard, L.M. and DeCarie, T.G. (1971) The effects of three kinds of perceptual-social stimuli on the development of institutional infants. *Early Child Development and Care, 1*, 11-30.

Brown, C.C. (1984) *The many facets of touch*. New York: Johnson and Johnson Baby Products Co., Pediatric Clinics Round Table Series (No. 10).

Brown, C.D. (1971) Cholinergic activity in rats following enriched stimulation and training: Direction and duration of effects. *Journal of Comparative and Physiologoical Psychology, 75*, 408-416.

Brown, J. (1972) Instrumental control of sucking response in the human newborn. *Journal of Experimental Child Psychiatry, 14*, 66-80.

Brown, J. and Bakeman, R. (1979) Relationships of human mothers with their infants during the first year of life: Effects of prematurity. In R. Bell and W. Smotherman (Eds.) *Maternal influences and early behaviour*. Holliswood, New York: Spectrum.

Brown, J. and Helper, R. (1976) Stimulation - a corollary to physical care. *American Journal of Nursing, 76*, 578-581.

Brown, J., LaRossa, M.M, Aylward, G.P., Davis, D.J., Rutherford, P.K. and Bakeman, R. (1980) Nursery based intervention with prematurely born babies and their mothers: Are there effects ?. *Journal of Pediatrics, 97*, 487-491.

Bruner, J.S. (1965) *On knowing: Essays for the left hand*. New York: Atheneum.

(1969) Eye, hand and mind. In D. Elkind and J.H. Flavell (Eds.) *Studies in cognitive development*. London: Oxford University Press.

(1973) *Beyond the information given*. New York: W.W. Norton.

Buium, N., Rynders, J. and Turnure, J. (1974) Early maternal linguistic environment of normal and Down's syndrome language-learning children. *American Journal of Mental Deficiency, 79*, 52-58.

Buka, S.L. and Lipsitt, L.P. (1991) Newborn sucking behaviour and its relation to grasping. *Infant Behaviour and Development, 14*, 59-67.

Burroughs, A.K., Asonye, U.O., Anderson-Shanklin, G.C. and Vidyasagar, D. (1978) The effect of nonnutritive sucking on transcutaneous oxygen tension in noncrying, preterm infants. *Research in Nursing and Health, 1,* 69-75.

Butler, S.R. and Schanberg, S.M. (1977) Effect of maternal deprivation on polyamine metabolism in pre-weanling rat brain and heart. *Life Science, 21,* 877-884.

Butler, S.R., Suskind, M.R. and Schanberg, S.M. (1978) Maternal behaviour as a regulator of polyamine biosynthesis in brain and heart of the developing rat pup. *Sciences, 21,* 877-884.

Butterfield, P.M. and Miller, L. (1984) Read your baby. *Infant Mental Health Journal, Summer.*

Byrne, J.M. and Degen-Horowitz, F. (1981) Rocking as a soothing intervention: The influence of direction and type of movement. *Infant Behaviour and Development, 4,* 207-218.

Caldwell, B.M. and Bradley, R.H. (1978) *Manual for the H.O.M.E observation measurement of the environment.* Little Rock, Arkansas: University of Arkansas Press.

(1984) HOME observation for measurement of the environment. *Unpublished manuscript.* Little Rock, Arkansas: University of Arkansas Press.

Cameron, H.C. (1922) Suction difficulties of young infants. *The Lancet, 1,* 936-938.

Campbell, S.K. (1982) Effects of developmental intervention in the special care nursery. *Journal of Developmental and Behavioural Pediatrics, 4,* 165-179.

Caputo, D.V., Goldstein, K.M. and Taub, H.B. (1979) The development of prematurely born children through middle childhood. In T.M. Field, A.M. Sostek and H.H. Shuman (Eds.), *Infants born at risk: Behaviour and development.* New York: SP Medical and Scientific Books.

Caputo, D.V. and Mandell, W. (1970) Consequences of low birthweight. *Developmental Psychology, 3,* 363-383.

Caputo, D.V., Taub, H.B., Goldstein, K.M., Smith, N., Dalack, J.D., Pusner, J.P. and Silverstein, R.M. (1974) An evaluation of various parameters of maturity at birth as predictors of development at 1 year. *Perceptual and Motor Skills, 39,* 631-652.

Carlsson, S.G., Fagerberg, H., Horneman G., Hwang C.P., Larsson K., Rodholm N., Schaller J., Danielsson B. and Grundewall, C. (1978) Effects of amount of contact between mother and child on mother's nursing behaviour. *Developmental Psychobiology, 11,* 143-150.

(1979) Effects of various amounts of contact between mother and child on the mother's nursing behaviour: A follow-up study. *Infant Behaviour and Development, 2,* 209-214.

Carlton, P.L. (1969) Brain acetylcholine and inhibition. In J. Trapp (Ed.) *Penferome: Current research and theories.* New York: Academic Press.

Carmichael, L. (1934) An experimental study in the prenatal guinea pig, of the origin and development of reflexes and patterns of behaviour, in relation to the stimulation of specific receptor areas during the period of active fetal life. *Genetic Psychology Monographs, 16,* 337-491.

(1946) *Carmichael's manual of child psychology.* New York: Wiley.

Caron, A.J. and Caron, R.F. (1981) Processing of relational information as an index of infant risk (p219-240). In S.L. Friedman and M. Sigman (Eds.) *Preterm birth and psychological development*. New York: Academic Press.

Carstairs, G.M., Walton, H.J., Smythies, J.R. and Chrisp, A.L. (1968) Survey of undergraduate psychiatry teaching in the United Kingdom. *British Journal of Psychiatry, 114*, 1411-1416.

Casler, L. (1965) The effects of extra tactile stimulation on a group of institutionalized infants. *Genetic Psychology Monographs, 71*, 137-175.

Cassady, G. (1970) Body composition in intrauterine growth retardation. *Pediatric Clinics of North America, 17*, 159-167.

Chamberlain, R.W. (1973) New knowledge in early child development: Its' importance for pediatrics. *American Journal of Disease in Children, 126*, 583-587.

Chapman, J.S. (1978) The effect of preterm infants' decreasing mortality on their future morbidity: Preliminary examination of long-term outcomes of stimulation programmes for preterm infants. *Nursing Papers, 10*, 31-54.

(1979) Influence of varied stimuli on development of motor patterns in the premature infant. In G. Anderson and B.Raff (Eds.) *Newborn behavioural organization: Nursery research and implications*. New York: A.R. Liss.

(1984) In L.A. Wattley and D.J. Muller, *Investigating Psychology: a practical approach for nursing*. London: Harper and Row.

Chickermore, A.S., Majumdar, G.R. and Shah, A.P. (1969) The use of maturity score in the assessment of gestational age of newborn babies with special reference to preterms. *Indian Pediatrics, 6,* 720-728.

Chipman, Y. (1991) Caring: Its meaning and place in the practice of nursing. *Journal of Nursing Education, 30,* 171-175.

Choi, M. (1973) A comparison of maternal psychological reactions to premature and full-size newborns. *Maternal Child Nursing Journal, 2,* 1-13.

Clark, D.L., Kreutzberg, J.R. and Chee, F.K.W. (1977) Vestibular stimulation influence on motor development in infants. *Science, 196,* 1228-1229.

Clarke, A.M. and Clarke, A.D.B. (1976) *Early experience: myth and evidence.* New York: The Free Press.

Clarke-Stewart, K.A. (1973) Interaction between mothers and their children: characteristics and consequences. *Monographs of the Society for Research in Child Development, 39,* 6-7, serial no. 153.

Clarkson, M. and Berg, W.K. (1977) Cardiac deceleration in neonates is influenced by temporal pattern and spectral complexity of auditory stimuli. Paper presented at the meeting of the *Society for Psychophysiological Research*, Philadelphia.

Clay, V.S. (1966) The effect of culture on mother-child tactile communication. *PhD thesis, Teacher's College, Columbia University, Columbia.*

Clifton, R. (1971) Heart rate conditioning in the newborn infant. Paper presented at the meeting of the *Society of Psychopysiological Research.* St. Louis, November.

(1974) Heart rate conditioning in the newborn infant. *Journal of Experimental Child Psychology, 13,* 43-57.

Clifton, R.K., Meyers, W.J. and Solomons, G. (1972) Methodological problems in conditioning the head turning response of newborn infants. *Journal of Experimental Child Psychology, 13,* 29-42.

Cobb, S. (1976) Social support as a moderator of life stress. *Psychosomatic Medicine, 38,* 300-314.

Cohen, D.J. (1967) The crying newborn's accomodation to the nipple. *Child Development, 38,* 89-100.

Cohen, S.E. (1986) The low birthweight infant and learning disabilities. In M. Lewis (Ed.) *Learning disabilities and prenatal risk.* Urbana, Illinois: University of Illinois Press.

Cohen, S.E. and Beckwith, L. (1979) Preterm infant interaction with the caregiver in the first year of life and competence at age two. *Child Development, 50,* 767-776.

Cohen, S.E. and Parmelee, A.H. (1983) Prediction of 5 year Stanford-Binet scores in premature infants. *Child Development, 54,* 1242-1253.

Condillac, G. Carr (1754 p71) Cited in Morgan M.J. (1977) *Molyneaux's question. Vison, touch and the philosophy of perception.* London: Cambridge University Press.

Condon, W.S. and Sander, L.W. (1974) Synchrony demonstrated between movements of the neonate and adult speech. *Child Development, 45,* 456-462.

Conel, J.L. (1939) *The postnatal development of the human cerebral cortex 1: cortex of the newborn*. Cambridge: Harvard University Press.

Corliss, C.E. (1976) *Human embryology*. New York: McGraw-Hill.

Cornell, E.M. and Gottfried, A.W. (1976) Intervention with premature human infants. *Child Development, 47*, 32-39.

Corrigan, F.C., Berger, S.I., Dientsbier, R.A. and Strok, E.S. (1967) The influence of prematurity on school performance. *American Journal of Mental Deficiency, 71*, 533-535.

Creutzfeldt, O.D. and Heggelund, P. (1975) Neural plasticity in visual cotrex of adult rats after exposure to visual patterns. *Science, 188*, 1025-1027.

Crnic, K.A., Greenberg, M.T., Ragozin, A.S., Robinson, N.M. and Basham, R.B. (1983) Effects of stress annd social support on mothers and premature and full-term infants. *Child Development, 54*, 209-217.

Crnic, K.A., Ragozin, A.S., Greenberg, M.T. et al. (1983) Social interaction and developmental competence of preterm and fullterm infants during the first year of life. *Child Development, 54*, 1199-1210.

Crockenberg, S.B. (1981) Infant irritability, mother responsiveness and social influences on the security of infant-mother attachment. *Child Development, 52*, 857-865.

Cronly-Dillen, J. and Perry, G.W. (1979) Effect of visual experience on tubulin synthesis during a critical period of visual cortex development in the hooded rat. *Journal of Physiology, 292*, 469-484.

Crook, C.K. (1979) The organization and control of infant sucking. *Advances in Child Development and Behaviour, 14,* 209-252.

Cross, H.A., Halcomb, C.G. and Malter, W.W. (1967) Imprinting or exposure learning in rats given early auditory stimulation, *Psychonomic Science, 7,* 233-234.

Cross, H.A., Stothers, T.K. and Stratton, D. (1975) An indirect estimate of total brain energy metabolism in the newborn infant. *Journal of Physiology, 250,* 15.

Crosse, V.M. (1963) Prematurity. *Medical Journal of Australia, 2,* 1009-1014.

Daum, C., Kurtzberg, D., Ruff, H. and Vaughan, H.G. (1980) Preterm development of visual and auditory orienting responses in very low birth infants. *Pediatric Research, 14,* 432.

David, M. and Appell, G. (1961) A study of nursing care and nurse - infant interaction. In R.C. Davis (1950) Motor responses to auditory stimuli above and below threshold *Journal of Experimental Psychology, 40,* 107-120.

Davis, J.M. and Rovee-Collier, C.K. (1983) Allieviated forgetting of a learned contingency in 8-week-old infants. *Developmental Psychology, 19,* 353-365.

Day, S. (1982) Mother-infant activities as providers of sensory stimulation. *American Journal of Occupational Therapy, 36,* 579-585.

DeCasper, A.J. and Fifer, W.P. (1980) Human bonding: Newborns prefer their mothers voices. *Science, 208,* 1174-1176.

DeChateau, P. (1976) Influence of early contact on maternal and infant behaviour on primiparae. *Birth and Family Journal, 3*, 149-155.

(1980) Early postpartum contact and later attitudes. *International Journal of Behavioural Development, 3*, 273-286.

DeChateau, P. and Wiberg, B. (1977) Longterm effect on mother-infant behaviour of extra contact during the first hour post-partum: First observatoins at 36 hours: follow-up at 3 months. *Acta Paediatrica Scandanavica, 66*, 137-143, 145-151.

DeHirsch, K., Jansky, J. and Langford, W.S. (1966) Comparisons between prematurely and maturely born children at three age levels. *American Journal of Orthopsychiatry, 36*, 618-628.

Dember, W.N. and Earl, R.W. (1957) Analysis of exploratory, manipulatory and curiosity behaviour. *Psychological Review, 64*, 91-96.

Denckla, M.B. (1978) Minimal brain dysfunction (p223-268). In J. Chall and A. Mirsky (Eds.) *Education and the brain. 77th yearbook of the National Society for the study of Education*. Chicago: University of Chicago Press.

Denelsky, G.Y. and Denenberg, V.H. (1967) Infantile stimulation and adult exploratory behaviour in the rat: Effects of handling upon tactual variation seeking. *Journal of Physiological Psychology, 63*, 309-312.

Denenberg, V.H. (1962) Effects of early experience (p109-138). In E.S.E. Hafez (Ed.) *The behaviour of domestic animals*. London: Bailliere, Tindall and Cox.

(1964) Critical period, stimulus input and emotional reactivity. A theory of infant stimulation. *Psychological Review, 71,* 335-351.

(1969) Open field behaviour in rats. *Annals of the New York Academy of the Sciences, 159,* 852-859.

Denenberg, V.H. and Karas, G.G. (1959) Effects of differential handling upon weight gain and mortality in the rat and mouse. *Science, 130,* 629-630.

Denenberg, V.H. and Morton, J.R.C. (1962) Effects of preweaning and postweaning manipulations upon problem-solving behaviour. *Journal of Comparative and Physiological Psychology, 55,* 1096-1098.

De Sa, D.J. (1969) Analysis of certain factors in the aetiology of respiratory distress syndrome of the newborn. *Journal of Obstetrics and Gynecology of the British Commonwealth,* 76, 148-153.

Deutsch, J.A. (1966) Substrates of learning and memory. *Diseases of the C.N.S., 27,* 20-24.

Dewey, J. (1938) *Logic: The theory of inquiry.* London: Allen and Unwin.

DiPetro, J.A., Larson, S.K. and Porges, S.W. (1987) Behavioural and heart-rate pattern differences between breast-fed and bottle-fed neonates. *Developmental Psychology, 23,* 467-474.

Dittman, (1968, Ed.) *Early child care: New perspectives.* New York: Atherton Press.

DiVitto, B. and Goldberg, S. (1979) The development of parent-infant interaction as a function of medical status. In T.M. Field, A. Sosteck, S. Goldberg and H. Shuman (Eds.), *Infants born at risk*: New York: Spectrum.

Dobbing, J. (1975) Human brain development and its vulnerability (p3-12). In *Mead Johnson symposium on Perinatal and Developmental Medicine (No. 6): Biologic and clinical aspects of brain development.*

Douek, E., Bannister, L.H., Dodson, H.C., Ashcroft, P. and Humphries, K.N. (1976) Effects of incubator noise on the cochlea of the newborn. *The Lancet,* 1110.

Dreyfus-Brisac, C. (1970) Ontogenesis of sleep in human prematures after 32 weeks of conceptual age. *Developmental Psychobiology, 3,* 91-121.

Drillen, C.M. (1964) *The growth and development of the prematurely born infant.* Baltimore: Williams and Wilkins.

(1967) The incidence of mental and physical handicaps in school age children of very low birth weight. *Pediatrics, 39,* 238 ff.

Dubignon, J. and Campbell, D. (1969) Sucking in the newborn during a feed. *Journal of Expererimental Child Psychology, 7,* 282-298

Dubignon, J., Campbell, D., Curtis, M. and Partington, M. (1969) The relation between laboratory measures of sucking, food intake and peri-natal factors during the newborn period. *Child Development, 40,* 1107-1120.

Duc, G., Bucher, H.U. and Micheli, J.L. (1975) Is transcutaneous PO2 reliable for arterial oxygen monitoring in newborn infants ? *Pediatrics, 55,* 566-567.

Dunbar, J. (1977) Maternal contact behaviours with newborn infants during feedings. *Maternal Child Nursing Journal, 6,* 209-294.

Dunn, J. (1977) *Distress and comfort.* Cambridge: Harvard University Press.

Dunn, H.G. (1986) Neurological, psychological and opthalmological sequelae of low birthweight. In H.G. Dunn (Ed.), *Sequelae of low birthweight: The Vancouver study*. London: MacKeith Press.

Eberhard, P. and Mindt, W. (1976) *An introduction to cutaneous oxygen monitoring in the neonate*. Basel, Switzerland: F. Hoffman-LaRoche.

Ehrlich, A. (1959) Effecys of past experience on exploratory behaviour in rats. *Canadian Journal of Psychology, 13*, 248-254.

Eisenberg, E.B., Coursin, D.B. and Rupp, N.R. (1966) Habituation to an acoustic pattern as an index of differences among human neonates. *Journal of Auditory Research, 6*, 239-248.

Elardo, R. and Bradley, R. (1981) The Home Observation for Measurement of the Environment: A review of research. *Developmental Review, 1*, 113-145.

Elder, M.S. (1970) The effects of temperature and position on the sucking pressure of newborn infants. *Child Development, 41*, 95-102.

Elliot, M.R., Fisher, K. and Ames, E.W. (1988) The effects of rocking on state and respiration of normal and excessive cryers. *Canadian Journal of Psychology, 42*, 163-172.

Ellis, and Lawley, (1951) Cited in T.M. Field, A.M. Sostek and H.H. Shuman (1983, Eds.) *Infants born at risk: Behaviour and development*. New York: SP Medical and Scientific Books.

Ellison, S.L., Vidyasagar, D. and Anderson, G.C. (1979) Sucking in the newborn infant during the first hour of life. *Journal of Nursing-Midwifery, 24*, 18-25.

Elmer, E. and Gregg, G.S. (1967) Developmental characteristics of abused children. *Pediatrics, 40*, 506-602.

Engel, G.L. (1977) The need for a new medical model: A challenge for biomedicine. *Science*, 196, 129-136.

Eron, L.D. (1955) Effect of medical education on medical student attitudes. *Journal of Medical Education, 30*, 339-366.

(1958) Effect of medical education on attitudes: A follow-up study. *Journal of Medical Education, 33*, 25-33.

Erway, L.C. (1975) Otolith formation and trace elements: A theory of schizophrenic behaviour. *Journal of Orthomolecular Psychiatry, 4*, 16-26.

Escalona, S.K. (1968) *The roots of individuality*. Chicago: Aldine Publishing Co.

(1970) *The roots of individuality*. London: Tavistock.

Evoniuk, G.E., Kuhn, C.M. and Schanberg, S.M. (1979) The effect of tactile stimulation on serum growth hormone and tissue ornithine decarboxylase activity during maternal deprivation in rat pups. *Communications in Psychopharmacology, 3*, 363-370.

Eysenck, H.J. (1963) The biological basis of personality. *Nature, 199*, 1031-1034.

Fagan, J.W. and Twarg-Singer, L. (1981) Intervention during infancy: General considerations. In S.L. Friedman and M. Sigman (1981, Eds.) *Preterm birth and psychological development* New York: Academic Press.

Fardig, J.A. (1980) A comparison of skin to skin contact and radiant heaters in promoting neonatal thermoregulation. *Journal of Nurse Machinery, 25,* 19-28.

Fenner, A., Muller R., Busse, H.G., Junge, M. and Wolfsdorf, J. (1975) Transcutaneous determination of arterial oxygen tension. *Pediatrics, 55,* 224-231.

Ferchmin, P.A., Bennett, E.L. and Rosenzweig, M.R. (1975) Direct contact with enriched environment is required to alter cerebral weights in rats. *Journal of Comparative Physiology, 88,* 360-367.

Ferchmin, P.A. and Eterovic, V.A. (1977) Brain plasticity and environmental complexity: role of motor skills. *Physiological Behaviour, 18,* 455-461.

Fernandez, U. (1918) Puericulta post-natal recien nacido algunos fenomenos fisiologicos immediatos al semana. *Nacimento Med., 25,* 115-118.

Fetters, (1980) Cited in S. Goldberg and B. Divitto (1983) *Born too soon: Preterm birth and early development.* San Francisco, CA: W.H. Freeman and Company.

Field, T.M. (1977a) Maternal stimulation during infant feeding. *Developmental Psychology, 13,* 539-540.

(1977b) The effects of early separation, interactive deficits and experimental manipulation on infant-mother and face to face interaction. *Child Development, 48,* 763-771.

(1978) The three Rs of infant-adult interactions: Rhythms, repertoires and responsivity. *Journal of Pediatric Psychology, 3,* 131-136.

(1979) Games parents play with normal and high-risk infants. *Child Psychiatry and Human Development, 10*, 1.

(1980) Supplemental stimulation of preterm neonates. *Early Human Development, 4*, 301-314.

(1982) Interaction coaching for high-risk infants and their parents. *Prevention in Human Services, 1*, 5-24.

(1990) Alleviating stress in newborn infants in the intensive care unit. In B.M. Lester and E. Tronick (Eds.) *Clinics in Perinatology, 17*, 1-11.

Field, T.M., Dabiri, C., Hallock, N. and Shuman, H.H. (1977) Developmental effects of prolonged pregnancy and the postmaturity syndrome. *Journal of Pediatrics, 90*, 836-839.

Field, T.M., Dempset, J.R. and Schuman, H.H. (1979) Developmental assessments of infants surviving the respiratory distress syndrome. In T.M. Field, A.M. Sostek and H.H. Shuman (1983, Eds.) *Infants born at risk: Behaviour and development.* New York: SP Medical and Scientific Books.

Field, T.M. et al (1980) *Interactions of high-risk infants and children: Disturbances and interventions.* New York: Academic Press.

Field, T.M., Sostek, A.M. and Shuman, H.H. (1983, Eds.), *Infants born at risk: Behaviour and development.* New York: SP Medical and Scientific Books.

Field, T.M., Schanberg, S., Scafidi, F., Bauer, C., Vega-Lahr, N., Garcia, R., Nystrom, J. and Kuhn, C. (1986) Tactile/kinaesthetic stimulation effects on preterm neonates. *Pediatrics, 77*, 654-658.

Field, T.M., Vega-Lahr, N., Goldstein, S. and Scafidi, F. (1987) Face to face interaction behaviour across early infancy. *Infant Behaviour And Development, 10,* 111-116.

Finkelstein, N.W. and Ramey, C.T. (1977) Learning to control the environment in infancy. *Child Development, 48,* 806-819.

Fish, M. and Crockenberg, S. (1981) Correlates and antecedents of nine-month interaction. *Infant Behaviour and Development, 4,* 69-81.

Fiske, D.W. and Maddi, S.R. (1961) *Functions of varied experience.* Homewood, Illinois: Dorsey Press.

Fitgerald, H.E., Lester, B.M. and Yogman, M.W. (1982, Eds.) *Theory and research in behavioural pediatrics (Vol. 1).* New York: Plenum.

Fitzhardinge, P.M. (1975) Early growth and development in low-birthweight infants following treatment in an intensive care nursery. *Pediatrics, 56,* 162-172.

Fitzhardinge, P. and Steven, E.M. (1972) The small for dates infant: Neurological and intellectual sequelae. *Pediatrics, 50,* 50.

Floeter, M.K. and Greenough, W.T. (1978) Cerebellar plasticity: modification of purkinje cell structure by differential rearing in monkeys. *Science, 206,* 227-229.

Fogel, A. (1977) Temporal organization in mother-infant, face-to-face interaction (p119-151). In H.R. Schaffer (Ed.) *Studies in mother-infant interaction.* London: Academic Press.

Fogel, A. and Hannan, T.E. (1985) Manual actions of nine to fifteen-week-old human infants during face-to-face interaction with their mothers. *Child Development, 56,* 1271-1279.

Fogel, A. and Melson, G.F. (1988) *Child development: Individual, family and society.* New York: West Publishing Company.

Forer, B.R. (1972) The use of physical contact in group therapy (p195-210). In L.N. Soloman and B. Benson (Eds.) *New perspectives in encounter groups.* San Francisco: Jossey Bass Inc.

Fox, N.A. and Lewis, M. (1980) Maturation and experience in preterm infants (p37-50). In J. Gallagher (Ed.) *New directions for exceptional children (Vol.3).* New York: Jossey Bass.

(1982) Motor asymmetries in preterm infants: Effects of ilness and maturity. *Developmental Psychobiology, 15,* 19-23.

(1983) Cardiac response to speech sounds in preterm infants: Effects of postnatal illness at three months. *Psychophysiology, 20,* 481-488.

Fox, N.A. and Porges, S.W. (1985) The relation between neonatal heart period patterns and developmental outcome. *Child Development, 56,* 28-37.

Francis-Williams, J. and Davies, P.A. (1974) Very low birthweight and later intelligence. *Developmental Medicine and Child Neurology, 16,* 709-728.

Frank, L.K. (1951) Genetic Psychology and its' prospects. *American Journal of Orthopschiatry, 21,* 517.

Frank, L.K. (1954) The psychological approach in sex research. *Social Problems, 1,* 133-139.

Fredrickson, W.T. and Brown, J.V. (1975) Posture as a determinant of visual behaviour in newborns. *Child Development, 46,* 579-582.

Fredrickson, W.T., Gould, P.L., Gunderson, V.M. and Grant-Webster, K.S. (1987) Complex learning by low-birth-weight and normal-birth-weight juvenile pigtailed macaques (Macaca Nemestrina). *Developmental Psychology, 23,* 483-489.

Freedman, D.G. (1969). Cited in A. Ambrose, *Stimulation in early infancy.* London: Academic Press.

Freedman, O.G., Boverman, T.I. and Freedman, N. (1966) The effects of kinaesthetic stimulation on weight gain and smiling in premature infants. Paper presented at the *American Orthopsyiatry Association, San Francisco.*

Freeman (1967) Cited in M.A. Ribble (1943) *The rights of infants*, Morningside heights, New York: Columbia University Press.

Freeman, E. (1969) The effects of interpersonal stimulation on the development of preterms. *PhD thesis, University of Florida, Florida.*

Fremont-Smith, (1978) In Senn M.J., (Ed.) Problems in early infancy. New York: Josiah Macey.

Freud, A. (1954) Psychoanalysis and education. *The Psychoanalytic Study of the Child, 9,* (12).

Freud, S. (1905) *Three essays on the theory of sexuality.* London: Imago (1949); London: Hogarth Press (1953).

Freud, W.E. (1980) Notes on some psychological aspects of neonatal intensive care (p257-271). In S.I. Greenspan and G.H. Pollock (Eds.), *The course of life 1: Infancy and Early Childhood.* Washington: U.S. Dept. of Health and Human Services.

Friedman, S.L. and Jacobs, B.S. (1981) Sex differences in neonates' behavioural responsiveness to repeated auditory stimulation. *Infant Behaviour and Development, 4,* 175-183.

Friedman, S.L. and Sigman, M. (1981, Eds.) *Preterm birth and psychological development* New York: Academic Press.

Friedman, S.L., Jacobs, B.S. and Werthmann, M.W. (1981) Sensory processing in preterm and fullterm infants in the neonatal period (p159-200). In S.L Friedman and M. Sigman (Eds.), *Preterm birth and psychological development.* New York: Academic Press.

Fries, M.E. (1947) Diagnosing the child's adjustment through age level tests. *Psychoanalytic Review, 34,* 1-31.

Frodi, A.M. (1981) Contribution of infant characteristics to child abuse. *American Journal of Mental Deficiency, 85,* 341-349.

Gadakeety, R., Doring, B., Keller, F. et al (1969) The noise level in a children's hospital and the wake-up threshold in infants. *Acta Paediatrica Scandanavica, 58,* 164.

Gagne, R. (1968) Contributions of learning to human development. *Psychological Review, 75*, 177-191.

Gaiter, J.L. (1980) Cited in Gaiter, J.L. (1985) Nursery environments-the behaviour and caregiving experiences of fullterm and preterm newborns (p55-81). In A.W. Gottfried and J.L. Gaiter (Eds.) *Infant stress under intensive care*. Baltimore: University Park Press.

(1985) Nursery environments-the behaviour and caregiving experiences of fullterm and preterm newborns (p55-81). In A.W. Gottfried and J.L. Gaiter (Eds.) *Infant stress under intensive care*. Baltimore: University Park Press.

Gandy, G.M. and Roberton, N.R.C. (1987) *Lecture notes on neonatology*. Oxford: Blackwell Scientific Publications.

Ganong, W.F. (1985) *Review of medical physiology*. Los Altos CA: Lange Medical Publications.

Gantt, R. (1979) Fluorescent light-induced dna cross-linkage and chromatid breaks in mouse cells in culture. *Proceedings of the National Academy of Science, 75*, 3809-3812.

Garcia-Coll, C. (1990) Behavioural responsivity in preterm infants. *Clinics in Perinatology, 17*, 113-123.

Gardner, D. B. (1964) *Development in early childhood*. New York: Harper and Row.

Gekowski, M.J. (1977) Visual attention and operant conditioning in infancy: A second look. *Dissertation Abstracts International 38*, 875B (University Microfilms No. 77-17, 533).

Gekowski, M.J., Fagen, J.W. and Pearlman, M.A. (1984) Early learning and memory in the preterm infant. *Infant Behaviour and Development, 7*, 267-276.

General Medical Council (1987) The teaching of behavioural sciences, community medicine and general practice. In *Basic Medical Education* London: General Medical Council.

Gennaro, S. (1985) Maternal anxiety, problem-solving ability and adaptation to the premature infant. *Pediatric Nursing, 11*, 343-348.

Genzmer, A. (1882) Untersuchwingen uber die sinnesbrenchgan des neurgebrenen menschen. *Dissertation No. 873*, Halle Niemenger.

Gesell, A. (1928) *Infancy and human growth.* New York: Macmillan.

Gesell, A. and Bates-Aimes, L. (1937) *Early evidence of individuality in the human infant.* New York: Wiley.

Gewirtz, J.L. (1968) On designing the functional environment of the child to facilitate behavioural development. In L.C. Dittman (Ed.) *Early child care: The new perspectives.* New York: Atherton Press.

Goldberg S. (1979) Premature birth: consequences for the parent-infant relationship. *American Scientist, 67*, 214.

Goldberger J. (1990) Lengthy or repeated hospitalization in infancy (p197-206). In B.M. Lester and E. Tronick (1990, Eds.) Stimulation and the preterm infant. *Clinics in Perinatology (Vol.17)*.

Gordon, I. (1969) *Early stimulation through parent education.* Washington DC: Department of Health, Education and Welfare.

Gorski, P.A., Davison, M.F. and Brazelton, T.B. (1979) Stages of behavioural organization in the high risk neonate: Theoretical and clinical considerations, *Seminars in Perinatology, 3,* 61-72.

Gorski, P.A., Hole, W.T., Leonard, C.H. et al (1983) Direct computer recording of premature infant and nursery care: Distress following two interventions. *Pediatrics, 72,* 198-202.

Gorski, P.A., Huntington, L. and Lewkowicz D.J. (1990) Handling preterm infants in hospitals: Stimulating controversy about timing of stimulation. *Clinics in Perinatology, 17,* 103-112.

Gottfried, A.W. (1985) Environmental neonatology- Implications for intervention (p251-257). In A.W. Gottfried and J.L. Gaiter (Eds.) *Infant stress under intensive care.* Baltimore: University Park Press.

Gottfried, A.W. and Gaiter, J.L. (1985, Eds.) *Infant stress under intensive care.* Baltimore: University Park Press.

Gottfried, A.W. and Rose, S.A. (1980) Tactile recognition memory in infants. *Child Development, 51,* 69-74.

Gottfried, A.W., Wallace-Lande, P., Sherman Brown, S, et al. (1981) Physical and social environment of newborn infants in special care units, *Science, 214,* 673-675.

Gottlieb, G. (1971) Ontogenesis of sensory function in birds and mammals (p67-128). In E. Tobach, L.R. Aronson and E. Shaw *The biopsychology of development.* New York: Academic Press.

(1973) Introduction of behavioural embryology (p3-45). In G. Gottlieb (Ed.) *Studies on the development of behaviour and the nervous system, Vol.1: Behavioural embryology.* New York: Academic Press.

Graham, F.K. and Clifton, R.K. (1966) Heart-rate change as a component of the orienting response. *Psychological Bulletin, 65,* 305-320.

Grant, D.A. (1964) Classical and operant conditioning. In A.W. Melton (Ed.), *Categories of human learning*. New York: Academic Press.

Graves, P.L (1980) The functioning fetus (p235-256). In S.I. Greenspan and G.H. Pollock (Eds.), *The course of life, Vol.1: Infancy and early childhood.* Washington D.C.: U.S. Dept. of Health and Human Services.

Gray, S.W. (1974) Children from 3-10: the early training project (p61-67). In S. Ryan (Ed.) *A report on the longitudinal evaluation of preschool programmes: Vol. 1: Longitudinal evaluations. D.H.E.W. Publication No. (O.H.D.) 74-22.* Washington D.C.: Dept. of Health, Education and Welfare.

Green, R.T. (1962) The absolute threshold of electrical shock. *British Journal of Psychology, 53,* 7-15.

Greenacre, P. (1952) Trauma, growth and personality. New York: International Universities Press.

Greenberg, M.T. and Crnic, K.A. (1988) Longitudinal predictors of developmental status and social interaction in premature and full-term infants at age two. *Child Development, 59,* 554-570.

Greenberg, M. and Morris, N. (1974) Engrossment: The newborn's impact upon the father. *American Journal of Orthopsychiatry, 44,* 520-531.

Greenberg, D.J. and O'Donnell, W.J. (1972) Infancy and the optimal level of stimulation. *Child Development, 43,* 639-645.

Greenberg, D., Uzgiris, I.C. and Hunt, J.McV. (1968) Hastening the development of the blimk response with looking. *Journal of Genetic Psychology, 113,* 167-176.

Greenberg, D.J. and Weizmann, F. (1971) The measurement of visual attention in infancy: A comparison of two methodologies. *Journal of Experimental Child Psychology, 11,* 234-243.

Greenman, N.J. and Duhring, F.L. (1931) *Breeding and care of albino rats for research purposes.* Philadelphia: Wistar Institute of anatomy and biology.

Greenough, W.T. (1975) Experimental modification of the brain. *American Scientist, 63,* 37-46.

(1976) Enduring brain effects of differential experiential and training (p255-278). In H.R. Rosenzweig and E.L. Bennett (Eds.) *Neural mechanisms of learning and memory.* Cambridge: Mass. Institute of Technology Press.

(1984). Brain storage of sensory information in development (p29-38). In C. Caldwell-Brown (Ed.) *The many facets of touch.* U.S.A.: Johnson and Johnson Baby Products Company.

Greenough, W.T., Juraska, J.M. and Volkmar, F.R. (1979) Maze training effects on dendritic branching in occipital cortex of adult rats. *Behavioural and Neural Biology, 26,* 287-297.

Gregg, C.L., Haffner, M.E. and Korner, A.F. (1976) The relative efficacy of vestibular-proprioceptive stimulation and the upright position in enhancing visual pursuit in neonates. *Child Development, 47,* 309-314.

Groom, G. (1973) The effects of perinatal factors and supplemental stimulation of premature infants upon measures of cognitive behaviour. *PhD thesis, Purdue University, U.S.A.*

Gryboski, J.D. (1969) Suck and swallow in the premature infant. *Pediatrics, 43,* 96-102.

Gullickson, G.R. and Crowell, D.H. (1964) Neonatal habituation to electrotactual stimulation. *Journal of Experimental Child Psychology, 1,* 388-396.

Gunn, T.R., Lepore, E. and Outerbridge, E.W. (1983) Outcome at school-age after neonatal mechanical ventilation. *Developmental Medicine and Child Neurology, 25,* 305-314.

Gunnar, M., Isensee, J. and Fust, L.S. (1987) Adrenocortical activity and the Brazelton Neonatal assessment scale: Moderating effects of the newborn's biomedical status. *Child Development, 58,* 1448-1458.

Hack, M. (1983) Sensorimotor development of the preterm infant. In A.A. Fanaroff and R.J. Martin (Eds.) *Behrman's neonatal-perinatal medicine*. St. Louis: Mosby.

Hagberg, B. (1975) Pre, peri and post-natal prevention of major neuropediatric handicaps. *Neuropaediatrie, 6,* 331-338.

Haggerty, R.J. (1980) Life stress, illness and social supports. *Developmental Medicine and Child Neurology, 22,* 391-340.

Hakanson, D.O. and Bergstrom, W.H. (1981) Phototherapy induced hypoglycemia in newborn rats: Prevention by melatonin. *Science, 214,* 807-809.

Hales, D., Kennell, Klaus, M., Mata, L., Sosa, R. and Urrutia, J. (1975) The effect of earl skin-to-skin contact on maternal behaviour at twelve hours. *Pediatric Research, 9,* 259.

Halliday, J.L. (1948) *Psychosocial medicine: A study of the sick society*. New York: W.W. Norton.

Halverson, H.M. (1938) Infant sucking and tensional behaviour *Journal of Genetic Psychology, 53,* 365-430

(1944) Mechanisms of early infant feeding *Journal of Genetic Psychology, 64,* 185-223.

Hammett, F.S. (1922) Studies of the thyroid apparatus: V The significance of the comparative mortality rates of parathyroidectomized wild Norway rats and excitable and non-excitable albino rats. *Endocrinology, 6,* 221-229.

Hamosh, M. (1979) A review. Fat digestion in the newborn: Role of lingual lipase and preduodenal digestion. *Pediatric Research, 13,* 615-622.

(1983) Lingual lipase and fat digestion in the neonatal period. *Journal of Pediatric Gastroenterology and Nutrition, 2,* 236-241.

Hamosh, M. (1990) *Lingual and gastric lipases: their role in fat digestion.* Boston: CRC Press.

Hamosh, M., Bitman, J., Liao, T.H., Mehta, N.R., Buczek, R.J., Wood, D.L., Grylack, L.J. and Hamosh, P. (1989a) Gastric lipolysis and fat absorption in preterm infants: effect of MCT or LCT containing formula. *Pediatrics, 83,* 86.

Hamosh, M., Ganot, D. and Hamosh, P. (1979) Rat lingual lipase. *Journal of Biological Chemistry, 254,* 12121.

Hamosh, M., Klaevemann, H.L., Wolf, R.O. and Scow, R.O. (1975) Pharyngeal lipase and digestion of dietary triglyceride in man. *Journal of Clinical Investigations, 55,* 908.

Hamosh, M., Smith, Y.F., Bernbaum, J., Waring, C.J., Mehta, N.R., Fink, C.S., York, C.M. and Hamosh, P. (1989b) Fat digestion in premature infants: effect of mode of feeding on lipase activity in the stomach. In L. Stern, M. Orzalesi and B. Friis-Hansen (Eds.), *Physiological foundations of perinatal care (Vol. 3).*

Hanna, D. (1990) *Not common speech.* Dublin: Raven Arts Press.

Harlow, H. (1958) The nature of love. *Amererican Psychologist, 13,* 673-685.

(1959a) Love in infant monkeys. *Scientific American, 200,* 68-74.

Harlow, H. (1959b) Basic social capacity of primates. In J.N. Spuhler (Ed.) *The evolution of man's capacity for culture.* Detroit: Wayne State University Press.

(1971) *Learning to love*. San Francisco: Albion Publication Corporation.

Harper, P.A. (1951) The pediatrician and the public. *Pediatrics, 7*, 430-432.

Harrison, L. (1985) Effects of early supplemental stimulation programmes for premature infants: Review of the literature. *Maternal-Child Nursing Journal, 14*, 69-90.

Harrington, G. and Kohler, G. (1966) Strain differences and positive reinforcement with shock. *Psychonomic Science, 6*, 417-420.

Harzem, P. (1987) On the virtues of being a psychologist. *Behaviour Analyst, 10*, 175-181.

Hashke, F., Hackel, F. and Hohenauer, L. (1976) Transcutaneous measurements of po2 in newborns with RDS. *Klinische Padiatria, 188*, 73-81.

Hasselmeyer, E.C. (1964) Handling and infant behaviour: an experimental study of the relationship between handling and selected physiological, pathological and behavioural indices related to body functioning among a group of prematurely born infants who weighed between 1501-2000 grammes at birth and were between the ages of 7 and 28 days of life. *Diss. Abstracts International*, *24b*, 2874b-2875b, Universities microfilms no. 64-257.

Hawker, R.W. (1981) *Notebook of medical physiology: Gastroenterology.* Edinburgh: Churchill Livingstone.

Hayden, A.H. and Haring, N.G. (1976) Early intervention for high risk infants and young children. In T.D. Tjossem (1976) *Intervention strategies with high risk infants and young children.* Baltimore: University Park Press.

Hebb, D.O. (1949) *The organization of behaviour*. New York: Wiley.

(1955) Drives and the C.N.S. *Psychological Review, 62,* 243-254.

Held, R. and Hein, A. (1943) Movement produced stimulation in the development of visually guided behaviour. *Journal of Comparative Physiological Psychology, 56,* 872-876.

Herzog, (1979) Disturbances in parenting high-risk infanta: Clinical impressions and hypotheses. In T.M. Field, A.M. Sostek and H.H. Shuman (1983, Eds.), *Infants born at risk: Behaviour and development* New York: SP Medical & Scientific Books.

(1982) Patterns of expectant fatherhood: A study of fathers of a group of preterm infants (p301-304). In S.H. Cath and A.R. Gurwitt (Eds.) *Father and child: Developmental and clinical perspectives*. Boston: Little, Brown.

Hetherington, R. (1983) Communication between doctors and psychologists. *British Journal of Medical Psychology,* 99-104.

Hines, J.D. (1971) Father-the forgotten man. *Nursing Forum, 10,* 176-200.

Hockey, C. (1980) Challenges for nursing. *Nursing Times, 76,* 908-911.

Hofer, M.A. (1975) Studies on how maternal separation produces behavioural change in young rats. *Psychosomatic Medicine, 37,* 245-264.

(1978) Hidden regulatory processes in early social relationships. In P.P.G. Bateson and P.H. Klopfer (Eds.) *Parental care in mammals*. New York: Plenum.

Hollenbeck, A.R., Gewirtz, J.L., Lawson-Sebris, S. and Scanlon, J.W. (1984) Labor and delivery medication influences parent-infant interaction in the first postpartum month. *Infant Behaviour and Development, 7,* 201-209.

Holmes, K., Nagy, J.N., Slaymaker, F. et al (1982) Early influences of prematurity, illness and prolonged hospitalization on infant behaviour. *Developmental Psychology, 18,* 744-750.

Holmes, D.L., Reich, J.N. and Pasternak, J.S. (1984) *The development of infants born at risk.* Hillsdale, New Jersey: Erlbaum.

Holmes, D.L., Reich, J.N. & Rieff, M.L. (1988) Kindergarten performance of children born at risk. *Canadian Journal of Psychology, 42,* 189-200.

Hogman, J.E. (1969) Clinical evaluation of the newborn infant. *Hospital Practice, 4,* 70-86.

Hooker, D. (1936) Early fetal activity in mammals. *Yale Journal of Biology and Medicine, 8,* 579-602.

(1942) Fetal reflexes and instinctual processes. *Psychosomatic Medicine, 4,* 199-205.

(1952) *The prenatal origin of behaviour.* Lawrence: University of Kansas Press.

Hopper, H.E and Pinneau, S.R. (1957) Frequency of regurgitation in infants as related to the ammount of stimulation received from the mother. *Child Development, 28,* 229-235.

Horn, G., Rose, S.P.R. and Bateson, P.P.G. (1973) Experience and plasticity in the central nervous system. *Science, 181,* 506-514.

Horowitz, F.D. (1969) Learning development research and individual differences. In L.P. Lipsitt and H.W. Reese (Eds.) *Advances in child development and behaviour (Vol.4).* New York: Academic Press.

Howard, J., Parmelee, A., Kopp, C.B. and Littman, B. (1976) A neurologic comparison of preterm and fullterm infants at erm conceptual age. *Journal of Pediatrics, 88,* 995-1002.

Hronsky, S.L. and Emory, E.K. (1987) Neurobehavioural effects of caffeine on the neonate. *Infant Behaviour and Development, 10,* 61-80.

Hubert, N.C., Wachs, T.D., Peters-Martin, P. and Gandour, M.J. (1982) The study of early temperament: Measurement and conceptual issues. *Child Development, 53,* 571-600.

Huch, A. and Huch, R. (1976) Transcutaneous noninvasive monitoring of pO2. *Hospital Practice, 38,* 43-52.

Hucklebridge, F.H. and Nowell, N.W. (1973) Effect of infantile handling upon plasma catecholamine response to acute noxious stimulation in adulthood. *Behavioural Biology, 9,* 563-579.

Humphrey, T. (1969) Postnatal repetiton of human prenatal activity sequences with some suggestion of the neuroanatomical basis. In R.J. Robinson (Ed.), *The brain and early behaviour.* New York: Academic Press.

Humphrey, N.K. (1970) What the frog's eye tells the monkey's brain. *Brain, Behaviour and Evolution, 3,* 324-337.

Hunt, J. McV. (1961) *Intelligence and experience* New York: The Ronald Press Company.

(1963) Motivation inherent in information processing and action. In O.J. Harvey (Ed.), *Motivation and social interaction.* New York: Ronald Press.

(1979) Psychological development: Early experience. *Annual Review of Psychology, 30,* 103-143.

Hunt, J. (1981) Predicting intellectual disorders in childhood for premature infants with a birthweight below 1501 grams (p329-352). In S.L. Friedman and M. Sigman (Eds.) *Premature birth and psychological development.* New York: Academic Press.

Hunt, J. and Rhodes, L. (1977) Mental development of preterm infants during the first year. *Child Development, 48,* 204-210.

Hunt, J.V., Tooley, W.H. and Harvin, D. (1982) Learning disabilities in children with birthweights < 1500 grams. *Seminars in Perinatology, 6,* 280-287.

Hunter, R., Kilstrom, H., Kraybill, E. and Loda, F.(1978) Antecedents of child abuse in premature infants: A prospective study in a newborn intensive care unit. *Pediatrics, 61,* 629-635.

Hutchison, J.H. (1975) *Practical paediatric problems.* London: Lloyd-Luke Ltd.

Hymovitch, B. (1952) Effect of experimental variations on problem-solving in the rat. *Journal of Comparative and Physiological Psychology, 45,* 313-321.

Ignatoff, E. and Field, T. (1982) Effects of nonnutritive sucking during tube feedings on the behaviour and clinical course of ICU preterm neonates. In L.P. Lipsitt and T.M. Field (Eds.) *Infant behaviour and development: Perinatal risk and newborn behaviour.* Norwood, New Jersey: Ablex.

Illingworth, R.S. (1963) *The development of the infant and young child* (2nd Ed.). Edinburgh: Livingstone.

(1972) *The development of the infant and young child: Normal and abnormal.* Baltimore: Williams and Wilkins.

Izard, C.E., Porges, S.W., Simons, R.F., Haynes, O.M., Hyde, C., Parisi, M. and Cohen, B. (1991) Infant cardiac activity: Developmental changes and relations with attachment. *Developmental Psychology, 27,* 432-439.

Jacklin, C.N., Snow, M.E. and Maccoby, E.E. (1981) Tactile sensitivity and muscle strength in newborn boys and girls. *Infant Behaviour and Development, 4,* 261-268.

Jackson, E. (1948) A hospital rooming-in unit for newborn infants and their mothers. *Pediatrics, 1,* 28-43.

Jackson, A. and Gorman, W.A. (1988) Maternal attitudes to preterm birth. *Journal of Psychosomatic Obstetrics and Gynaecology, 8,* 119-126.

Jacobson, S., Fein, G., Jacobson, J., Schwartz, P. and Dowler, J. (1984) Neonatal correlates of premature exposure to smoking, caffeine and alcohol. *Infant Behaviour and Development, 7,* 253-265.

James, W. (1890) *Principles of Psychology (Vol.3).* New York: Holt.

Jay, S. (1982) The effects of gentle human touch on mechanically ventilated very short gestation infants. *Maternal-Child Nursing Journal, 11,* 199-256.

Jensen, K. (1932) Differential reactions to taste and temperature stimuli in newborn infants. *Genetic Psychology Monographs, 12,* 127-172.

Jones, D.A. (1981) Controlled trial of a regularly cycled oscillating waterbed and a non-oscillating waterbed in the prevention of apnoea in the preterm infant. *Archives of Disease in Childhood, 56,* 889-891.

Jumonville, (1968) in A. Ambrose (1969) *Stimulation in early infancy.* London: Academic Press.

Kagan, J.H. (1965) The new marriage: Pediatrics and psychology. *American Journal of Diseases in Children, 110,* 272-278.

(1969) Cited in A. Am (1969) Cited in A. Ambrose (1969) *Stimulati*

(1972) Do infants think ?. *Scientific American, 226,* 74-82.

(1980) The contributions of developmental psychology to pediatrics. Paper presented at a *conference on the future of Academic Pediatrics*, New Orleans, June.

Kahn, J.H. (1971) *Human growth and the development of personality* (2nd Ed.). Oxford: Pegamon Press.

Kalnins, J. and Bruner, J. (1973) The co-ordination of visual observations and instrumental behaviour in early infancy. *Perception, 2,* 307-314.

Kasatkin and Leivikova (1935). Cited in Kasatkin N.I. (1948) *Early conditioned reflexes in the ontogenesis of man.* Moscow: Mediz.

Katona, F. and Berenyi, M. (1974) Differential reaactions and habituation to acoustical and visual stimuli in neonates. *Activitas Nervosa Superior, 16,* 305.

Kattwinkel, J., Nearman, H.S., Fanaroff, A.A., Katona, P.G. and Klaus, M.H. (1975) Apnea of prematurity: Comparative therapeutic effects of cutaneous stimulation and nasal continuous positive airway pressure. *The Journal of Pediatrics, 86,* 588-592.

Katz, V. (1971) Auditory stimulation and developmental behaviour of the premature infant, *Nursing Research, 20,* 196-201.

Kaufman, R. and Kaufman, F. (1980) The face schema in 3 and 4 month-old infants: The role of dynamic properties of the face. *Infant Behaviour and Development, 3,* 331-339.

Kaye, K. (1966) The effects of feeding and tonal stimulation on non-nutritive sucking in the human newborn. *Journal of Experimental Child Psychology, 3,* 131-145.

Kaye, K. (1967) Infant sucking behaviour and its' modification (p2-52). In L. Lipsitt and C. Spiker (Eds.) *Advances in Child Development and Behaviour.* New York: Academic Press.

(1977) Towards the origin of dialogue. In H.R. Schaffer (Ed.) *Studies in maternal infant interaction.* London: Academic Press.

Kaye, K. and Brazelton, T.B. (1971). In E.B. Thoman How a rejecting baby affects mother-infant synchrony (p177-191).

Kaye, K. and Fogel, A. (1980) Temporal structure of face-to-face communication between mothers and infants. *Developmental Psychology, 16,* 454-464.

Kaye, K. and Wells, A.J. (1980) Mothers' jiggling and the burst-pause pattern of neonatal feeding. *Infant Behaviour and Development, 3,* 29-46.

Kearsley, R.B. (1979) Iatrogenic retardation: a syndrome of learned incompetence. In R.B. Kearsley and I.E. Sigel (1979, Eds.) *Infants at risk: assessment of cognitive functioning*. Hillsdale, New Jersey: Erlbaum.

Kearsley, R.B. and Sigel, I.E. (1979, Eds.) *Infants at risk: assessment of cognitive functioning*. Hillsdale, New Jersey: Erlbaum.

Keen, K. (1964) The effects of auditory stimuli in human neonates. *Journal of Experimental Child Psychology, 1,* 348-354.

Keller, W.D., Hildebrandt, K.A. and Richards, M.A. (1985) Effects of extended father-infant contact during the newborn period. *Infant Behaviour and Development, 8,* 337-350.

Kennedy, A.R., Ritter, M.A. and Little, J.B. (1980) Fluorescent light induces malignant transformation in mouse embryo cell cultures. *Science, 207,* 1209-1211.

Kennedy-Schaper, K. (1982) Towards a calm baby and relaxed parents. *Family Relations, 31,* 409-414.

Kennell, J.H., Jerauld, R., Kreger, N.C., McAlpine, W., Steffa, M. and Klaus, M.H. (1974) Maternal behaviour one year after early and extended post-partum contact. *Developmental Medicine and Child Neurology, 16,* 172.

Kennell, J.H., Trause, M.A. and Klaus, M.H. (1975) Evidence for a sensitive period in the human mother. In *Parent-infant interaction, Ciba Foundation Symposium (Vol. 33).* New York: Elsevier.

Kessen, W. and Leutzendorff, A.M. (1963) The effect of non-nutritive sucking on movement in the human newborn. *Journal of Comparative and Physiological Psychology, 56,* 69-72.

King, J.A. (1958) Parameters relevant to determine effects of early experience upon the adult behaviour of animals. *Psychological Bulletin, 55,* 46-58.

Klaus, M.H. and Fanaroff, A.A. (1973) *Care of the high-risk neonate.* Philadelphia: Saunders.

Klaus, M.H., Jerauld, R., Kreger, N.C., McAlpine, W., Steffa, M. and Kennell, J.H. (1972) Maternal attachment: importance of the first post-partum days. *New England Journal of Medicine, 286,* 460-463.

Klaus, M.H. and Kennell, J.H. (1970) Mothers separated from their newborn infants. *Pediatric Clinics of North America, 17,* 1015.

(1976) *Maternal-infant bonding.* St. Louis: Mosby.

(1982) *Parent-infant bonding* (2nd Ed.). St. Louis: Mosby.

Knight, J.A. (1981) *Doctor-to-be; Coping with the trials and triumphs of medical school.* New York: Appleton, Century, Crofts.

Klien, M. and Stern, I.L. (1971) Low birthweight and battered child syndrome. *American Journal of Disease in Childhood, 122,* 15-18.

Klein, N., Hack, M., Gallagher, J. and Fanaroff, A.A. (1985) Preschool performance of children with normal intelligence who were very low birthweight. *Pediatrics, 75,* 531-537.

Knoblach, H., Rider, R. and Harper, P. (1956) Neuropsychiatric sequelae of prematurity. *Journal of the American Medical Association, 161,* 581.

Koch, J. (1969) Influence of early motor stimulation on motility and on mental development in infants. *Acta Nerv. Symp., 2,* 312-313.

Kogan, (1970) *Journal of Experimental Child Psychology, 10,* 67-78.

Kohen-Raz, R. (1967) Scalogram analysis of some developmental sequences of infant behaviour as measured by the Bayley infant scale of mental development (Monograph). *Genetic Psychology Monographs, 76,* 3-21.

Koniak-Griffin, D. and Luddington-Hoe, S.M. (1987) Paradoxical effects of stimulation on normal neonates. *Infant Behaviour and Development, 10,* 261-277.

Koops, B.L. and Harmon, R.J. (1980) Studies on longterm outcome in newborns with birthweights under 1500 grams. *Advances in Behavioural Pediatrics, 1,* 1-28.

Korner, A.F. (1969) Neonatal startles, smiles, erections and reflex sucks as related to state, sex and individuality. *Child Development, 40,* 1040-1052.

(1977) Early stimulation and maternal care as related to infant capabilities and individual differences. In S. Cohen and T. Cominsky (Eds.) *Child development, contemporary perpectives.* Illinois: R.E. Peacock Publishers Inc.

(1979) Maternal rhythms and waterbeds. A form of intervention with premature infats. In E.B. Thoman (Ed.), *Origins of the infant's social responsiveness*. Hillsdale, New Jersey: Erlbaum.

(1981) Intervention with premature infants: rationale, aims and means (p13-19). In V.L. Smerligo (Ed.) *Newborns and parents, parent - infant contact and newborn sensory stimulation*. Hillsdale, New Jersey: Erlbaum.

(1984) Interconnections between sensory and affective development in early infancy. *Zero to Three: Bulletin of the National Centre for Clinical Infant Programs, 5, 1.*

Korner, A. and Grobstein, S. (1966) Visual alertness as related to soothing in neonates. *Child Development, 37,* 867-876.

Korner, A.F., Guilleminault, C., Van den Hoed, J. and Baldwin, R.B. (1978) Reduction of sleep apnoea and bradycardia in premature infants on oscillating water beds: a controlled polygraphic study. *Pediatrics, 61,* 528-533.

Korner, A.F., Kraemer, H.C., Haffner, M.E. and Cosper, L.M. (1975) Effects of waterbed flotation on preterm infants: A pilot study. *Neuropediatrics, 14,* 170-175.

Korner, A.F. and Schneider, P. (1983) Effects of vestibular-proprioceptive stimulation on the neurobehavioural development of preterm infants: A pilot study. *Neuropediatrics, 14,* 170-175.

Korner, A.F. and Thoman, E.B. (1970) Visual alertness in neonates as evoked by maternal care. *Journal of Experimental Child Psychology, 10,* 67-78.

(1972) The relative efficacy of contact and vestibular-proprioceptive stimulation in soothing neonates. *Child Development, 43,* 443-453.

Korones, S.B. (1976a) *High risk newborn infants.* St. Louis: Mosby.

(1976b) Disturbance and infant rest (p94-97). In T.D. Moore (Ed.) *Iatrogenic problems in neonatal units: Report of the 69th Ross conference on pediatric research.* Columbia, Ohio: Ross Labs.

Kramer, L.I. and Pierpont, M.E. (1976) Rocking waterbeds and auditory stimuli to enhance the growth of preterms. *Journal of Pediatrics, 88,* 297.

Kramer, M., Chamorro, I., Green, D. and Knudtson, F. (1975) Extra tactile stimulation of the premature infant. *Nursing Research, 24,* 324-354.

Kravitz, H., Goldenberg, D. and Neyhus, A. (1978) Tactual exploration by normal infants. *Developmental Child Neurology, 20,* 720-726.

Krech, O., Rosenzweig, M.N. and Bennett, E.I. (1960) Effects of environmental complexity and training on brain chemistry. *Journal of Comparative and Physiological Psychology, 53,* 509-519.

Kron, R. and Littman, M. (1971) Fluid mechanics of nutritive sucking behaviour: The sucking infant oral apparatus analyzing as a hydraulic pump. *Medical Biology of England, 9,* 45-60.

Kron, R., Stein, M. and Goddard, K. (1966) Newborn sucking behaviour affected by obstetric sedation. *Pediatrics, 37,* 1012-1016.

Kuhn, C.M., Evoniuk, G.E. and Schanberg, S.M. (1978) Selective depression of serum growth hormone during maternal deprivation in rat pups. *Science, 201,* 1034-1036.

(1979) Loss of tissue sensitivity to growth hormone during maternal deprivation in rats. *Life Sciences, 25,* 2089-2097.

Kulka, A., Fry, C. and Goldstein, F. (1960) Kinaesthetic needs in infancy. *American Journal of Orthopsychiatry, 30,* 562-571.

Kunst, M.S. (1948) A study of thumb and finger sucking in infants. *Psychological Monographs, 48,* 1-71.

Kunst-Wilson, W. and Croenwett, L. (1981) Nursing care for the emerging family: Promoting paternal behaviour. *Research in Nursing and Health, 4,* 201-211.

Lacey, J.I., Kagan, J., Lacey, B.C. and Moss, H.A. (1963) Situational determinants and behavioural correlates of autonomic response patterns (p161-196). In P.H. Knapp (Ed.) *Expression of emotion in man.* New York: International Universities Press.

Lamb, M.E. (1981) *The role of the father in child development* (2nd ed.). New York: Wiley.

Landreth, G. (1966) *The psychology of early childhood.* New York: A. Knopf.

Landry, S.H., Fletcher, J.M., Zarling, C.L., Chapieski, and Francis, D.J. (1984) Differential outcomes associated with early medical complications in premature infants, *Journal of Pediatric Psychology, 9,* 3.

Lang, R. (1972) *The birth book.* Ben Lomand, CA: Genesis.

Langworthy, O.R. (1933) Development of behaviour patterns and myelinization of the nervous system in the human fetus and infant. *Contributions of the Embryological Carnegie Institute*. Publication No. 443.

Largerspitz, K., Nygard, M. and Strandvik, C. (1971) The effects of training in crawling o the motor and mental development of infants. *Scandinvian Journal of Psychology, 12,* 192-197.

Largo, R.H., Graf, S., Kundu, S., Hunziker, U. and Molinari, L. (1990) Predicting developmental outcome at school age from infant tests of normal, at-risk and retarded infants. *Developmental Medicine and Child Neurology, 32,* 30-45.

Largo, R.H., Molinari, L., Kundu, S., Hunziker, U. and Duc, G. (1989) Neurological outcome in high-risk, weight appropriate for gestational age, preterm children at school age. *European Journal of Pediatrics, 149,* 835-844.

Largo, R.H., Pfister, D., Molinari, L., Kundu, S., Lipp, A. and Duc, G. (1989) Significanc of prenatal, perinatal and postnatal factors in the development of a.g.a preterm infants at five to seven years. *Developmental Medicine and Child Neurology, 31,* 440-456.

Lawson, K., Daum, C. and Turkewitz, G. (1977) Environmental characteristics of a neonatal intensive care unit. *Child Development, 48,* 1633-1639.

League, R., Parker, J., Robertson, M., Valentine, V. and Powell, J. (1972) Acoustical environments in incubators and infant oxyen tents. *Preventitive Medicine, 1,* 231-239.

Leavitt (1977) Cited in T.M. Field, A.M. Sostek and H.H. Shuman (1979; Eds.), *Infants born at risk: Behaviour and development*. New York: SP Medical and Scientific Books.

Legerstee, M., Corter, C. and Kienapple, K. (1990) Hand, arm and facial actions of young infants to a social and nonsocial stimulus. *Child Development, 61,* 774-784.

Lee, H.F. (1954) A rocking-bed respirator for use with premature infants in incubators. *Journal of Pediatrics, 44,* 570-573.

Leib, S.A., Benfield, G. and Guidubaldi, J. (1980) Effects of early intervention and stimulation of the premature infant. *Pediatrics, 66,* 83-89.

Leiderman, P. and Seashore, M.J. (1975) Mother-infant neonatal separation: Some delayed consequences (p213-219). In *Ciba foundation symposium 33: Parent-infant interaction.* Amsterdam: A.S.P.

Leifer, A.D., Leiderman, P.H., Barrett, C.R. and Williams, J. (1972) Effects of mother-infant separation on maternal attachment behaviour. *Child Development, 43,* 1203-1278.

Lenard, H.G., Bernuth, H. Von and Prechtl, H. (1968) Reflexes and their relationship to behavioural state in the newborn. *Acta Pediatrica Scaninavica, 3,* 177-185.

Leonard, S. (1976) How first-time fathers feel toward their newborns. *American Journal of Maternal Child Nursing, 1,* 361-365.

Lerner, R.M. and Lerner, J.V. (1983) Temperament-intelligence reciprocities in early childhood: A contextual model. In M. Lewis (Ed.) *Origins of intelligence (2nd Ed.).* New York: Plenum.

Lester, B.M. (1985) There's more to crying thhan meets the ear (p1-27). In B.M. Lester and C.F.Z. Boukydis (Eds.) *Infant crying: Theoretical and research perspectives*. New York: Plenum.

Lester, B.M., Zachariah-Boukydis, C.F., McGrath, M., Censullo, M., Zahr, L. and Brazelton, T.B. (1990) Behavioural and psychophysiologic assessment of the preterm infant (p155-173). In B.M. Lester and E. Tronick (1990, Eds.) Stimulation and the preterm infant. *Clinics in Perinatology, 17,* (Whole issue).

Levin, G. and Kaye, H. (1966) Work decrement and rest recovery during non-nutritive sucking in the human neonate. *Journal of Experimental Child Psychology, 3,* 146-154.

Levine, S. (1956) A further study of infantile handling and adult avoidance learning. *Journal of Personality, 25,* 70-80.

(1957a) A further study of infantile handling and adult avoidance learning. *Journal of Personality, 25,* 70-80.

(1957b) Infantile experience and resistance to psychological stress. *Science, 12,* 405.

(1958) Noxious stimulation in infant and adult rats and consummatory behaviour. *Journal of Comparative and Physiological Psychology, 51,* 230-233.

(1960) Stimulation in infancy. *Scientific American, 202,* 80-86.

(1962) Psychophysiological effects of infantile stimulation. In E.L. Bliss (Ed.) *Roots of behaviour*. New York: Harper.

Levine, S. and Alpert, M. (1959) Differential maturation of the C.N.S as a function of early experience. *Archives of General Psychiatry, 1,* 403-405.

Levine, S., Alpert, M. and Lewis, G.W. (1957) Infant experience and maturation of the pituitary-adrenal axis. *Science, 126,* 1347.

(1958) Differential maturation of an adrenal response to cold stress in rats manipulated in infancy. *Journal of Comparative and Physiological Psychology,* 51, 774-777.

Levine, S. and Broadhurst, P.L. (1963) Genetic and autogenetic determinants of adult behaviour in the rat. *Journal of Comparative and Physiological Psychology, 56,* 423-428.

Levine, S. and Lewis, G.W. (1959) Critical period for the effects of infantile experience on maturation of stress response. *Science, 129,* 52.

Levine, S. and Mullins, R.F. (1966) Hormonal influences and brain organization in infant rats. *Science, 152,* 1585-1592.

Levine, S. and Otis, L.S. (1958) Effects of handling before and after weaning on resistance of albino rats to later deprivation. *Canadian Journal of Psychology, 12,* 103-108.

Levy-Schiff, R., Sharir, H. and Mogilner, M.B. (1989) Mother- and father-preterm infant relationship in the hospital preterm nursery. *Child Development, 60,* 93-102.

Lewis, M. (1976, Ed.) *Origins of intelligence: Infancy and early childhood.* New York: Plenum.

Lewis, M. and Coates, D.L. (1980) Mother-infant interaction and cognitive development in 12 week-old infants. *Infant Behaviour and Development, 3,* 95-105.

Lewis, M., Dodd, C. and Harwitz, M. (1969) Cardiac responsivity to tactile stimulation in waking and sleeping infants. *Perceptual Motor Skills, 29,* 259-269.

Liao, T.H., Hamosh, P. and Hamosh, M. (1983) Gastric lipolysis in the developing rat: ontogeny of the lipases active in the stomach. *Biochim. Biophys. Acta, 754,* 1.

Liley, A.W. (1965) *Studies in physiology.* Berlin: Springer.

Lincoln, L.W. and Waverly, J.B. (1974) Electrophysiological evidence for the activation of supraoptic neurones during the release of oxytocin. *Journal of Physiology, 12,* 103-108.

Lipsitt, L.P. and Kaye, H. (1964) Conditioned sucking in the human newborn. *Psychonomic Science, 1,* 29-30.

Lipsitt, L.P., Kaye, H. and Bosack, T.N. (1966) Enhancement of neonatal sucking through reinforcement. *Journal of Experimental Child Psychology, 4,* 163-168.

Lipsitt, L.P. and Levy, N. (1959) Electrotactual threshold in the neonate. *Child Development, 30,* 547-554.

Locke, J. (1693) Some thoughts concerning education. In P. Gay (1964, Ed.) *J. Locke on education.* New York: Columbia University Press.

Lodge, A. (1976) Determination and prevention of infant brain dysfunction, sensory and nonsensory aspects. In R.N. Walsh and W.T. Greenough (Eds.) *Environments as therapy for brain dysfunction.* New York: Plenum.

Long, J.G., Alistair, G.S., Philip, A.G.S., et al. (1980) Excessive handling as a cause of hypoxemia. *Pediatrics, 65,* 203-206.

Lopez, C.J. (1983) Early experiences of premature infants and their providers: Psychodynamic and environmental factors in neonatal intensive care. *Zero to Three, Bulletin of the National Centre for Clinical Infant Programs, 2,* Dec., 7-11.

Lorenz, K.L. (1937) The companion in the bird's world. *Auk, 54,* 245-273.

Lubchenko, L.O., Horner, F.A., Reed, L.H., Hix, I.E, Metcalf, D., Cohig, R., Elliott, H.C. and Bourg, M. (1963) Sequelae of premature birth. *American Journal of Dissertations of Childhood, 106,* 101-115.

Lucy, J.F. (1977) Is intensive care too intensive?. *Pediatrics (Neonatology supplement), 59,* 1069.

Luddington, S. (1983) Infant stimulation: New concepts in neonatal/infant growth and development. *Workshop sponsored by Symposia Medicus*, Dallas, Texas.

Lynch, M. (1975) Ill health and child abuse. *The Lancet,* 2317-2319.

Lynch, J.J. et al (1974) The effects of human contact on cardiac arrythemia in corony care patients. *Journal of Nervous and Mental Disease, 158,* 88-99.

Lynn, D.B. (1974) *The father: His role in child development.* Monterey, California: Brooks/Cole.

Macedo, E. N. (1984) The effects of early tactile stimulation on low birthweight infants -2 year follow up. *Ph.D thesis, Bedford College, University of London.*

Maddi, S.R. (1961a) Exploratory behaviour and variation seeking in man (p253-278). In D.W. Fiske and S.R. Maddi (1961) *Functions of varied experience.* Homewood, Illinois: Dorsey Press.

(1961b) Affective tone during environmental regularity and change. *Journal of Abnormal Social Psychology, 7,* 3-7.

Mahler, M.S. (1968) *On human symbiosis and the vicissitudes of individuation.* New York: International Universities Press.

Main, M. (1975) Autism and adaptation. Paper presented at the *International Society for the Study of Behavioural Development.* University of Surrey, Guilford, July.

Malloy, G.B. (1979) The relationship between maternal and music auditory stimulation and the developmental behaviour of premature infants. In G. Anderson and B. Raff (Eds.) *Newborn behavioural organization: Nursing research and implications.* New York: A.R. Liss.

Maltzman, I. (1960) On the training of originality. *Psychological Review, 67,* 229-242.

Marquis, D.P. (1931) Can conditioned responses be established in the newborn infant ? *Journal of Genetic Psychology, 39,* 479-492.

Martin, R.J., Herrell, N., Rubin, D. and Faranoff, A. (1979) Effects of supine and prone position on arterial oxygen tension in the premature infant. *Pediatrics, 63,* 528-531.

Marton, P., Davison, H. and Minde, K. (1980) The interaction of ward personnel with infants in the preterm nursery. *Infant Behaviour and Development,* 3, 307-313.

Marton, P., Minde, K. and Perotta, M. (1981) The role of the father for the infant at risk. *American Journal of Orthopsychiatry, 51,* 672-679.

Masi, W. (1979) Supplemental stimulation of premature infants (p367-387). In T.M. Field (Ed.) *Infants born at risk.* New York: Sp Medical and Scientific Books.

Matheny, A.P.Jr. (1980) Bayley's infant behaviour record: Behavioural components and twin analyses. *Child Development, 51,* 1157-1167.

Mayron, L. and Kaplan, E. (1976) Bioeffects of fluorescent light. *Academic Therapeutics, 12,* 75-90.

McCall, R. (1981) Nature-nurture and the two realms of developmetn: A proposed integration with respect to mental development. *Child Development, 52,* 1-12.

McCall, R.B. and Melson, W.H. (1970) Amount of short-term familiarization and the response to auditory discrepancy. *Child Development, 41,* 861-869.

McCance, R.A. and Oatley, M. (1951) Course of blood urea in newborn rats, pigs and kittens. *Journal of Physiology, 113,* 18-22.

McCandless, B.R. (1967) *Children: Behaviour and Development* (2nd Ed.). New York: Holt, Rinehart and Winston.

McClelland, W.J. (1956) Differential handling and weight gain in the albino rat. *Canadian Journal of Psychology, 10,* 19-22.

McDonald, D. (1978) Paternal behaviour at first contact with the newborn in a birth environment without intrusions. *Birth and Family Journal, 5,* 123-132.

McDonald, R.L., Gynther, M.D. and Christakos, A.C. (1963) Relations between maternal anxiety and obstetric complications. *Psychosomatic Medicine, 25,* 357-363.

McGehee, L.J. and Eckerman, C.O. (1983) The preterm infant as a social partner: Responsive but unreadable. *Infant Behaviour and Development, 6,* 461-470.

McGraw, M.B. (1935) *Growth: A study of Johnny and Jimmy.* New York: Appleton Century Croft.

McNichol, T. (1974) Some effects of different programmes of enrichment on the development of premature infants in the hospital nursery. *Diss. Abs Int., 34: 9B,* 4707-4708.

MacPhee, D., Benson, J.B. and Bullock, D. (1986) Influences on maternal self-perceptions. *Unpublished manuscript, University of Denver, Colorado.*

Margolin, S.E., Orringer, Kaufman, Winkelstein, Hollander, Jankowitz, Stein and Levy (1950) Variations of gastric functions during states. *Ass. Res. Nerv. Dis. Proc., 29,* 656.

Measel, C.P. and Anderson, G.C. (1979) Nonnutritive sucking during tube feedings: Effect on clinical course in infants. *Journal of Obstetric, Gynecologic and Neonatal Nursing, 8,* 265-272.

Meier, G.W. (1961) Infantile handling and development in Siamese kittens. *Journal of Comparative and Physiological Psychology, 54,* 284-286.

Meier, G.W. and Stuart (1959). Cited in Meier G.W. (1961) Infantile handling and development in Siamese kittens. *Journal of Comparative and Physiological Psychology, 54,* 284-286.

Meisels, S.J., Jones, S.N. and Stiefel, G.S. (1983) Neonatal intervention: problems, purposes and prospects. *Topics in Early Childhood Special Education, 3,* 1-13.

Meisels, S.J., Plunkett, J.W., Roloff, D.W., Pasick, P.L. and Steifel, G.S. (1986) Growth and development of preterm infants with respiratory distress syndrome and bronchopulmonary dysplasia. *Pediatrics, 77,* 345-352.

Meisels, S.J., Cross, D.R. and Plunkett, J.W. (1987) Use of the Bayley infant behaviour record with preterm and fullterm infants. *Developmental Psychology, 23,* 475-482.

Melzack, K. and Scott, T.H. (1957) The effect of early experience and response to pain. *Journal of Comparative and Physiological Psychology, 50,* 155-161.

Mendelson, M.J. and Haith M.M. (1975) The relation between non-nutritive sucking and visual information processing in the human newborn. *Child Development, 46,* 1025-1026.

Meyers B.J. (1982) Early intervention using Brazelton training with middle-class mothers and fathers of newborns. *Child Development, 53,* 462-471.

Mieth, D., Micheli J.L. and Duc, G. (1976) Transcutaneous pO2 with Roche-electrode at 44 degrees Celsius in newborn infants with RDS. Paper presented at the *Fifth European Congress of Perinatal Medicine.* Uppsala, Sweden.

Miller, (1969) Cited in J. Nash (1970) *Developmental psychology: a psychobiological approach.* New Jersey: Prentice Hall.

Minde, K., Ford, L., Celhoffer, L. and Boukydis, C. (1975) Interactions of mothers and nurses with premature infants *Canadian Medical Association Journal, 113,* 741-745.

Minde, K., Trehub, S., Corter, C., Boukydis, C., Celhoffer, L. and Marton, P. (1978) Mother-child relationships in the premature nursery: An observational study. *Pediatrics, 61,* 373-379.

Minde, K., Shosenberg, N.E., Marton, P., Thompson, J., Ripley, J. and Burns, S. (1980) Self-help groups in a premature nursery: A controlled evaluation. *The Journal of Pediatrics, 96*, 933-940.

Minde, K., Whitelaw, A., Brown, J. and Fitzhardinge, P. (1983) Effects of neonatal complications in premature infants on early parent-infant interactions. *Developmental Medicine and Child Neurology, 25,* 763-777.

Miranda, S.B. (1970) Visual abilities and pattern preferences of preterms and fullterms. *Journal of Experimental Child Psychology, 10,* 189-205.

(1976) Visual attention in high risk infants. *Merrill Palmer Quaterly of Behaviour and Development, 22,* 201-208.

Moltz, H. (1963) Imprinting: An epigenetic approach. *Psychological Review, 70,* 123-138.

Montagu, A. (1943; 1978 2nd Ed.) *Touching-the human significance of the skin.* New York: Harper and Row.

(1953) The sensory influences of the skin. *Texas Reports On Biology And Medicine, 11,* summer.

(1962) *Prenatal influences*. Springfield, Ill: Thomas.

Murdoch, D.R. and Darlow, B.A. (1984) Handling during neonatal intensive care. *Archives of Disease in Childhood, 59*, 957-961.

Murphy, B. and Moriarty, A. (1976) Vulnerability in infants and young children: a pilot study. *Genetic Psychology Monographs, 73-74 (Whole Vols.)*.

Murray, A.D. (1979) Infant crying as an elicitor of parental behaviour: An examination of two models. *Psychological Bulletin, 86*, 191-215.

Naqvi, M. and Hyatt, K. (1980) Neonatal stimulation programme reduces hospital time and cost. *Pediatric Research, 14*, 436.

Nash, J. (1970) *Developmental psychology: a psychobiological approach*. New Jersey: Prentice Hall.

(1978) *Developmental Psychology, a psychobiological approach* (2nd Ed.). Englewood Cliffs, New Jersey: Prentice Hall Inc.

National Institute of Child Health and Human Development (1968) *Perspectives in human deprivation: Biological, Psychological and Sociological*. Washington D.C.: U.S Dept. of Health, Education and Welfare.

Neal, M.V. (1968) Vestibular stimulation and developmental behaviour linked to the small premature infant. *Nursing Research Report, 3*, 3-5.

Newman, L.F. (1981) Social and sensory environment of low birthweight infants in special care units. *Science, 169*, 448-455.

Newton, J.E.D. and Gantt, W.H. (1968) *The history of a catatonic dog. Conditional Reflex, 3*, 45-61.

Niswander, K.R. (1977) Obstetric factors related to prematurity. In D.M. Reed and F.J. Stanley (Eds.) *The epidemology of prematurity*. Baltimore and Munich: Urban and Schwarzenberg.

Northern, J. and Downs, M. (1984) *Hearing in children*. Baltimore: Williams and Wilkins.

Nurcombe, B., Howell, D.C., Rauh, V.A., Teti, D.M., Ruoff, P. and Brennan, J. (1984) An intervention programme for mothers of low-birthweight infants: preliminary results. *Journal of the American Academy of Child Psychiatry, 23*, 319-325.

Oehler, J.M., Eckerman, C.O. and Wilson, W.H. (1988) Social stimulation and the regulation of premature infants' state prior to term age. *Infant Behaviour and Development*, 11, 333-351.

Office of Population, Census and Surveys (1980) *Classification of occupations and coding index*. HMSO.

O'Brien, R.A.D., Ostberg, J.C. and Vrbova, G. (1978) Observations on the elimination of poly-neural innervation in developing mammalian and skeletal muscle. *Journal of Physiology, 282*, 571-582.

O'Callaghan, M.J. and Hull, D. (1978) Failure to thrive or failure to rear ? *Archives of Disease in Childhood, 53*, 788-793.

O'Connor S., Altemeier, W.A., Sherrod K.B., Sandler M. and Vietze P.M. (1978) The effect of extended postpartum contact on problems with parenting: A controlled study of 301 families. *Birth and Family Journal, 5,* 231-234.

O'Hara, M.W., Rehm, L.P. and Campbell, S.B. (1983) Postpartum depression: A role for social network and life stress variables. *Journal of Nervous and Mental Disease, 171,* 336-341.

Oppenheim, R.W. (1976) The antecedents of integrated behaviour from a neuroembryological perspective. Paper read at the *10th International Study Group on Child Neurology and Cerebral Palsy.* St Edmund's Hall, Oxford, 31st August.

Oppenheimer, E. (1959, Ed.) *Ciba collection of medical illustrations (Vol.3): Digestive system (part 1): Upper digestive tract.* New York: Ciba Publications.

Oswald, I. (1969) Human brain protein, drugs and dreams. *Nature, 233,* 893.

Ourth, L. and Brown, K.B. (1961) Inadequate mothering and disturbance in the neonatal period. *Child Development, 32,* 287-295.

Palkovitz, R. (1982) Fathers' birth attendance, early extended contact and father-infant interaction at five months postpartum. *Birth: Issues in Perinatal Care and Education, 9,* 173-177.

Pannabecker, B., Emde, R., and Austin, B. (1982) The effect of early extended contact on father-newborn interaction. *Journal of Genetic Psychology, 141,* 7-17.

Papousek, H. (1967) Experimental studies of appetitional behaviour in human newborns and infants. In H.W. Stevenson, E.H. Hess and H.L. Rheingold (Eds.), *Early behaviour* New York: Wiley.

Papousek, H. and Papousek, M. (1977) Mothering and the cognitive head-start: Psychobiological considerations. In H.R. Schaffer (Ed.), *Studies in mother-infant interaction*. London: Academic Press.

Parke, R.D. (1974) Father-infant interaction (p61-63). In M.H. Klaus, T. Leger and M.A. Trause (Eds.) *Maternal attachment and mothering disorders: A round table*. Sausalito, CA: Johnson and Johnson.

(1979) Perspectives on father-infant interaction (p549-590). In J.D. Osofsky (Ed.) *Handbook of infant development*. New York: Wiley-Interscience Publications.

(1981) The father's role in infancy: A re-evaluation. *Birth and the Family Journal, 5*, 19-21

Parke, R.D. and Sawin, D.B. (1980) The family in early infancy: Scoial interactional and attitudinal analysis (p44-70). In F.A. Pederson (1980) *The father-infant relationship*. New York: Praeger.

Parke, R.D. and O'Leary, S.E. (1976) Father-mother-infant interaction in the newborn period: Some findings, some observations and some unresolved issues. In K. Riegel and J. Meacham (Eds.) *The developing individual in a changing world, Vol. 2: Social and environmental issues*. The Hague: Mouton.

Parmelee, A.H. (1975) Neurophysiological and behavioural organization of premature infants in the first months of life. *Biological Psychiatry, 10*, 501-512.

Parmelee, A.H. and Sigman, M. (1976) Development of visual behaviour and neurological organization in preterm and fullterm infants (p119-155). In A.D. Pick (Ed.) *Minnesota symposia on child psychology (Vol.10).* Minneapolis: University of Minnesota Press.

Parnavelas, J.G. (1978) Influence of stimulation on cortical development (p247-260). In M.A. Corner, R.E. Baker, N.E. v.d. Pol, D.F. Swaab and H.B.M. Ulyings (Eds.) *Maturation of the nervous system, progress in brain research (Vol. 48).* Amsterdam: Elsevier.

Pasamanick, B., Rogers, M.E. and Lilienfeld, A.M. (1956) Pregnancy experience and the development of behaviour disorders in children. *American Journal of Psychiatry, 112,* 613-618.

Pasamanick, B. and Knobloch, H. (1960) Brain damage and reproductive casualty. *American Journal of Orthopsychiatry, 30,* 298-305.

Pasamanick, B. and Lilienfield, A.M. (1974) Maternal and fetal factors in the development of epilepsy: Relationship to some clinical features of epilepsy. *Neurology, 5,* 77-83.

Pauk, J., Kuhn, C., Field, T.M., and Schanberg, S. (1986) Positive effects of tactile versus kinaesthetic or vestibular stimulation on neuroendocrine and ODC activity in maternally deprived rat pups. *Life Sciences, 39,* 2081-2087.

Pavlov I. (1910) *The work of the digestive glands.* London: Griffin.

Paykel, E.S., Emms, E.M., Fletcher, J. and Rassaby, E.S. (1980) Life events and social support in puerperal depression. *British Journal of Psychiatry, 136,* 339-346.

Peabody, J.L. and Lewis, K. (1985) *Consequences of newborn intensive care: Environmental neonataology.* Baltimore: University Park Press.

Peabody, J.L., Willis, M.M., Gregory, G.A. et al (1978) Clinical limitations and advantages of transcutaneous oxygen electrodes. *Acta Paediatrica Scandanavica, 68,* 76.

Peck, M.L. and Jennings, S. (1989) Student perceptions of the links between nursing and the liberal arts. *Journal of Nursing Education, 28,* 406-414.

Pederson, F.A. (1980) *The father-infant relationship.* New York: Praeger.

Pederson, F.A., Anderson, B.J. and Cain, R.L. (1977) An approach to understanding linkages between the parent-infant and spouse relationships. Paper presented at the *Society for Research in Child Development.* New Orleans, March.

Pederson, D.R., Jenkins, S., Evans, B., Chance, G.W. and Fox, A.M. (1985) Maternal responses to the birth of a preterm infant. Presented at the biennial meeting of the *Society for Research in Child Development.* Toronto.

Pelletier, J., Short, M. and Nelson, D. (1985) Immediate effects of waterbed floatation on approach and avoidance behaviours of premature infants. *Physical and Occupational Therapy in Pediatrics, 5, (2/3),* 81-92.

Pfifferling, J.H. (1980) *The improved physician: An overview.* Chapel Hill, North Carolina: Health Sciences Consortium.

Philips, C.R. and Anzalone, J.T. (1978) *Fathering: Participation in labor and birth.* St. Louis: C.V. Mosby.

Piaget, J. (1952a). *The origins of intelligence in children.* New York: International Universities Press.

(1952b) Cited in P. Rochat (1987) Mouthing and grasping in neonates: evidence for the early detection of what hard or soft substances afford for action. *Infant Behaviour and Development, 10,* 435-449.

Pluciniski, T.M., Hamosh, M. and Hamosh, P. (1979) Fat digestion in rat: role of lingual lipase. *American Journal of Physiology, 237,* 541.

Pollitt, E., Gilmore, M. and Valcarcel, M. (1978) The stability of sucking behaviour and its relationship to intake during the first month of life. *Infant Behaviour and Development, 1,* 347-357.

Pomerleau, A. and Malcuit G. (1981) State effects on concomitant cardiac and behavioural responses to a rocking stimulus in human newborns. *Infant Behaviour and Development, 4,* 163-174.

Pomerleau-Malcuit, A., and Clifton, R.K., (1973) Neonatal heart-rate response to tactile, auditory and vestibular stimulation in different states. *Child Development, 44,* 485-496.

Porges, S.W. (1974) Heart-rate indices of newborn attentional responsivity. *Merrill Palmer Quaterly, 20,* 231-254.

Porter, C.S. and Anderson-Shanklin, G.C. (1979) Nonutritive sucking during tube feedings: Effect upon clinical course in premature infants. Unpublished manuscript cited in T.M. Field (1980) Supplemental stimulation of preterm neonates. *Early Human Development, 4/3,* 301-314.

Pounder, R.E. (1986) *Recent advances in gastroenterology*. London: Churchill Livingstone.

Powell, L.F. (1974) The effect of extra stimulation and maternal involvement on the development of low-birthweight infants and on maternal behaviour. *Child Development, 45*, 106-113.

Prescott, Y.H. (1971) Early somatosensory deprivation as an ontogentic process in the abnormal development of the brain and behaviour. In Goldsmith E.I. and Moor-Jankowski J. (Eds.) *Medical perinatology*. New York: Kagan.

(1975) Body pleasure and the origins of violence. *The Futurist*, April (p64-65).

Prescott, Y.H. and David, T.G. (1976). In Gellert E. (Ed.) *Psychosocial aspects of pediatric care*. New York: Grune and Stratton.

Preyer, W. (1881) *The mind of the child*. New York, Appleton 1893.

Provence, S. (1968) The first year of life (p25-31). In C.A. Chandler, R.S. Lourie, A. DeHuff Peters and L.L. Dittman (Ed.), *Early childcare - the new perspectives*. New York: Atherton Press.

Provence, S. and Lipton, R.L. (1962) *Infants in institutions*. New York: International Universities Press.

Pysh, J.J. and Weiss, G.M. (1979) Exercise during development induces an increase in dendritic tree size. *Science, 206*, 230-232.

Rado, S. (1931) The psychical effects of intoxication. *Psychological Review, 18*, 69-84.

Raina, A. and Janne, J. (1970) Polyamines and the accumulation of RNA in mammalian systems. *Fed. Processes, 29,* 1568-1574.

Ramey, C.T. and Bakerward, L. (1982). Cited in H.E. Fitzgerald, B.M. Lester and M.W. Yogman (1986, Eds.), *Theory and research in behavioural pediatrics (Vol. 3).* New York: Plenum.

(1983) Early stimulation and mental retardation. In Wolman B. (Ed.) *International encyclopedia of neurology, psychiatry, psychoanalysis and psychology.* New York: Van Nostrand Rheinold.

Ramey, C.T., Farran, D.C. and Campbell, F.A. (1979) Predicting IQ fromp mother-infant interactions. *Child Development, 50,* 804-814.

Ramey, C.T., Zeskind, P.S. and Hunter, R. (1981) Biomedical and psychosocial interventions for premature infants (p395-415). In S.L. Freidman and M. Sigman (Eds.) *Preterm birth and psychological development.* New York: Academic Press.

Raphall-Left (1982) H.E. Fitzgerald, B.M. Lester and M.W. Yogman (1986, Eds.), *Theory and research in behavioural pediatrics (Vol. 3).* New York: Plenum.

Rauh, V.A, T.M. Achenbach, B. Nurcombe, C.T. Howell & D.M. Teti (1988) Minimizing adverse effects of low birthweight: Four year old results of an early intervention program. *Child Development, 59,* 544-553.

Rausch, P.B. (1981) Effects of tactile-kinaesthetic stimulation on premature infants. *Journal of Obstetrics, Gynecology and Neonatal Nursing, 10,* 34-37.

Ramey, C.T., Farran, D.C. and Campbell, F.A. (1979) Predicting IQ from mother-infant interactions. *Child Development, 50,* 804-814.

Redshaw, M.E., Rivers, K.P. and Rosenblatt, D.B. (1985) *Born too early.* Oxford: Oxford University Press.

Reiber, V.D. (1976) Is the nurturing role natural to fathers? *American Journal of Maternal Child Nursing, 1,* 366-371.

Reyniers, J.A. (1946) Germ free life studies. *Labund Reports, 1,* University of Notre-Dame.

(1949) Germ free life studies. *Labund Reports, 2,* University of Notre-Dame.

Reynolds, O.R., Robertson, N.R.C. and Wigglesworth, J.S. (1968) *Pediatrics, 42,* 758.

Ribble, M.A. (1939) The significance of infantile sucking on psychic development of the individual. *Journal of Nervous and Mental Disease, 90,* 455-463.

(1941) Disorganizing factors of infant personality. *American Journal of Psychology, 98,* 459-463.

Ribble, M.A.(1943) *The rights of infants,* Morningside heights, New York: Columbia University Press.

Rice, R.D. (1977) Neurophysiological development in premature infants following stimulation. *Developmental Psychology, 13,* 69-76.

Richards, M.P.M. (1978) Possible effects of early separation on later development of children: a review. In F.S.W. Brimblecombe and M.P.M. Richards *Separation and special care baby units*. London.

(1986) Psychological aspects of neonatal care. In N.R.C. Roberton (Ed.) *Textbook of neonatology*. Edinburgh: Churchill-Livingstone.

Riekelawson, K., Turkewitz, G., Platt, M. and McCarton, C. (1985) Infant state in relation to its environmental context. *Infant Behaviour and Development, 8*, 269-281.

Ringler, N.M., Kennell, J.H., Jarvella, R., Navojosky, B.J. and Kalus, M.H. (1975) Mother-to-child speech at 2 years-effects of early postnatal contact. *Behavioural Pediatrics, 86*, 141-144.

Robin, M. (1982) Neonate-mother interaction: tactile contacts in the days following birth. *Early Child Development and Care, 9*, 221-236.

Rochat, P. (1983) Oral touch in young infants: responses to variations of nipple characteristica in the first months of life. *International Journal of Behaviour and Development, 6*, 123-133.

Rochat, P. (1986) Unity of the senses and early development of action. Paper presented at the *European Conference on Developmental Psychology*, Rome, Italy.

Rodholm, M. and Larsson, K. (1970) Father-infant interaction at the first contact after delivery. *Early Human Development, 3*, 21-27.

(1982) Father-infant interaction at the first contact after delivery. *Early Human Development, 3*, 21-27.

Rogers, L.J., Schanberg, S.M. and Fellows, R.E. (1974) Growth and lactogenic hormone stimulation of ornithine decarboxylase in neonatal rat brain. *Endocrinology, 95,* 904-911.

Rooth, G. (1975) Transcutaneous oxygen tension measurements in newborn infants. *Pediatrics, 55,* 232-235.

Rosanoff, A. and Inman-Kane, C. (1934) *American Journal of Psychiatry,* 13, 829-852.

Rose, S.A. (1980) Enhancing visual recognition memory in premature infants. *Developmental Psychology, 16,* 85-92.

(1981) Lags in the cognitive competence of prematurely born infants (p255-269). In S.L Friedman and M. Sigman (Eds.) *Preterm birth and psychological development.* New York: Academic Press.

Rose, S.A., Feldman, J.F., McCarton, C.M. and Wolfson, J. (1988) Information processing in 7 month old infants as a function of risk status. *Child Development, 59,* 589-603.

Rose, S.A., Schmidt, K. and Bridger, W.H. (1976) Cardiac and behavioural responsivity to tactile stimulation in premature and fullterm infants. *Developmental Psychology, 12,* 311-320.

Rose, S.A., Schmidt, K., Riese, M.L. and Bridger, W.H. (1980) Effects of prematurity and early intervention on responsivity to tactile stimuli: a comparison of preterm and fullterm infants. *Child Development, 51,* 416-425.

Rosen, J. (1958) Dominance behaaviour as a function of post-weaning gentling in the albino rat. *Canadian Journal of Psychology, 12,* 229-234.

Rosenblith, J.F. and DeLucia, L.A. (1963) Tactile sensitivity and muscular strength in the neonate. *Biologica Neonatorium, 5,* 266-282.

Rosenfeld, M. and Snyder, T.D. (1937) Direct observation of intrauterine respiratory movements in the foetus and the role of CO2 and O2 in their regulation. *American Journal of Physiology, CXXH,* 153-166.

Rosenfield, A.G. (1980) Visiting in the intensive care nursery. *Child Development, 51,* 939-941.

Rosenthal, M.J. (1952) Psychosomatic study of infantile eczema. *Pediatrics, 10,* 581-593.

Rosenthal, R. (1966) *Experimenter effects in behavioural research.* New York: Appleton-Century-Crofts.

Rosenzweig, M.R. and Bennett, E.L. (1978b) Experimental influences on brain anatomy and brain chemistry in rodents (p289-327). In G.Gottlieb (Ed.) *Studies on the developmeent of behaviour and th nervous system (Vol. 4): Early influences.* New York: Academic Press.

Rosenzweig, M.R., Bennett, E.L. and Diamond, M.C. (1967) Cerebral effects of differential experience. Symposium on cellular mechanisms in learning. Presented at the annual meeting of the *American Psychological Association*, Washington, D.C., Sept.

Rosenzweig, M., Bennett, E. and Diamond, M. (1972) Brain changes in response to experience. *Scientific American, Feb.*

Ross, G. (1985) Use of the Bayley scales to characterize abilities of premature infants. *Child Development, 56,* 835-842.

Rothschild, B.T. (1966) Incubator isolation as a possible continuing factor to the high incidence of emotional disturbance among premature born persons. *Journal of Genetic Psychology, 110,* 287-304.

Rovee-Collier, C.K. (1984) The ontogeny of learning and memory. In R. Kail and N.E. Spear (Eds.) *Comparative perspectives on learning and memory: The Purdue symposium.* Hillsdale, New Jersey: Erlbaum.

Roy, C.C., Roulet, M., LeFevbre, D., Chartand, L., Lepage, G. and Fournier, C.A. (1979) The role of gastric lipolysis on fat absorption and bile acid metabolism in the rat. *Lipids, 14,* 811.

Royal College of Nursing (1982) *Research mindedness and nurse education.* London: R.C.N.

Rubin, R. (1963) Maternal touch. *Nursing Outlook, November,* 828-831.

Rubin, R.A., Rosenblatt, C. and Barlow, B. (1973) Psychological and educational sequelae of prematurity. *Pediatrics, 52,* 352-363.

Rubenstein, J. (1967) Maternal attentiveness and subsequent exploratory behaviour in the infant. *Child Development, 38,* 1089.

Ruegamer, W.R. and Silverman, F.R. (1956) Influence of gentling on the physiology of the rat. *Proceedings of the Society of Experimental Biological Medicine, 92,* 170-174.

Ruegamer, W.R., Bernstein, L. and Benjamin, J.D. (1954) Growth, food utilization and throid activity in the albino rat as a function of extra handling. *Science, 120,* 184-185.

Ruesch, J. (1957) *Disturbed communication.* New York: W.W. Norton.

Runge, M., (1895) Der erste schner under der este. *Athemzing Berlin Klin Wscher., 32,* 93-95.

Russell, B. (1959) Pruritic skin conditions (p48). In C. Newman (Ed.) *The nature of stress disorder*. New York: W.W. Norton.

Sackett, G.P. (1962) Effects of rearing conditions upon behaviour of rhesus monkeys. *Child Development, 36,* 854-868.

Sackett, G.P. (1972) Exploratory behaviour as a function of rearing experiences and sex. *Developmental Psychology, 6,* 260-270.

Salk, L. (1960) The effects of normal heartbeat sound on the behaviour of the newborn infant: Implications for mental health. *World Mental Health, 12,* 1-8.

Sameroff, A.J. (1967) Non-nutritive sucking in newborns under visual and audit. stimulation. *Child Development, 38,* 443-452.

(1968) The components of sucking in the human newborn. *Journal of Experimental Child Psychology, 6,* 607-623.

(1970) Changes in the nonnutritive sucking response to stimulation during infancy. *Journal of Experimental Child Psychology, 10,* 112-119.

(1972) Learning and adaptation in infancy: A comparison of models (p169-214). In H.W. Reese (Ed.) *Advances in child development and behaviour (Vol.7)*. New York: Academic Press.

Sameroff, A.J. and Cavanagh, P.J. (1979) Learning in infancy: A developmental perspective (p344-392). In J.D. Osofosky (Ed.) *Handbook of infancy*. New York: Wiley-Interscience Publications.

Sameroff, A.J. and Chandler, M.J. (1975) Reproductive risk and the continuum of caretaking casualty (p187-244). In F.D. Horowitz (Ed.) *Review of child development research, (Vol.4)*. Chicago: University of Chicago Press.

Sanford-Zeskind, P. and Iacino, R. (1987) The relation between length and physical development of premature infants. *Infant Behaviour and Development, 10*, 217-221.

Scafidi, F.A., Field, T.M., Schanberg, S.M., Bauer, C.R., Vega-Lahr, N., Garcia, R., Poirier, J., Nystrom, G. and Kuhn, C.M. (1986) Effects of tactile/kinesthetic stimulation on the clinical course and sleep/wake behaviour of preterm neonates. *Infant Behaviour and Development, 9*, 91-105.

Scafidi, F.A., Field, T.M., Schanberg, S.M., Bauer, C.R., Tucci, K., Roberts, J., Morrow, C. and Kuhn, C.M. (1990) Massage stimulates growth in preterm infants: A replication. *Infant Behaviour and Development, 13*, 167-188.

Scarr-Salaptek, S. (1973) Effects of early stimulation on child development. *Child Development, 44*, 94-101.

Scarr-Salapatek, S. and Williams, M.L. (1973) The effects of early stimulation on low-birthweight infants. *Child Development, 44,* 94-101.

Schaeffer, J.A. (1978) Differential postnatal care and sleep behaviour in premature infants. *Dissertation Abstracts International, 38,* 4479.

Schaeffer, T. (1963) Early experience and its effects on later behavioural processes in rats. A critical factor in the early handling phenomenon. *Transactions of the New York Academy of Science, 25,* 871-889.

Schaffer, H.R. (1966) Activity level as a constitutional determinant of infant reaction to deprivation.

Schaffer, H.R. (1971) *The origins of human social relations.* New York: Academic Press.

(1977) *Studies in mother-infant interaction.* New York: Academic Press.

Schaffer, H.R. and Emerson, P.E. (1964) Patterns of response to physical contact in early human development. *Journal of Child Psychology and Psychiatry, 5,* 1-13.

Schaffer, R. (1977) *Mothering.* London: Open Books.

Schaller, J., Carlsson, S.G. and Larsson, K. (1979) Effects of extended post-partum mother-child contact on the mother's behaviour during nursing. *Infant Behaviour and Development, 2,* 319-324.

Schanberg, S.M. and Field, T.M. (1987) Sensory deprivation, stress and supplemental stimulation in rat pups and premature human neonates. *Child Development, 58,* 1431-1447.

Schmitt, B.D. and Kempe, C.H. (1979) Abuse and neglect of children. In V.C. Vaughan, R.J. McKay and R.E. Behrman (Eds.) (p120-126). *Nelson textbook of pediatrics (11th Ed.).* Philadelphia: W.B. Saunders.

Schulman-Galambus, C. and Galambus, R. (1975) Brain stem auditory evoked responses in premature infants. *Journal of Speech and Hearing Research, 18,* 456-465.

Scott, J.P. and Richards, M. (1979) Nursing low birthweights on lambwool. *The Lancet,* 1208.

Scott, K., Field, T.M. and Robertson, E. (1980) *Teenage parents and their offspring.* New York: Grune and Stratton.

Segall, M. (1971) Relationship between auditory stimulation and heart rate response of the premature infant (p119-129). In the American Nurses' Association, *Nursing Research Conference (Vol.7).* Kansas City: American Nurses' Association.

(1972) Cardiac responsivity to auditory stimulation in premature infants. *Nursing Research, 21,* 15-19.

Seligman, M.E.P. (1970) On the generality of the laws of learning. *Psychological Review, 77,* 406-418.

(1975) *Learned helplessness: On development, depression and death.* San Francisco: Freeman and Co.

Semb, G. and Lipsitt, L.P. (1968) Effects of acoustic stimulation on cessation and initiation of non-nutritive sucking in neonates.*Journal of Experimental Child Psychology, 6* 585-597.

Senn, M.J.E. (1975) Insights on the child development in the United States. *Monographs of the Society for Research in Child Development, 40,* (Serial No. 161).

Sepkoski, C., Coll, C.G. and Lester, B.M. (1977) The effects of high risk factors on neonatal behaviour as measured by the Brazelton scale. Biennial Meeting of the *Society for Research in Child Development*, New Orleans.

Shevrin, H. and Toussing, P.W. (1965) Vicissitudes of the need for tactile stimulation in instintual development. *The Psychanalytic Study of the Child, 20,* 310-339.

Shirley, M. (1939) A behaviour syndrome characteristic of prematurely born children. *Child Development, 10,* 115-128.

Siegel, R. (1982) A family centred programme of infant care. *Health and Social Work, 7,* 50-58.

Sigman, M. and Parmelee, A. (1979) Longitudinal evaluation of the preterm infant. In Field T., Sostek A., Goldberg S. and Schuman H.H. (Eds.) *Infants born at risk.* New York: Spectrum.

Silcock, A. (1984) Crises in parents of prematures. An Australian study. *British Journal of Developmental Psychology, 2,* 257-268.

Sinclair, J.C. (1972) Low-birthweight infant. In H.L. Barnett and A.H. Einhorn (Eds.) *Pediatrics (15th Ed.)*. New York: Appleton-Century-Crofts.

Singer, R.D. and Singer, A. (1969) *Psychological development in children*. Philadelphia: W.B. Saunders.

Siperstein, G.N. (1973) Differential modification of neonatal behaviour. Paper presented at meeting of the *Society for Research in Child Development*, Philadelphia, Penn.

Siqueland, E.R. (1968) Reinforcement patterns and extinction in human newborns. *Journal of Experimental Child Psychology, 6,* 431-442.

Siqueland, E.R. (1969) The development of instrumental exploratory behaviour during the first year of human life. Paper presented at the *Society for Research in Child Development.*

(1973) Biological and experiential determinants of exploration in infancy. In L.J. Stone, H.T. Smith and L.B. Murphy (Eds.) *The competent infant*. New York: Basic Books.

Siqueland, E.R. and DeLucia, C.A. (1969) Visual reinforcement of non-nutritive sucking in human infants. *Science, 165,* 1144-1146.

Siqueland, E.R. and Lipsitt, L.P. (1966) Conditioned head-turning behaviour in newborns. *Journal of Experimental Child Psychology, 3,* 356-376.

Smith, N., Schwartz, J.R., Mandell, W., Silberstein, R.M., Dalack, J.D. and Sacks, S. (1969) Mothers' psychological reactions to premature and full-size newborns. *Archives of General Psychiatry, 21,* 177-181.

Smith, C. and Steinschneider, A. (1975) Differential effects of prenatal rhythmic stimulation on neonatal arousal states. *Child Development, 46,* 574-578.

Snyder, F.F. and Rosenfield, M. (1937) Direct observation of intra-uterine respiratory movements of the fetus and the role of Co2 and O2 in their regulation. *American Journal of Physiology, 19,* 153-166.

Sokolov, E. (1963) *Perception and the conditioned reflex.* New York: Pergamon.

Solkoff, N., Yaffe, S., Weintraub, D. and Blase, B. (1969) The effects of handling on the subsequent development of premature infants. *Developmental Psychology, 1,* 765-768.

Solkoff, N. and Matuszak, D. (1975) Tactile stimulation and behavioural development among low birthweights. *Child Psychiatry and Human Development, 6,* 33-37.

Spahr, J.C., McDonald, H.M. and Mueller-Heubech, E. (1981) Knee-chest position and neonatal oxygenation and blood pressure. *American Journal of Diseases in Childhood, 135,* 79-80.

Spear, N.E. (1979) Memory storage factors leading to infantile amnesia. In G.H. Bower (Ed.) *The psychology of learning and motivation (Vol. 13).* New York: Academic Press.

Speidel, B.D. (1978) Adverse effects of routine procedures on premature infants. *The Lancet, 1,* 864-865.

Spence, M.J. and DeCasper A.J. (1987) Prenatal experience with low-frequency maternal voice sounds influence neonatal perception of maternal voice samples. *Infant Behaviour and Development, 10,* 133-142.

Spitz, R. (1945) Hospitalization: An inquiry into the genesis of psychiatric conditions in early childhood. *The Psychoanalytic Study of the Child, 1,* 53-74.

Sroufe, L.A., Waters, E. and Matas, L. (1974) Contextual determinants of infant affective response. In M. Lewis and L.A. Rosenblum (Eds.) The origins of fear. New York: Wiley.

Stack D.M. (1988) Effect of tactile stimulation on infant affect and attention during adult-infant interactions. *PhD thesis, Queen's University, Kingston, Ontario, Canada.*

Stave, U. (1978) *Perinatal physiology.* New York: Plenum Medical Book Company.

Stave, U. and Ruvalo, C. (1980) Neurological development in very low-birthweight infants. *Early Human Development, 4,* 229-241.

Stechler, G. (1964) A longitudional follow-up of neonatal apnoea. *Child Development, 35,* 333-348.

Sterman, M.B. (1967) Relationship of intrauterine fetal activity to maternal sleep stage. *Experimental Neurology, 19,* 98-106.

Stern, D.N. (1974) Mother and infant at play: The dyadic interaction involving facial, vocal and gaze behaviours. In M. Lewis and A.L. Rosenblum (Eds.) *The effect of the infant on its caregiver.* New York: Wiley.

Stern, G.G., Caldwell, B.M., Hersher, L., Lipton, E.L. and Richmond, J.B. (1969) A factor analytic study of the mother-infant dyad. *Child Development, 40,* 163-181.

Stratton, P. (1982) *Psychology of the newborn.* London: Wiley.

Strassberg, S. (1978) Paternal involvement with first-borns during infancy. *Dissertations Abstracts International, 39, 2528B-2529B (University Microfilms No. 7819833).*

Stubbe, P. and Wolf, H. (1971) The effect of stress on growth hormone, glucose and glycerol levels in newborn infants. *Hormone and Metabolic Research, 3,* 175-179.

Sweeney, J.K. (1983) Neonatal hydrotherapy: An adjunct to developmental intervention in an intensive care nursery setting. *Physical and Occupational Therapy in Pediatrics, 3,* 39-52.

Swoboda, P.J., Kass, J., Morse, P.A. and Leavitt, L.A. (1978) Memory factors in vowel discrimination of normal and at-risk infants. *Child Development, 49,* 332-339.

Swoboda, P.J., Morse, P.A. and Leavitt, L.A. (1976) Continuous vowel discrimination in normal and at-risk infnats. *Child Development, 47,* 459-465.

Tanaka, Y. and Arayana, T. (1969) Fetal responses to acoustic stimuli. *Practica Oto-rhino-laryngotogica, 31,* 269-273.

Tapp, J.T. and Markowitz, H. (1963) Infantile handling: Effects of avoidance learning on brain weight and cholinesterase activity. *Science, 140,* 486-487.

Taylor, J.L. (1921) The states of human life. Cited in A. Montagu (1978) *Touching: The human significance of the skin.* New York: Harper and Row.

Telzrow, R. and Snyder, D. (1977) Effects of phototherapy on neonatal behaviour. Paper presented at the *Society for Research in Child Development*, New Orleans, April.

Telzrow, R., Kang, R., Mitchell, S., Ashworth, C. and Barnard, K. (1982) An assessment of the premature infant at 40 weeks conceptual age. In L.P. Lipsitt and T.M. Field (Eds.) *Infant behaviour and development: Perinatal risk and newborn behaviour.* Norwood, New Jersey: Ablex.

Terres, N. (1979) Psychological aspects of neonatal intensive care. Paper presented at the *Fourth International Symposium on Clinical Applications of Research in Infant-Parent Relationships*, Boston.

Thoman, E. (1975) Early development of sleeping behaviours in infants (p123-138). In N. Ellis (Ed.) *Aberrant development in infancy.* Hillsdale, New Jersey: Ablex.

Thoman, E.B. and Korner, A.S. (1971) Effects of vestibular stimulation on the behaviour and development of rats. *Developmental Psychology, 5,* 92-98.

Thomas, H. (1971) Discrepancy hypothesis: methodological and theoretical considerations. *Psychological Review, 78,* 249-259.

Thomas, A. and Chess, S. (1977) *Temperament and development.* New York: Bruner/Mazel.

Thompson, W.R. (1958) Motivational factors in development. *Australian Journal of Psychology, 10,* 127-143.

Tizard, B. (1990) Research and policy: Is there a link ?. *The Psychologist, 30,* 435-440.

Tjossem, T.D. (1976) *Intervention strategies with high risk infants and young children.* Baltimore: University Park Press.

Touwen, B.C.L. (1980) The preterm infant in the extrauterine environment: Implications for neurology. *Early Human Development, 4/3,* 287-300.

Tryowski, L.E. (1979) The effects of oral sensory stimulation on nutritive sucking in premature infants. *PhD. thesis, Medical College of Virginia, Virginia, UA.*

Tuck, S.J., Monin, P., Duvivier, C., May, T. and Vert, P. (1982) Effect of a rocking bed o apnoea of prematurity. *Archives of Disease in Childhood, 57*, 475-476.

Turkewitz, G. and Kenney, P.A. (1985) Role of developmental limitations of sensory and perceptual organization. *Developmental and Behavioural Pediatrics, 6,* 302-306.

Turkewitz, G., Moreau, T., Birch, H.G. and Crystal, D. (1967) Realtionship between prior head position and lateral differences in responsiveness to somesthetic stimulation in the human neonate. *Journal of Experimental Child Psychology, 5,* 548-561.

Turner, E. (1981) Cinical nursing responsibilities for research involving parents and their infants (p129-131). In V.L. Smerligo, (Ed.), *Newborns and parents, parent-infant contact and newborn sensory stimulation.* Hillsdale, New Jersey: Erlbaum.

Turner, J. (1980) *Made for life.* London: Methuen.

Ulyings, H.B.M., Kuypers, K. and Veltman, W.A.M. (1978) Environmental influences on the neocortex in later life (p261-274). In *Programmes of brain research (Vol.48).* Amsterdam: Elsevier.

Van Bree, N.S. (1981) Undergraduate research. *Nursing Outlook, 29,* 39-41.

Van den Daele, L.D. (1970) Modification of infant state by treatment in a rockerbox. *Journal of Psychology, 44,* 161-165.

Vander, A.J., Sherman, J.H. and Luciano, D.S. (1980) *Human physiology: The mechanisms of bodily function, (3rd Ed.).* New York: McGraw-Hill.

Vander-Lind, E. (1982) The effects of training factors on acquisition and retention in early infancy. *PhD. thesis, Rutgers University, U.S.A.*.

Van Wyk, J.J. and Underwood, L.E. (1978) Growth hormone, somatomedins and growth failure. *Hospital Practice, 65,* 57-67.

Vaughn, V.C. (1969) Developmental pediatrics. In W. Nelson, V.C. Vaughan and R.J. McKay (Eds.), *Textbook of pediatrics.* Philadelphia PA: Sunders.

Vietze, P.M., Falsey, S., O'Connor, S., Sandler, H., Sherrod, K. and Altmeier, W.A. (1980) Newborn behavioural and interaction characteristics of failure-to-thrive children. In T. Field (Ed.) *High risk infants and children: Adult and peer interactions.* New York: Academic Press.

Vital-Durand, F. and Michel, F. (1969) Effects de la deafferentiation sensorielle sur le cycle veille-sommeil. *Journal of Physiology, 61,* 186.

Vinza, M. (1971) The social contacts of infants and young children reared together. *Early Child Development and Care, 1,* 99-109.

Von Ebner, V. (1899) Cited in V. *Koelliker's Handb D Geweblehre D Menschen* (Vol. 3, p18), Die acinosen Drusen der Zunge und ihre Beziehungen zu den Geschmacksorganen. Austria: Leuschner und Lubenskky.

Wachs, T.D. (1974) Visual exploratory behaviour by rats as a function of early handling, sex and level of auditory prestimulation. *Developmental Psychobiology, 5*, 385-392.

Wagaman, M.J., Shutack, J.G., Moomjian, A.S. et al. (1979) Improved oxygenation and lung compliance with prone positioning of neonates. *Journal of Pediatrics, 84*, 787-791.

Wasserman, G., Soloman-Schwerzer, C.R., Spieker, S. and Stern, D. (1980) "Maternal interactive style with normal and at-risk toddlers". Paper presented at the *International Conference on Infant Studies*. New Haven, CT.

Watson, J. (1985) *Nursing: Human sciences and a theory of nursing*. Norwolk, CT: Appleton, Century, Crofts.

Watt, J. (1986) Intrauterine growth retardation: A preliminary behavioural intervention study. *Journal of Reproductive and Infant Psychology, 4*, 77-84.

(1990) Interaction, intervention and development in small-for-gestational-age infants. *Infant Behaviour and Development, 13*, 273-286.

Wattley, L.A. and Muller, D.J. (1984) *Investigating psychology: A practical approach for nursing*. London: Harper and Row.

Weininger, O. (1954) Physiological damage under emotional stress as a function of early experience. *Science, 119*, 285-286.

(1956) The effects of early experience on behaviour and growth characteristics. *Journal of Comparative Physiological Psychology, 49*, 1-9.

Weinman, J. (1989) A survey of pre-clinical psychology teaching in U.K. medical schools. *Medical Education, 23,* 77-88.

Weizmann, F., Cohen, L.B. and Pratt, J. (1971) Novelty, familiarity and development of infant attention. *Developmental Psychology, 4,* 149-154.

Wenger, M.A. (1936) An investigation of conditioned responses in human infants. *University of Iowa Studies in Child Welfare, 12,* 1-90.

Werboff, J., Anderson, A. and Heggett, B.N. (1968) Handling of pregnant mice: gestation and postnatal behaviour effects. *Physiology and Behaviour, 3,* 35-39.

Werner, J.S. and Siqueland, E.R. (1978) Visual recognition memory in the preterm infant. *Infant Behaviour and Development, 1,* 79-94.

Wexler, M. (1976) The behavioural sciences in medical education: A view from psychology. *American Psychologist, 31,* 275-283.

White, B.L. (1967) An experimental approach to the effects of experience on early human behaviour. Presented at the *Minnesota Symposium on Child Psychology.* Minneapolis, U.S.A.

White, B.L. (1969) The initial co-ordination of sensori-motor schemas in human infants - Piaget's ideas and the role of experience. In D. Elkind and J.H. Flavell (Eds.) *Studies in cognitive development.* New York: Oxford University Press.

(1971) *Human infant experience and psychological development.* Inglewood Cliffs, New Jersey: Prentice Hall.

(1975) Critical influences in the origins of the development of competence. *Merrill-Palmer Quaterly, 21*, 243-266.

White, R.W. (1961) Motivation reconsidered: The concept of competence (p378-326). In D.W. Fiske and S.R. Maddi (Eds.) *Functions of varied experience*. Illinois: Dorsey Press.

White, B.L. and Castle, P.W. (1964) Visual exploratory behaviour following postnatal handling of human infants. *Perceptual Motor Skills, 18*, 497-502.

White, B.L. and Held, R. (1966) Plasticity of sensorimotor development in the human infant. In J.F. Rosenblith and W. Allinsmith (Eds.) *The causes of behaviour (Vol. 3)*. Boston: Allyn and Bacon.

White, J. and LaBarba, R. (1976) The effects of tactile and kinesthetic stimulation on neonatal development in the premature infant. *Developmental Psychology, 9*, 569.

White-Traut, R.C. and Carrier Goldman, M.B. (1988) Premature infant massage: is it safe ?. *Pediatric Nursing, 14*, 285-289.

Whitelaw, A., Minde, K., Brown, J. and Fitzhardinge, P. (1980). The effect of severe physical illness on the behaviour of very small premature infants. *Journal of Developmental Medicine and Child Neurology*, 8.

Wickler, A. (1950) Sites and mechanisms of action of morphine and related drugs in the C.N.S.. *Pharmacological Review, 12*, 435-506.

Widmayer, S. and Field, T.M. (1981) Effects of Brazelton Demonstrations for mothers on the development of preterm infants. *Pediatrics, 67*, 711-714.

Willie, D.E. (1991) The relation of premature birth with quality of infant-mother attachment at 1 year. *Infant Behaviour and Development, 14,* 227-241.

Windle, W.F. and Griffin, A.F. (1931) Observations on embryonic and fetal movements of the cat. *Journal of Comparative Neurology, 52,* 149-188.

Winefield, H.R. (1982) Subjective and objective outcomes of communication skills training in the first year. *Medical Education, 16,* 192-196.

Wohlwill, J.F. (1973) *The study of behavioural development.* New York: Academic Press.

Wolff, P.H. (1959) Observations on newborn infants *Psychosomatic Medicine, 21,* 110-118.

Wolff, P.H. (1966) The causes, controls and organization of behaviour in the neonate. *Psychological Issues, 5,* 17.

Wolff, P.H. and Simmons, M.A. (1967) Non-nutritive sucking and response thresholds in young infants. *Child Development, 38,* 631-638.

Wolff, P.H. and White, B.L. (1965) Visual pursuit and attention in young infants. *Journal of Child Psychiatry, 4,* 473-484.

Wolf, T.M., Balson, P.M., Faucett, J.M. and Randall, H.M. (1989) A retrospective study of attitude change during medical education. *Medical Education, 23,* 19-23.

Wolf, T.M., Randall, H.M., Von Alma, K. and Tynes, C.C (1991) Perceived mistreatment and attitude change by graduating medical students: A retrospective study. *Medical Education, 25,* 182-190.

Wolke, D. (1987) Environmental and developmental neonatology. *Journal of Reproductive and Infant Psychology, 5,* 17-42.

Woodson, R.H. (1983) Newborn behaviour and the transition to extrauterine life. *Infant Behaviour and Development, 6,* 139-144.

World Health Organization (1961) *Public health aspects of low birthweight.* Geneva: Technical Paper No. 217

Wozniak, E., Fenton, K. and Millar, J.P. (1983) The development of tasting, smell and intestinal motility in the human neonate. *Pre-print of the Proceedings of the Eleventh International Symposium on Gastrintestinal Motility.*

Wright, G.H. (1955) The variability of the threshold for sensations of warmth as evoked by radiation. *Journal of Physiology, 128,* 333-343.

Wright, L. (1971) The theoretical and research base for a program of early stimulation care and training of the premature infants (p276-304). In J. Hellmuth (Ed.), *The exceptional infant (Vol.2).* New York: Bruner Mazel.

Wurtman, R.J. (1975) The effects of light on the human body. *Scientific American, 233,* 68-77.

Wurtman, R.J. and Weisel, J. (1969) Environmental lighting and neuroendocrine function: Relationship between the spectrum of light source and gonadal growth. *Endocrinology, 85,* 1218-1221.

Yang, R.K. and Douhitt, T.C. (1974) Newborn responses to threshold tactile stimulation. *Child Development, 45,* 237-242.

Yarrow, L.J. (1963) Research in dimensions of early maternal care. *Merrill Palmer Quaterly, 9,* 101-114.

Yarrow, L.J., Rubenstein, J.L. and Pederson, F.A. (1971) Dimensions of early stimulation: differential effects on infants. Paper presented at the *Society for Research in Child Development.* Minneapolis, April.

Yarrow et al., (1975) *Infant and environment: early cognitive and maturational development.* New York: Wiley.

Yogman, M.W. (1981) Pediatric concerns in the perinatal period; the need for interdisciplinary research (p25-49). In K. Bloom (Ed.), *Prospective issues in infancy research.* New Jersey: Erlbaum.

Youngberg, S.P. (1978) *The effect of cycled and uncycled lighting on sleep behaviour of neonates.* Phd thesis, University of Washington, Washington D.C.

Yu, V.Y.H. (1975) Effect of body position on gastric emptying in the neonate. *Archives of Dissertations of the Child,* 50, 500-504.

Zelazo, P.R., Zelazo, N.A. and Kolb, S. (1972) Walking. *The newborn, 176,* 314-315.

Zeskind, P.S. and Lester, B.M. (1978) Acoustic features and auditory perceptions of the cries of newborns with prenatal and perinatal complications. *Child Development, 49,* 580-589.

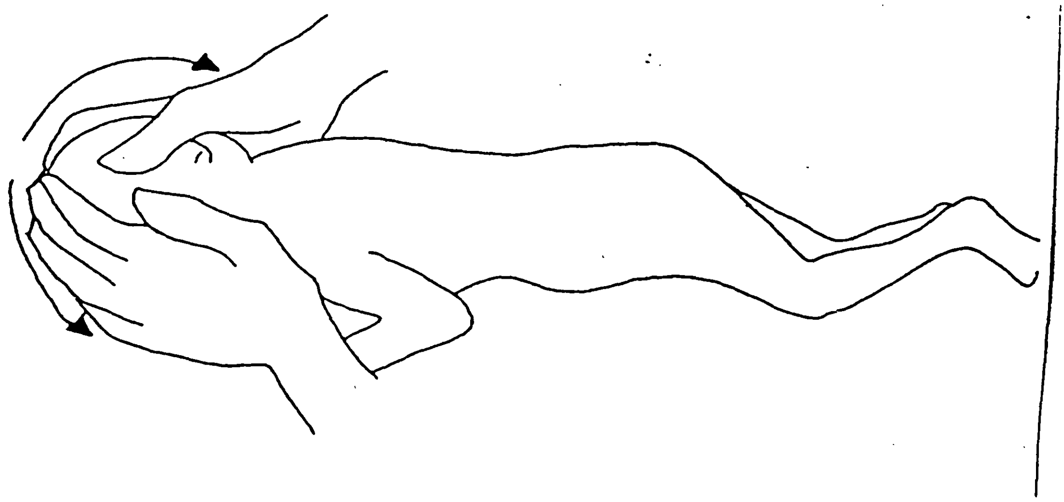
Appendices

APPENDIX 6.1.4

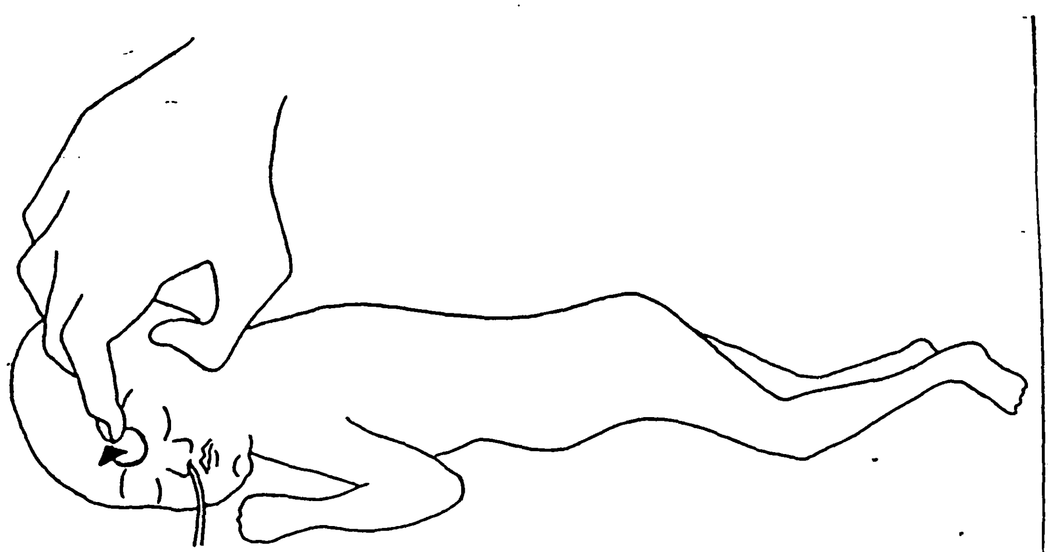
I

Illustrations Of Tac-tic Stimulation Procedure

1.1 Using both hands, cover the baby's head from the middle crain towrds the forehead with the left hand, and from the middle crown towards the neck with the right hand.

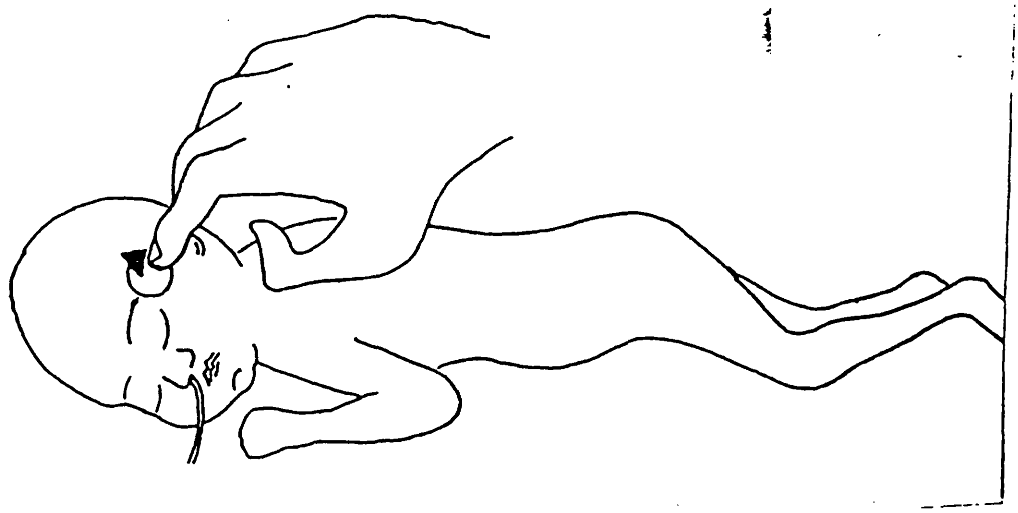


1.2 Repeat this movement three to six times.

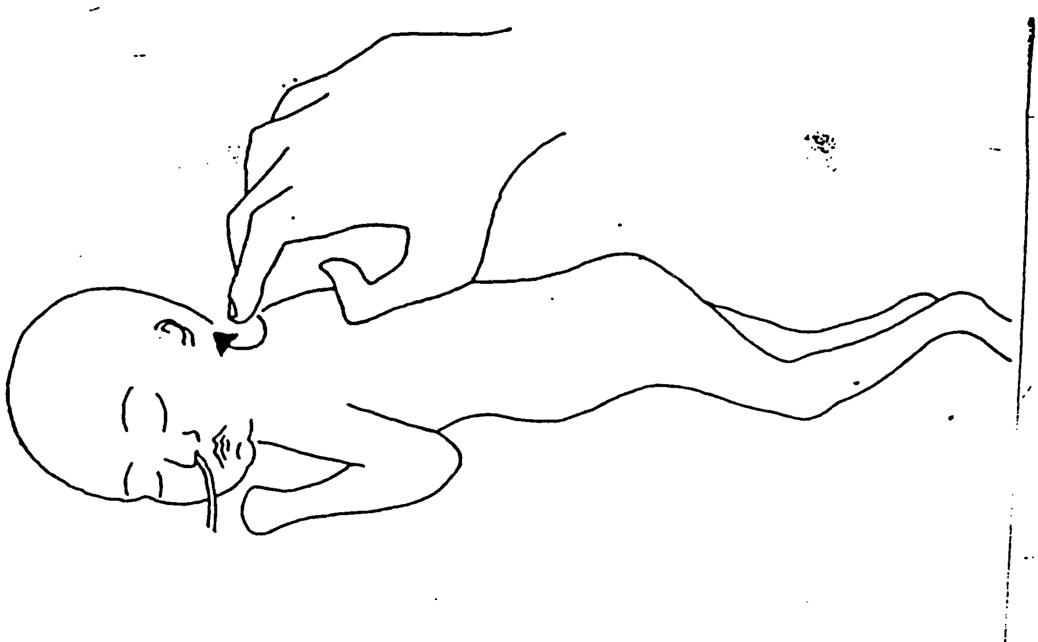


Using one finger in circular movements between the eyebrows, caress the middle of the forehead.

1.3 Do the same as 1.2, but on the temples

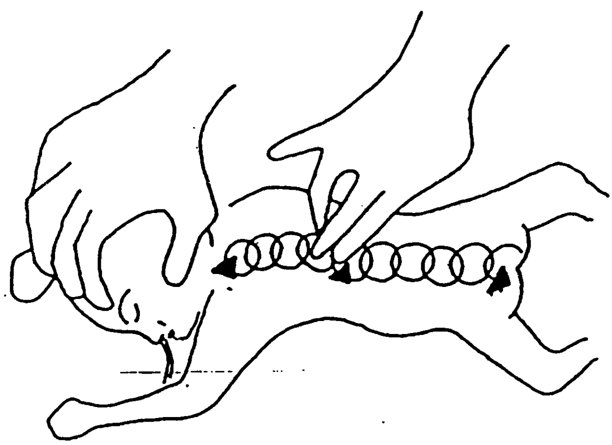


1.4 Do the same as 1.2 and 1.3, but on the nape of the neck, at the top of the spine.

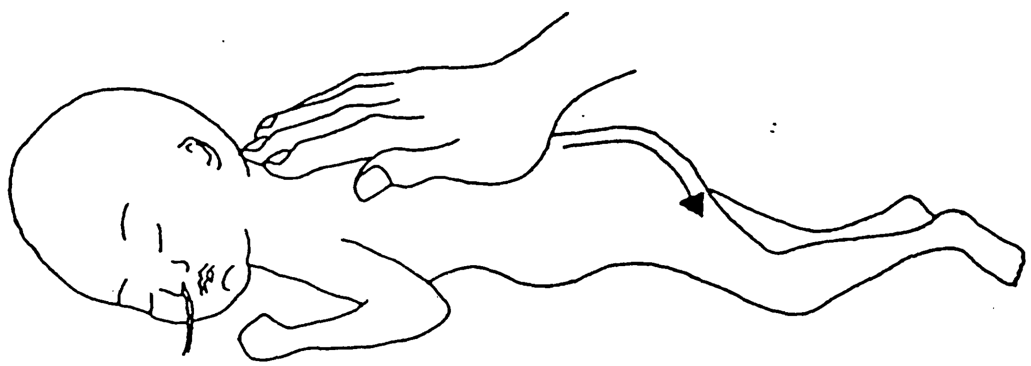


1.5 With the second fingers of both hands, placing each one in each side of the body, make sideways and downward movements towards the spine. Do this three to six times using gentle but firm touching. Press gently and make circular movements

1.6 With one finger make circular movements, all the way down the spine, from neck to bottom.

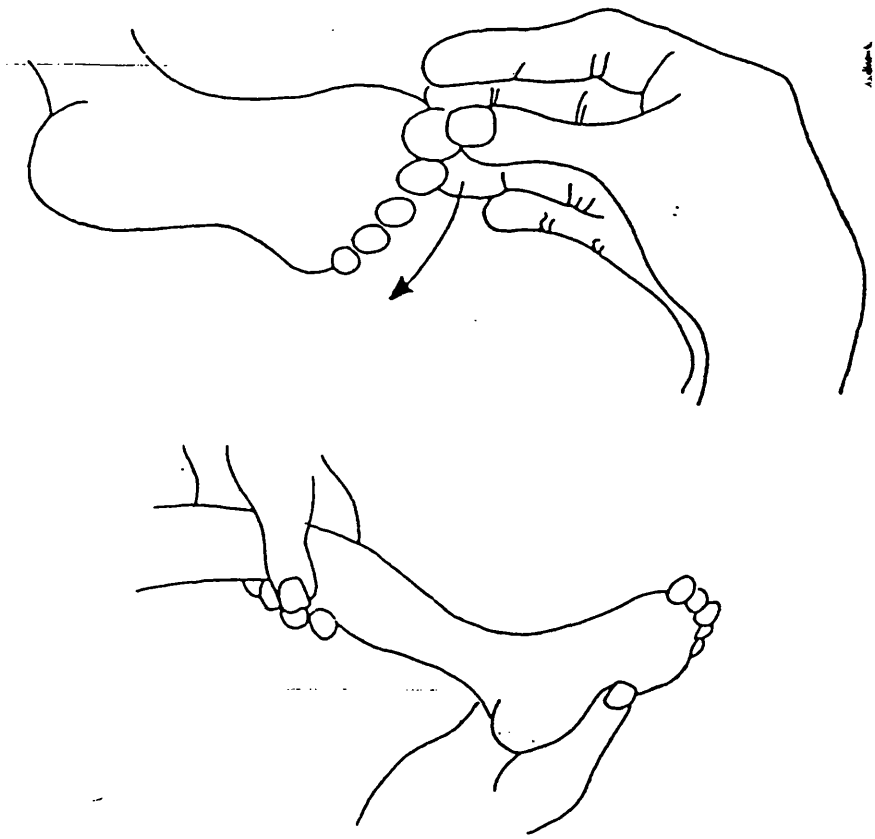


1.7 Cover the back with the hand from the nape of the neck, and stroke towards the bottom. Repeat 3 to 6 times. IV

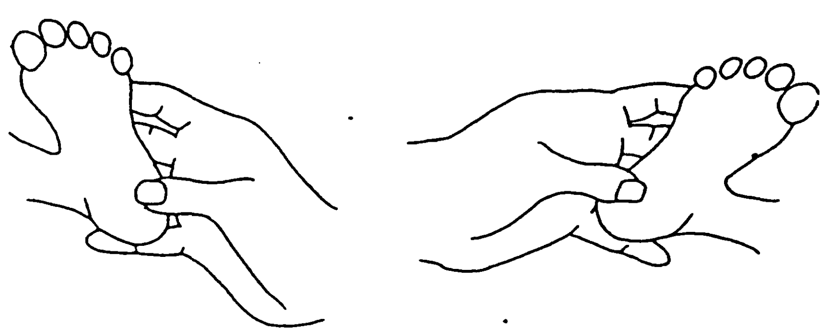


Authors	Procedure	Ss	Results
9.Parnavelas 1978	contingent visual illumination from birth until day 80	rats	1.positive effects upon the morphology of the visual area
10.Ulyings et al. 1978	enriched environment	rats (adult)	1.inc dendritic count in the occipital area
11.Cronly-Dillen & Perry 1979	visual stimulation from birth on	rats	1.positive effect on occipital cortex biochemistry
12.Ferchmin et al. 1975	enriched environment & motor training from day 25-65	rats	1.inc wgt gain of various brain areas
13.Floeter & Greenough 1978	social experience & enriched environment from birth-8 months	monkeys	1.Positive effects on purkinje cells
14.Greenough et al. 1979	maze training	rats (adult)	1.occipital cortex morphology benefits
15.Pysh & Weiss 1979	physical activity from day 18-35	mice	1.benefited purkinje cells
16.Pauk et al. 1986	tactile (stroking), vestibular (rocking) or kinaesthetic (passive limb movement), stimulation for 2 hrs after experiencing maternal deprivation	rats	1.only tactile stimulation i.e. stroking inc odc, gh & decreased corticosterone, thereby reversing the effects of maternal deprivation

1.8 Hold the foot gently. Stroke from the upper leg to the foot and toes. Extend toes. Press sole of foot gently.

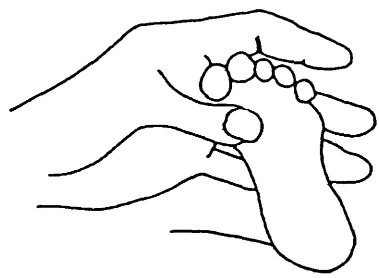


1.9 Press gently the outer, rear side of the left foot.

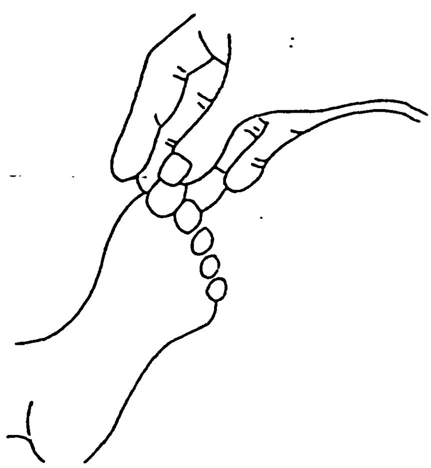


1.10 Press gently on the outer, front side of the foot.

1.11 Then press gently the ball of the left foot.



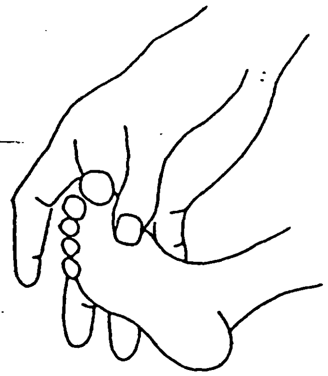
1.12 Press gently the big toe of the left foot.



1.13 Press gently the second toe of the same foot.

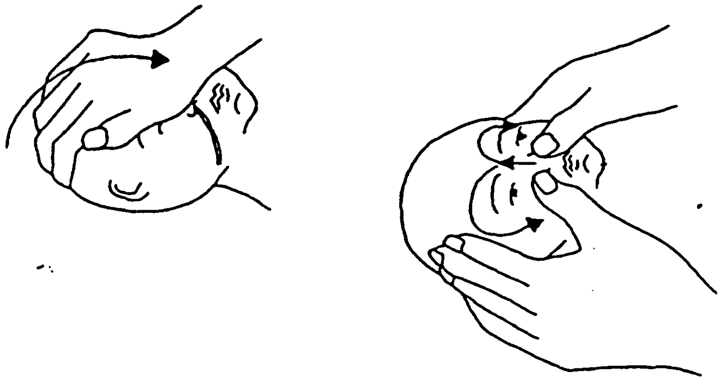
1.14 Press gently the fourth toe.

1.15 Repeat each of the previous instructions, 1.8 to 1.14 in sequence on the right foot.

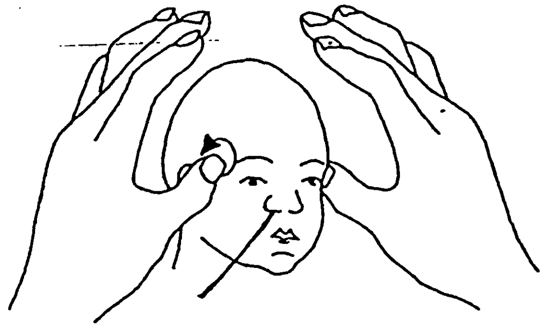


1.16 Turn the baby over. Place a light touch on the top of the head and stroke towards the forehead. Repeat 3 to 6 times.

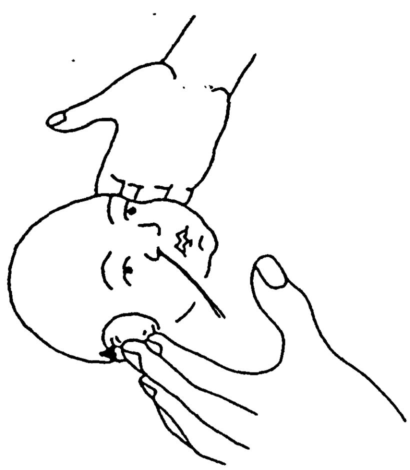
1.17 Put one hand on the toe of the head and stroke down to the forehead and down to the nose. Place both thumbs on nose, and stroke up to the forehead in the direction towards the chin. Repeat 3 to 6 times.



1.18 Put each of thumbs on temples, and stroke each of these areas with a circular movement.



1.19 Stroke the surface of the ears. Repeat 3 to 6 times using index fingers.



1.20 Place index fingers on each side of neck, and circularly stroke. Repeat 3 to 6 times.

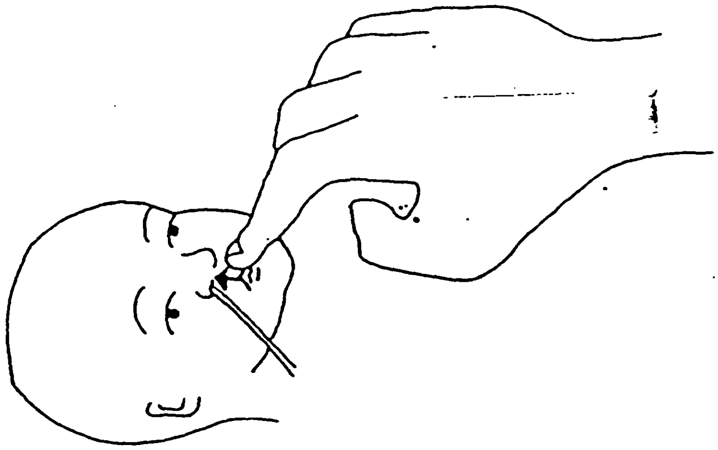
1.21 With thumbs, stroke gently around the eyes.

1.22 With index finger, make circular movements on the middle of the forehead. Repeat 3 to 6 times.

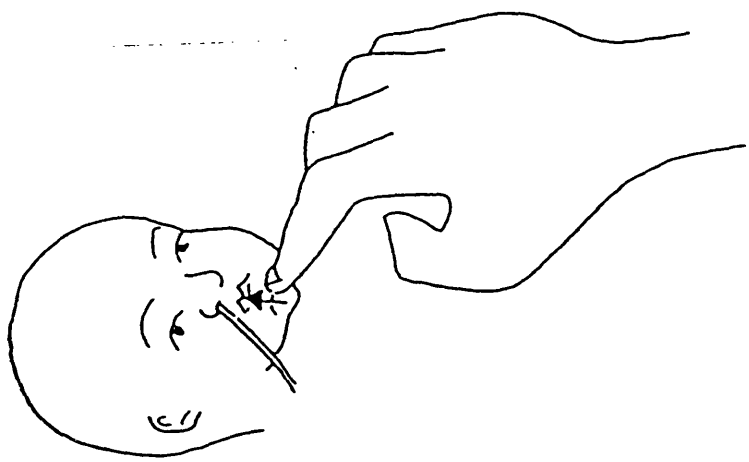
1.23 Move thumbs from the sides of the nose towards the cheek and towards the ears.

1.24 With index finger stroke around the baby's mouth.

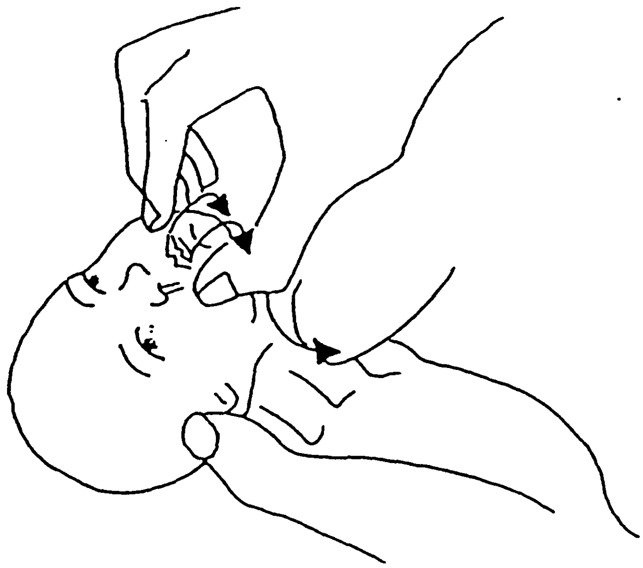
1.25 Touch the middle top of the lip with one finger, move finger slowly towards the nose. Repeat 3 to 6 times. X



1.26 With one finger, touch gently the middle of the bottom lip. Repeat 3 to 6 times.

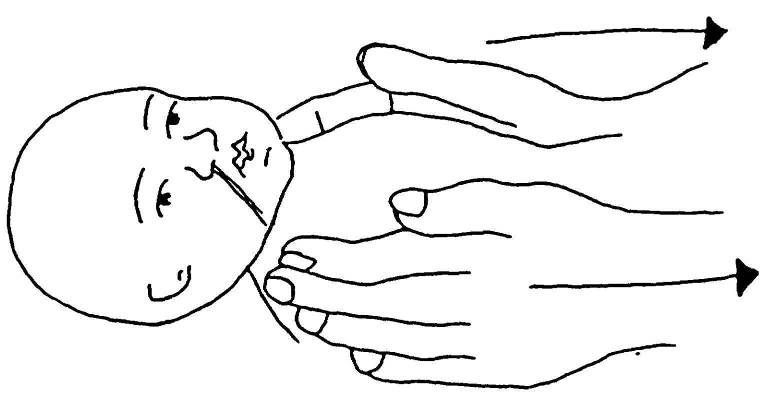


1.27 Tilt the baby's head back with support and thumb stroke the middle of the chin towards the throat. Repeat 3 to 6 times.



1.28 Cover the baby's body with one or two hands and stroke from the throat towards the bottom.

1.29 Place hands beneath arms and stroke from there towards the legs. Repeat 3 to 6 times.



1.30 Hold the baby's hand with one hand and with the other hand stroke from the shoulder down the arm towards the hand. Repeat 3 to 6 times. XII

1.31 Do the same action with the fingers and toes.

1.32 With two fingers, with 'vibrating' movements, stroke from the throat to the bottom.

1.33 Hold the foot with one hand and with the other stroke from the upper leg towards the foot. Do the same movement on the other leg.

1.34 Repeat all the movements shown from 1.16 to 1.33 to give the baby a feeling of continuity. Then place the baby in the initial position.

APPENDIX 6.2.1.1

RULES OF MATCHING

The overall distributions of the experimental and control infant samples were matched in the characteristics 1-6 below.

This was achieved by assigning an infant to one sample (Experimental/Control) if a similar infant belonged in the other sample. Infants were consider similar or "matched" if (in decreasing order of importance) they:

(1) were of the same gender

(2) both had experienced the same amount of ventilation i.e both for under 24 hours or both for under 48 hours

(3) were within +/- 3 weeks of each other in gestational age

(4) were within +/- 0.5 kg of each other in birthweight

(5) had an Apgar at 1 minute +/- 3 of each other

(6) had an Apgar at 5 minutes +/- 2 of each other.

APPENDIX 6.2.2.1.1

SELF-PERCEPTIONS OF THE PARENTAL ROLE

INSTRUCTIONS

The following questions ask about how you see yourself as a parent. There are no right or wrong answers. Instead, we are interested in your opinions about parents and how you are doing as a parent. Each question gives you two statements about parents. Choose the one which fits best with your own views, then decide whether it is very true for you, or only partly true for you. Please tick only 1 of the 4 boxes for each question. Tick the one that best describes you. For example, if you feel that your child should eat up everything, you should tick one of the boxes on the left. If you don't mind your child leaving some food, you should tick one of the boxes on the right. The box you do tick depends on whether you feel the statement is very true for you, or only partly true.

	Very True for me	Partly True for me				Partly True for me	Very True for me
	☐	☐	Some parents like their child to eat up everything on the plate	BUT	Other parents don't mind if their child leaves food uneaten	☐	☐

REMEMBER: Tick only *one* box per question.

	Very True for me	Partly True for me				Partly True for me	Very True for me
1.	☐	☐	Some parents do a lot of reading about how to be a good parent.	BUT	Other parents don't spend much time reading about being a parent.	☐	☐
2.	☐	☐	Some parents have clear ideas about the right and wrong ways to bring up children.	BUT	Other parents have doubts about the way they are bringing up their children.	☐	☐
3.	☐	☐	Some parents feel that they don't see enough of their friends since they've had children.	BUT	Other parents see their old friends just as often, or they have made new ones.	☐	☐
4.	☐	☐	Some parents often wish they hadn't had children.	BUT	Other parents rarely regret having had children.	☐	☐
5.	☐	☐	Some parents want to learn everything possible about being a parent.	BUT	Other parents feel that they already know all they need to know about being a parent.	☐	☐
6.	☐	☐	Some parents often can't work out what their children need or want.	BUT	Other parents seem to have a knack for understanding what their children need or want.	☐	☐

	Very True for me	Partly True for me				Partly True for me	Very True for me
7.	☐	☐	Some people feel they end up making too many sacrifices for their children.	BUT	For other parents, there are more rewards than sacrifices in having children.	☐	☐
8.	☐	☐	Some adults are more content being a parent than they ever thought possible.	BUT	For other adults, being a parent hasn't fulfilled them like they had hoped it would.	☐	☐
9.	☐	☐	Some parents don't think too much about how to bring up their children; they just do it.	BUT	Other parents try to learn as much as they can about how bringing up children.	☐	☐
10.	☐	☐	Some parents feel that they are doing a good job of providing for their children's needs.	BUT	Other parents have doubts about how well they are meeting their children's needs.	☐	☐
11.	☐	☐	Some parents resent the fact that having children means less time to do the things they like.	BUT	Other parents don't mind having less free time for themselves.	☐	☐
12.	☐	☐	Some adults would hesitate to have children if they could start all over again.	BUT	Given the choice, other adults wouldn't think twice before having children.	☐	☐
13.	☐	☐	Some parents feel they must keep up with the latest advice and methods on bringing up children.	BUT	Other parents would rather deal with their children on a day-to-day basis with what they already know.	☐	☐
14.	☐	☐	Some parents often worry about how they're doing as a parent.	BUT	Other parents feel confident about their abilities as parents.	☐	☐
15.	☐	☐	For some mothers and fathers, the marriage is just as strong after having children as before.	BUT	For other mothers and fathers, being a parent gets in the way of being a good wife or husband.	☐	☐
16.	☐	☐	For some parents, children mostly feel like a burden.	BUT	For other parents, their children are a main source of joy in their lives.	☐	☐

	Very True for me	Partly True for me				Partly True for me	Very True for me
17.	☐	☐	Some mothers and fathers are concerned about being a parent; they think or worry about it a lot.	BUT	Other mothers and fathers usually don't worry about being a parent; they take it as a matter of course.	☐	☐
18.	☐	☐	Some mothers and fathers think that they are not very effective parents.	BUT	Other mothers and fathers think they are fairly capable as parents.	☐	☐
19.	☐	☐	For some parents, having children means that they can't do the things they used to like to do.	BUT	For other parents, having children doesn't change their lifestyle very much.	☐	☐
20	☐	☐	Being a parent is a satisfying experience to some adults.	BUT	For other adults, being a parent is not all that satisfying.	☐	☐
21	☐	☐	Some mothers and fathers aren't sure they were suited to be parents.	BUT	Being a parent comes easily and naturally to other mothers and fathers.	☐	☐
22.	☐	☐	Some parents feel that their lives are restricted or confined since having children.	BUT	Other parents don't stop doing things they like to do just because of their children.	☐	☐

COMMENTS:

APPENDIX 6.2.2.1.2

HOME Inventory*

Place a plus (+) or minus (-) in the box alongside each item if the behavior is observed during the visit or if the parent reports that the conditions or events are characteristic of the home environment. Enter the subtotal and the total on the front side of the Record Sheet.

I. Emotional and Verbal RESPONSIVITY	
1. Parent spontaneously vocalized to child twice.	
2. Parent responds verbally to child's verbalizations.	
3. Parent tells child name of object or person during visit.	
4. Parent's speech is distinct and audible.	
5. Parent initiates verbal exchanges with visitor.	
6. Parent converses freely and easily.	
7. Parent permits child to engage in "messy" play.	
8. Parent spontaneously praises child at least twice.	
9. Parent's voice conveys positive feelings toward child.	
10. Parent caresses or kisses child at least once.	
11. Parent responds positively to praise of child offered by visitor.	
Subtotal	

II. ACCEPTANCE of Child's Behavior	
12. Parent does not shout at child.	
13. Parent does not express annoyance with or hostility to child.	
14. Parent neither slaps nor spanks child during visit.	
15. No more than one instance of physical punishment during past week.	
16. Parent does not scold or criticize child during visit.	
17. Parent does not interfere or restrict child more than 3 times.	
18. At least ten books are present and visible.	
19. Family has a pet.	
Subtotal	

III. ORGANIZATION of Environment	
20. Substitute care is provided by one of three regular substitutes.	
21. Child is taken to grocery store at least once/week.	
22. Child gets out of house at least four times/week.	
23. Child is taken regularly to doctor's office or clinic.	
24. Child has a special place for toys and treasures.	
25. Child's play environment is safe.	
Subtotal	

IV. Provision of PLAY MATERIALS	
26. Muscle activity toys or equipment.	
27. Push or pull toy.	
28. Stroller or walker, kiddie car, scooter, or tricycle.	
29. Parent provides toys for child during visit.	
30. Learning equipment appropriate to age--cuddly toys or role-playing toys.	
31. Learning facilitators--mobile, table and chairs, high chair, play pen.	
32. Simple eye-hand coordination toys.	
33. Complex eye-hand coordination toys (those permitting combination).	
34. Toys for literature and music.	
Subtotal	

V. Parental INVOLVEMENT with Child	
35. Parent keeps child in visual range, looks at often.	
36. Parent talks to child while doing household work.	
37. Parent consciously encourages developmental advance.	
38. Parent invests maturing toys with value via personal attention.	
39. Parent structures child's play periods.	
40. Parent provides toys that challenge child to develop new skills.	
Subtotal	

VI. Opportunities for VARIETY	
41. Father provides some care daily.	
42. Parent reads stories to child at least 3 times weekly.	
43. Child eats at least one meal per day with mother and father.	
44. Family visits relatives or receives visits once a month or so.	
45. Child has 3 or more books of his/her own.	
Subtotal	

TOTAL SCORE	

*For complete wording of items, please refer to the Administration Manual.

APPENDIX 6.2.2.2.4.1.1

Experimental Long-term Letter

HELPING THE PREMATURE BABY

Dear Mrs Jones,

I hope this letter find you and Jessica well. Now that she is approaching her fifteenth month, I would appreciate very much if I could visit you and Jessica at your home, at a time convenient to you. This visit would take under two hours and would simply comprise of seeing how Jessica has developed.

I would be most grateful if you could fill in and send on to me the form below in the stamped addressed envelopeand I will contact you when Jessica has reached the stated age.

Thank you very much for your co-operation.

Yours sincerely,

Aine de Roiste (Psychologist)

Name ______________________________

Address ______________________________

____

____

Tel. No. ______________________________

APPENDIX 6.2.2.2.4.1.2

Control Long-term Letter

HELPING THE PREMATURE BABY

Dear Ms Smith,

I have been conducting a study looking at premature infants in the Queen Mother's Hospital at Yorkhill and am now seeing how they are doing at around the fifteenth month age-range. I would appreciate very much if I could visit you and Mark at your home, at a time convenient to you. This visit would take under two hours and would simply comprise of seeing how Mark has developed.

I would be most grateful if you could fill in and send on to me the enclosed form in the stamped addressed envelope and I will contact you when Mark has reached the stated age.

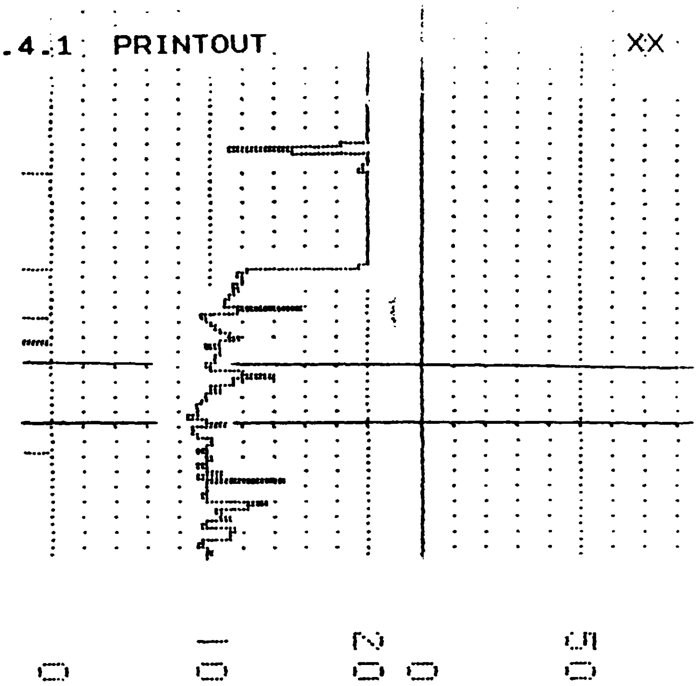
Thank you very much for your co-operation.

Yours sincerely,

Aine de Roiste (Psychologist)

APPENDIX 7.2.4.1 PRINTOUT XX

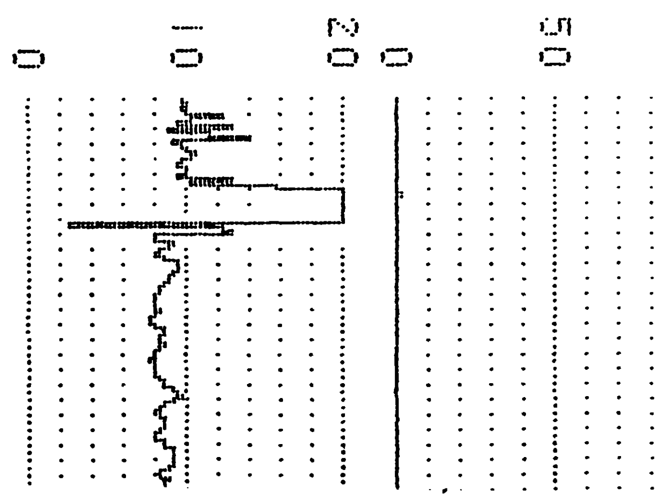
10:00
10:16 C2
10:42 C3
10:55 C4
11:02 C6
11:07 C7
11:23 C8
11:31 C9



31 Mar P 02 Mean BF

31 Mar P 02 Mean BF

12:00
13:00



APPENDIX 7.3.1.2.2

Mean Respiration Rate values for order of Experimenter2 and Mother

(a) Before Phase: Respiration Rate

	Mean	S.Dev
MOTHER FIRST	62.43	2.78
EXPERIMENTER SECOND	57.66	7.52
EXPERIMENTER FIRST	50.82	8.54
MOTHER SECOND	57.67	7.26

(b) During Phase: Respiration Rate

	Mean	S.Dev
MOTHER FIRST	64.05	8.66
EXPERIMENTER SECOND	60.41	7.07
EXPERIMENTER FIRST	45.57	11.86
MOTHER SECOND	60.60	5.65

(c) After Phase: Respiration Rate

	Mean	S.Dev
MOTHER FIRST	65.98	8.06
EXPERIMENTER SECOND	56.76	15.93
EXPERIMENTER FIRST	47.12	15.82
MOTHER SECOND	58.91	6.50

APPENDIX 7.3.1.2.1

Mean Heart Rate values for order of Experimenter2 and Mother

(a) Before Phase: Heart Rate

	Mean	S.Dev
MOTHER FIRST	182.32	3.27
EXPERIMENTER SECOND	181.59	5.25
EXPERIMENTER FIRST	168.48	2.00
MOTHER SECOND	166.90	5.56

(b) During Phase: Heart Rate

	Mean	S.Dev
MOTHER FIRST	179.04	4.55
EXPERIMENTER SECOND	180.18	5.82
EXPERIMENTER FIRST	167.43	14.14
MOTHER SECOND	170.04	8.93

(c) After Phase: Heart Rate

	Mean	S.Dev
MOTHER FIRST	173.80	8.74
EXPERIMENTER SECOND	177.80	6.50
EXPERIMENTER FIRST	168.18	12.01
MOTHER SECOND	172.40	11.30

APPENDIX 7.3.1.2.3

Mean Tcpo2 values for order of Experimenter2 and Mother

(a) Before Phase: Tcpo2

	Mean	S.Dev
MOTHER FIRST	7.50	1.49
EXPERIMENTER SECOND	7.88	0.96
EXPERIMENTER FIRST	10.36	2.46
MOTHER SECOND	8.45	0.48

(b) During Phase: Tcpo2

	Mean	S.Dev
MOTHER FIRST	7.16	1.38
EXPERIMENTER SECOND	8.13	1.16
EXPERIMENTER FIRST	10.24	2.41
MOTHER SECOND	8.54	0.66

(c) After Phase: Tcpo2

	Mean	S.Dev
MOTHER FIRST	6.33	0.49
EXPERIMENTER SECOND	7.62	1.56
EXPERIMENTER FIRST	10.27	2.90
MOTHER SECOND	8.49	1.22

APPENDIX 10.2.1.1

MATERNAL ATTITUDE SCALE

Please circle either YES or NO to the following questions :

PREGNANCY - ATTITUDES TOWARDS SELF

1. Did you feel O.K. during this pregnancy ? YES NO
2. Did you enjoy eating ? YES NO
3. Did you eat any differently during pregnancy than before pregnancy ? YES NO
4. Did you worry that your baby might not grow right inside of you ? YES NO
5. Were you worried about getting too fat ? YES NO
6. Did you enjoy wearing maternity clothes ? YES NO
7. Did you think that you looked physically unattractive during your pregnancy ? YES NO
8. Were you happy during the prenancy ? YES NO
9. Did you get upset very easily during pregnancy ? YES NO
10. Did you dislike being pregnant ? YES NO

PREGNANCY - ATTITUDES REGARDING FETUS

1. Did your baby kick a lot inside of you ? YES NO
2. Did you enjoy your baby's kicking + movements ? YES NO
3. Did your baby's movements inside of you ever frighten you ? YES NO
4. Were you ever afraid that your baby might be born deformed ? YES NO
5. Were you ever afraid that the baby might die before he / she was born ? YES NO
6. Were you looking forward to the birth of your baby ? YES NO
7. Did your partner accompany you to prenatal classes ? YES NO
8. Would you have liked him to ? YES NO
9. Did you and your partner pratice breathing techniques together ? YES NO

LABOUR + BIRTH

1. Were you confused about when to actually go to the hospital or call for help ? YES NO
2. Were you worried when you reached the hospital or called for help ? YES NO
3. Were labour pains a horrible experience for you YES NO
4. Were your labour pains worse than you expected ? YES NO
5. Were you alarmed for your own health during labour ? YES NO
6. Did you want someone to be with you all the time ? YES NO
7. Were you left alone too much ? YES NO
8. Were you frightened about giving birth ? YES NO
9. Did you want to be awake during the birth ? YES NO
10. Were you frightened of being torn or cut when your baby was born ? YES NO

PLEASE TURN OVER ...

12. Were you at any time alarmed for your own health during the birth ? YES NO
13. Were you at any time alarmed for your baby's health during the birth ? YES NO
14. Did the doctors and nurses or people around you make you feel safe ? YES NO
15. Did they say anything to frighten you ? YES NO
16. Were you glad you were awake during the birth ? YES NO
17. Were you glad to see your baby right after he or she was born ? YES NO

POST BIRTH

1. Did you feel depressed after the birth ? YES NO
2. Did you love your baby as soon as you saw him or her ? YES NO
3. Did you want to keep your baby near you after he or she was born ? YES NO
4. Would you have liked your partner to have stayed in the hospital on an overnight basis, if he had had the opportunity ? YES NO
5. Did you want to take care of your baby yourself ? YES NO
6. Do you want to breast feed your baby ? YES NO
7. Were you afraid you wouldn't know what to do with your baby ? YES NO
8. Are you worried that you might drop your baby while holding him or her ? YES NO
9. Do you feel like your baby is really your own ? YES NO
10. Are you happy about being a mother ? YES NO
11. Do you think that your partner is a good support ? YES NO

POSTPARTUM PERIOD

1. Do you find the technical equipment in the unit intimidating ? YES NO
2. Was the technical equipment explained well enough to you ? YES NO
3. Are you worried about being seperated from your baby ? YES NO
4. Do you feel that you get adequate support from the hospital staff ? YES NO
5. Do you find it comforting to see pictures of other healthy infants who were once part of the unit ? YES NO
6. If encouraged, would you like to bring in your baby's own toys, mobiles etc.. ? YES NO
7. Do you often talk to your baby ? YES NO

PLEASE TURN OVER ...

8. Do you feel silly talking to your baby ? YES NO
9. When younger, were you often physically comforted by your own parents ? YES NO
10. Do you think that your baby is now developing OK ? YES NO
11. Does your baby's crying irritate you ? YES NO
12. Do you like holding your baby ? YES NO
13. Do you like feeding your baby ? YES NO
14. Do you like bathing your baby ? YES NO
15. Are you worried about having to take care of your baby ? YES NO
16. Do you think you'll know how to take care of your baby ? YES NO
17. Will you have help taking care of your baby ? YES NO
18. Will someone else take care of your baby instead of yourself ? YES NO
19. Are you glad ? YES NO
20. Did you think your partner helped you enough in the feeding, changing, bathing etc... of your baby ? YES NO
21. Would you like to have another baby ? YES NO

PREGNANCY ONSET

1. Did you plan to have this baby ? YES NO
2. Were you aware of all the different methods of contraception ? YES NO
3. Did you or your partner use anything to try to avoid pregnancy ? YES NO
4. Were you upset when you first knew that you were pregnant ? YES NO
5. Was your partner annoyed when he first knew you were pregnant ? YES NO
6. Were you cross with your partner when you found out ? YES NO
7. Were your parents displeased about your being pregnant ? YES NO

THANK YOU FOR YOUR HELP AND CO-OPERATION !!!

APPENDIX 10.2.1.2

PATERNAL ATTITUDE SCALE

A G E :_____ O C C U P A T I O N :________________________

Please circle either YES or NO to the following questions :

P R E G N A N C Y : ATTITUDES TOWARDS SELF

1. Did you worry that your baby might not grow right inside of your partner ? YES NO
2. Did you find your partner physically unattractive during her pregnancy ? YES NO
3. Did you like your partner wearing maternity clothes ? YES NO
4. Were you more irritable during your partner's pregnancy ? YES NO
5. Did you dislike your partner being pregnant ? YES NO

P R E G N A N C Y : ATTITUDES TOWARDS FETUS

1. Did your baby kick a lot when inside your partner ? YES NO
2. Did you enjoy your baby's kicking + movements ? YES NO
3. Did your baby's movements inside of your partner ever frighten you ? YES NO
4. Were you ever afraid that your baby might be born deformed ? YES NO
5. Were you ever afraid that the baby might die before he / she was born ? YES NO
6. Were you looking forward to the birth of your baby ? YES NO
7. Did you attend pre-natal classes with your partner ? YES NO
8. Did you and your partner practice breathing techniques together ? YES NO

LABOUR + BIRTH

1. Were you confused about when to actually go to the hospital or call for help ? YES NO
2. Were you worried when you reached the hospital or called for help ? YES NO
3. Did you find your partner's labour pains frightening ? YES NO
4. Were your partner's labour pains worse than you expected ? YES NO
5. Were you alarmed for your partner's own health during labour ? YES NO
6. Did you want someone to be with your partner all the time ? YES NO
7. Was your partner left alone too much ? YES NO

PLEASE TURN OVER ...

8. Were you frightened about your partner giving birth ? YES NO
9. Did you want to attend the birth of your child ? YES NO
10. Were you at any time alarmed for your partner's own health during the birth ? YES NO
11. Were you at any time alarmed for your baby's health during the birth process ? YES NO
12. Did the doctors and nurses around you reassure you ? YES NO
13. Did they say anything to frighten you ? YES NO
14. Were you glad your partner was awake during the birth ? YES NO
15. If you attended the birth, were you glad to see your baby right after he/she was born ? YES NO

POST BIRTH

1. Did you feel depressed after the birth ? YES NO
2. Did you love your baby as soon as you saw him or her ? YES NO
3. Did you want to keep your baby near you after he / she was born ? YES NO
4. Would you have liked to have stayed in the hospital near your baby after he / she was born, on an overnight basis ? YES NO
5. Did you want to take care of your baby yourself ? YES NO
6. Do you want your partner to breast feed your baby ? YES NO
7. Were you afraid you wouldn't know what to do with your baby ? YES NO
8. Are you worried that you might drop the baby while holding him / her ? YES NO
9. Do you feel like your baby is really your own ? YES NO
10. Are you happy about being a father ? YES NO

POSTPARTUM PERIOD

1. Do you find the technical equipment in the unit intimidating ? YES NO
2. Was the technical equipment explained well enough to you ? YES NO
3. Are you worried about being seperated from your baby ? YES NO
4. Do you feel that you get adequate support from the staff at the special care unit ? YES NO

PLEASE TURN OVER ...

5. Do you find it comforting to see pictures of other healthy infants who were once part of the unit ? YES NO
6. If encouraged, would you like to bring in your baby's own toys, mobiles etc.. ? YES NO
7. Do you often talk to your baby ? YES NO
8. Do you feel silly talking to your baby ? YES NO
9. When younger, were you often physically comforted by your own parents ? YES NO
10. Do you think that your baby is now developing OK ? YES NO
11. Does your baby's crying irritate you ? YES NO
12. Do you like holding your baby ? YES NO
13. Do you like feeding your baby ? YES NO
14. Do you like bathing your baby ? YES NO
15. Are you worried about having to take care of your baby ? YES NO
16. Do you think you'll know how to take care of your baby ? YES NO
17. Will you have help taking care of your baby ? YES NO
18. Will someone else take care of your baby instead of yourself ? YES NO
19. Are you glad ? YES NO
20. Do you feel you helped enough with the feeding, bathing, changing etc... of your baby ? YES NO
21. Would you like to have another baby ? YES NO

PREGNANCY ONSET

1. Did you plan to have this baby ? YES NO
2. Were you aware of all the different methods of contraception ? YES NO
3. Did you or your partner use anything to try to avoid pregnancy ? YES NO
4. Were you annoyed when you first found out that your partner was pregnant ? YES NO
5. Was your partner upset when she first discovered that she was pregnant ? YES NO
6. Were you cross with your partner when you found out ? YES NO
7. Were your parents displeased about your partner being pregnant ? YES NO

THANK YOU FOR YOUR HELP AND CO-OPERATION !!!

APPENDIX 10.2.1.3 ORIGINAL P.A.A.S

PERINATAL ANXIETIES AND ATTITUDES SCALE (PAAS)

Field, T. Early development of infants born to teenage mothers. In K. Scott, T. Field & E. Robertson (Eds.), Teenage parents and their offspring. New York: Grune & Stratton, 1980.

PREGNANCY - Attitudes toward self

Yes No

1. Did you feel O.K. during this pregnancy?
2. Did you enjoy eating?
3. Did you eat any differently during pregnancy than before pregnancy?
4. Did you worry that your baby might not grow right inside of you?
5. Were you worried about getting too fat?
6. Did you enjoy wearing maternity clothes?
7. Do you think you looked ugly during pregnancy?
8. Were you happy during the pregnancy?
9. Did you get upset very easily during pregnancy?
10. Did you hate being pregnant?

TOTAL

PREGNANCY - Anxieties and attitudes regarding fetus

Yes No

1. Did your baby kick a lot when inside of you?
2. Did you enjoy your baby's kicking and movements?
3. Did your baby's movements inside of you ever frighten you?
4. Were you afraid your baby might be born deformed?
5. Were you afraid the baby might die before it was born?
6. Were you looking forward to having a baby?

TOTAL

LABOR and BIRTH - Anxieties and Attitudes

Yes No

1. Were you mixed up about when to go to the hospital or call for help?
2. Were you frightened when you reached the hospital or called for help?
3. Were labor pains a horrible experience for you?
4. Were your labor pains worse than you expected?
5. Were you afraid you might die during labor?
6. Did you want someone to be with you all the time?
7. Were you left alone too much?
8. Were you frightened about giving birth?
9. Did you know how babies are born before this delivery?
10. Did you want to be awake during the birth?
11. Were you frightened of being torn or cut when your baby was born?

(LABOR & BIRTH, continued)

Yes No

12. Were you afraid you might die during the birth?
13. Were you afraid the baby might die during his/her birth?
14. Did the doctors and nurses or people around you make you feel safe?
15. Did they say anything to frighten you?
16. Were you glad you were awake during the birth?
17. Were you glad to see your baby right after he/she was born?

TOTAL

CIRCLED ANSWERS ARE CONSIDERED "anxious" RESPONSES AND TOTALS ARE USED TO DERIVE ANXIETY RATING.

POST BIRTH - Anxieties and Attitudes

Yes No

1. Did you feel depressed after the birth
2. Did you love your baby as soon as you saw him or her?
3. Did you want to keep your baby near you after he or she was born?
4. Did you want to take care of your baby yourself?
5. Did you want to breast feed your baby?
6. Were you afraid you wouldn't know what to do with your baby?
7. Are you worried that you might drop the baby while holding him or her?
8. Do you feel like your baby is really your own?
9. Are you happy about being a mother?

TOTAL

POSTPARTUM PERIOD - Anxieties and Attitudes

Yes No

1. Do you think your baby's normal?
2. Does your baby's crying make you mad?
3. Do you like holding your baby?
4. Do you like feeding your baby?
5. Are you worried about having to take care of your baby?
6. Do you think you'll know how to take care of your baby?
7. Will you have help taking care of your baby?
8. Will someone else take care of your baby instead of yourself?
9. Are you glad?
10. Would you like to have another?

TOTAL

PREGNANCY ONSET - Anxieties and Attitudes

Yes No

1. Did you plan to have this baby?
2. Did you know how to avoid being pregnant?
3. Did you or your boyfriend/husband use anything so that you wouldn't become pregnant?
4. Were you angry when you first knew you were pregnant?
5. Was your boyfriend/husband angry when he first knew you were pregnant?
6. Were you angry at your boyfriend/husband when you found out?
7. Were your parents angry about your being pregnant?

TOTAL

APPENDIX 10.2.1.4

D I A R Y   O F   P A R E N T A L   C A R E

D A T E ____________________

MUM / DAD * Please delete as appropriate

ACTIVITY	NO. OF TIMES	POSITIVE/ ENJOYABLE	NEGATIVE/ STRESSFUL
(example :)			
Kissed your baby	3		
1.Fed your baby			
2.Changed him/her			
3.Sang to your baby			
4.Talked to your baby			
5.Hugged him/her			
6.Stroked your baby			
7.Bathed him/her			
8.Carried out any medical procedures on him/her			

APPENDIX 10.2.1.5

STROKING QUESTIONNAIRE

THE STROKING PROGRAMME

Please circle either YES or NO

to the following questions :

1. Did you enjoy stroking your baby ?

YES NO

2. Did the stroking make you feel more confident in dealing with your baby ?

YES NO

3. Do you think that you will carry out the programme on a regular or daily basis?

YES NO

4. Do you think that the baby enjoyed the strokes ?

YES NO

5. Do you find some of the strokes better than others ?

YES NO

6. If you did find some strokes better than others please write down which ones :

____

____

PLEASE ADD ANY OTHER COMMENTS YOU HAVE ON THE STROKING PROGRAMME AS ALL INFORMATION IS A GREAT HELP TO US

____

____

____

____

____

____

THANK - YOU FOR YOUR HELP AND CO - OPERATION !!!

APPENDIX 10.2.1.6 REACTION BOOKLET

Please tick any of the reactions you see your baby make to the following strokes :

F R O N T   S T R O K E S: HEAD MOVEMENTS

1.CENTRE EMBRACE: Bodily Stretch

Yawn

Open / Shut Eyes

Head Movement

Arm Movement

Leg Movement

Grasp Reflex

Mouthing

Jumps

Gurgles

Goes Red

Cries

2. CENTRE FORWARDS + BACKWARDS :

Bodily Stretch

Yawn

Open / Shut Eyes

Head Movement

Arm Movement

Leg Movement

Grasp Reflex

Mouthing

Jumps

Gurgles

Goes Red

Cries

3. THREE TEMPLE MOVEMENTS :

Bodily Stretch

Yawn

Open / Shut Eyes

Head Movement

Arm Movement

Leg Movement

Grasp Reflex

Mouthing

Jumps

Gurgles

Goes Red

Cries

4. NAPE OF NECK :

Bodily Stretch

Yawn

Open / Shut Eyes

Head Movement

Arm Movement

Leg Movement

Grasp Reflex

Mouthing

Jumps

Gurgles

Goes Red

Cries

5. CIRCUMFERENCE OF FACE :

Bodily Stretch

Yawn

Open / Shut Eyes

Head Movement

Arm Movement

Leg Movement

Grasp Reflex

Mouthing

Jumps

Gurgles

Goes Red

Cries

6. ROUND EYES :

Bodily Stretch

Yawn

Open / Shut Eyes

Head Movement

Arm Movement

Leg Movement

Grasp Reflex

Mouthing

Jumps

Gurgles

Goes Red

Cries

7. ROUND MOUTH :

- Bodily Stretch
- Yawn
- Open / Shut Eyes
- Head Movement
- Arm Movement
- Leg Movement
- Grasp Reflex
- Mouthing
- Jumps
- Gurgles
- Goes Red
- Cries

8. UP + DOWN LIPS :

- Bodily Stretch
- Yawn
- Open / Shut Eyes
- Head Movement
- Arm Movement
- Leg Movement
- Grasp Reflex
- Mouthing
- Jumps
- Gurgles
- Goes Red
- Cries

TRUNK MOVEMENTS

1. STRAIGHT DOWN CHEST :

Bodily Stretch

Yawn

Open / Shut Eyes

Head Movement

Arm Movement

Leg Movement

Grasp Reflex

Mouthing

Jumps

Gurgles

Goes Red

Cries

2. ZIGZAG DOWN CHEST :

Bodily Stretch

Yawn

Open / Shut Eyes

Head Movement

Arm Movement

Leg Movement

Grasp Reflex

Mouthing

Jumps

Gurgles

Gces Red

Cries

3. STRAIGHT DOWN SIDES OF BODY :

Bodily Stretch

Yawn

Open / Shut Eyes

Head Movement

Arm Movement

Leg Movement

Grasp Reflex

Mouthing

Jumps

Gurgles

Goes Red

Cries

<u>LIMB MOVEMENTS</u>

1. FOREARMS->PALMS OF HANDS->FINGERS :

Bodily Stretch

Yawn

Open / Shut Eyes

Head Movement

Arm Movement

Leg Movement

Grasp Reflex

Mouthing

Jumps

Gurgles

Goes Red

Cries

2. STRAIGHT DOWN SIDES OF LEGS :

Bodily Stretch

Yawn

Open / Shut Eyes

Head Movement

Arm Movement

Leg Movement

Grasp Reflex

Mouthing

Jumps

Gurgles

Goes Red

Cries

3. ALONG FEET -> TOES :

Bodily Stretch

Yawn

Open / Shut Eyes

Head Movement

Arm Movement

Leg Movement

Grasp Reflex

Mouthing

Jumps

Gurgles

Goes Red

Cries

BACK STROKES

1. STRAIGHT DOWN BACK :

Bodily Stretch

Yawn

Open / Shut Eyes

Head Movement

Arm Movement

Leg Movement

Grasp Reflex

Mouthing

Jumps

Gurgles

Goes Red

Cries

2. FIGURES OF 8 AROUND SPINE :

Bodily Stretch

Yawn

Open / Shut Eyes

Head Movement

Arm Movement

Leg Movement

Grasp Reflex

Mouthing

Jumps

Gurgles

Goes Red

Cries

3. STRAIGHT DOWN SIDES OF BODY :

Bodily Stretch

Yawn

Open / Shut Eyes

Head Movement

Arm Movement

Leg Movement

Grasp Reflex

Mouthing

Jumps

Gurgles

Goes Red

Cries

<u>THANK - YOU FOR YOUR HELP !</u>

APPENDIX 10.2.1.7

STROKE CATEGORIZATION

HEAD STROKES

1. CENTRE EMBRACE
2. CENTRE FORWARDS + BACKWARDS
3. THREE TEMPLE MOVEMENTS
4. NAPE OF NECK
5. CIRCUMFERENCE OF FACE
6. ROUND EYES
7. ROUND LIPS
8. DOWN SIDES OF MOUTH

TRUNK STROKES

1. LAYING OF HAND ON CHEST
2. STRAIGHT DOWN CHEST
3. ZIGZAG DOWN CHEST
4. STRAIGHT DOWN SIDES OF BODY
5. STRAIGHT DOWN BACK
6. FIGURES OF 8 AROUND SPINE

LIMB STROKES

1. FOREARMS->PALMS OF HANDS->FINGERS
2. STRAIGHT DOWN SIDES OF LEGS
3. ALONG FEET -> TOES

APPENDIX 10.2.1.9

Experimental Letter

HELPING THE PREMATURE BABY

Dear Mrs Smith,

I am conducting a study looking at the benefits of stroking for premature infants and would appreciate a meeting with you to discuss this and to find out if you would like Jane to be involved in the study.

Please indicate some convenient dates and times overleaf and leave this letter by Jane's cot, where I will be able to collect it.

This study has the support of the consultants and staff in the neonatal unit.

Yours sincerely,

Aine de Roiste (Psychologist).

Day: ______________ Time: ______________________

Day: ______________ Time: ______________________

Day: ______________ Time: ______________________

Day: ______________ Time: ______________________

APPENDIX 10.2.1.10

Control Letter

HELPING THE PREMATURE BABY

Dear Mrs Jones,

I am conducting a study looking at parental attitudes and would be very grateful if I could meet you. Please indicate some convenient dates and times below and leave this letter by Jane's cot, where I will be able to collect it.

This study has the support of the consultants and staff in the neonatal unit.

Yours sincerely,

Aine de Roiste (Psychologist).

Day: ____________ Time: ____________

Day: ____________ Time: ____________

Day: ____________ Time: ____________

Day: ____________ Time: ____________

PLEASE CIRCLE YOUR CHOSEN RESPONSE.

(1) Do you think Psychology has anything to offer Neonatal Care ?

Nothing Not a lot Not much Unsure A little A lot (Quite a lot)

(2) What do you think Psychology can offer Neonatal Care ?

Counselling & Support	(Yes)	Maybe	No
Stimulation managment	(Yes)	Maybe	No
Information on development & bonding	(Yes)	Maybe	No
Stress reduction	(Yes)	Maybe	No
Equipment design and layout	(Yes)	Maybe	No

(3) Do you think Psychological interventions in neonatal units should occur in :

Special care	Yes	Maybe	No
Intensive care rooms only	Yes	Maybe	No
Both of the above	(Yes)	Maybe	No

EASE CIRCLE YOUR CHOSEN RESPONSE.

Given that Psychological interventions in neonatal units can
ur in the many areas indicated below, please rate these in
ns of importance.

1	2	3	4	5	6
ential	Very important	Important	Not so important	Not important	Irrelevant

ent-Infant relations	1	(2)	3	4	5	6
vention of sensory abilities	1	2	(3)	4	5	6
motion of covert infant health .heart rate)	1	2	(3)	4	5	6
ental support & counselling	1	(2)	3	4	5	6
ff-Parent relations	(1)	2	3	4	5	6
motion of infant emotionality mfort,security)	1	(2)	3	4	5	6
vention of intellectual kwardness	1	2	3	4	(5)	6
ff support & counselling	1	(2)	3	4	5	6
motion of overt infant health j.weight gain)	1	2	(3)	4	5	6

) How important do you think it is to treat not only what is
rong" with the infant but also what is "right" with the infant?

(1)	2	3	4	5	6
sential	Very important	Important	Not so important	Not so important	Irrelevant

PLEASE CIRCLE YOUR CHOSEN RESPONSE.

(6) What Preterm infant features do you consider, best reflect improved health ? Please rate your answer.

	1 Very Good	2 Quite Good	3 Good	4 Not so Good	5 Not Good	6 Not at all Good
Weight gain	1	2	3	4	5	6
Stable respiration	1	2	3	4	5	6
Alertness	1	2	3	4	5	6
Sucking	1	2	3	4	5	6
Inactivity	1	2	3	4	5	6
Yawning	1	2	3	4	5	6
Stretching	1	2	3	4	5	6
Colour stability	1	2	3	4	5	6
Hand-mouth activity	1	2	3	4	5	6
Crying	1	2	3	4	5	6

(7) Please rate the following neonstal unit features in order of importance.

	1 Essential	2 Very important	3 Important	4 Not so important	5 Not important	6 Irrelevant
Friendliness	1	2	3	4	5	6
Resourcefulness	1	2	3	4	5	6
Research oriented	1	2	3	4	5	6
Cleanliness	1	2	3	4	5	6
Cost-efficency	1	2	3	4	5	6
Flexibility of routine & procedure	1	2	3	4	5	6
Educativeness	1	2	3	4	5	6
Time-efficency	1	2	3	4	5	6
Homeliness	1	2	3	4	5	6

EASE CIRCLE YOUR CHOSEN RESPONSE.

Please rate the following in terms of annoyance:

1	2	3	4	5	6
emely ying	Very annoying	Annoying	Not so annoying	Not annoying	Not at all annoying

urbance of routine	1	2	3	(4)	5	6
consumption	1	2	3	(4)	5	6
ractions	1	2	3	(4)	5	6
ding	1	2	(3)	4	5	6
g watched ork.	1	2	3	4	(5)	6
-orderliness	1	(2)	3	4	5	6

In your opinion, in what sense is the preterm infant most sitive ? touch

) Please rank these from highest to lowest (1-5) in order of ortance for the preterm newborn.

	Rank
ll	4
ion	3
ch	1
itary	2
ste	5

1) Do you think these are sufficently catered for in the onatal intensive care unit ? Yes (Maybe) No

2) If No please indicate which senses are insufficently catered r from highest (most inadequately catered for) to lowest (1-5).

sion	(4)
uch	(5)
uditory	(3)
ell	(1)
aste	(2)

PLEASE CIRCLE YOUR CHOSEN RESPONSE.

(13) Do you think that lambswool blankets are benefical ?

Yes Maybe No

(14) Please rate them in terms of their effectiveness on the following:

1	2	3	4	5	6
Extremely effective	Very effective	Effective	Not so effective	Not effective	Not at all effective

Comfort of rashes and sores	1	2	3	4	5	6
Provision of tactile stimulation	1	2	3	4	5	6
Provision of warmth	1	2	3	4	5	6

(15) Please rate these in terms of their importance to you in your daily preterm infant care.

1	2	3	4	5	6
Essential	Very important	Important	Not so important	Not important	Irrelevant

Acquiring eye contact with infant	1	2	3	4	5	6
Quietly closing incubator doors	1	2	3	4	5	6
Talking to infant	1	2	3	4	5	6
Stroking infant during routine care procedures	1	2	3	4	5	6
Stroking infant outside of routine care procedures	1	2	3	4	5	6
Changing position of infant several times daily	1	2	3	4	5	6
Positioning of infant to acquire visual stimulation	1	2	3	4	5	6
Ensuring infant is always warm	1	2	3	4	5	6
Rocking infant during feeds	1	2	3	4	5	6
Provision of non-nutritive sucking opportunities	1	2	3	4	5	6

P.T.O.

LEASE CIRCLE YOUR CHOSEN RESPONSE.

15) Cont'd.

1	2	3	4	5	6
ssential	Very important	Important	Not so important	Not important	Irrelevant

sing lambswool blankets	1	2	3	4	5	6
ight & Day light variation	1	2	3	4	5	6
roviding musical stimulation or infant	1	2	3	4	5	6
nsuring hand-mouth activity is ossible and not restricted	1	2	3	4	5	6
roviding infant with aids to elf-regulation (eg. a toy to grasp onto during an injection)	1	2	3	4	5	6

16) How much activity (self or externally initiated) do preterms n neonatal units need per day ?

one	Yes	Maybe	No
little dispersed throughout the day (< 15 mins)	Yes	Maybe	No
ome throughout the day (> 30 mins)	Yes	Maybe	No
lot throughout the day (> 30 min)	Yes	Maybe	No

THANK YOU FOR YOUR CO-OPERATION

APPENDIX 11.2.1.2 Covering Letter

HELPING THE PREMATURE BABY

Dear Final year medical student,

I would be grateful if you could spare fifteen minutes of your time to complete the enclosed questionnaire and return it in the stamped addressed envelope provided. This questionnaire is a part of study examining the attitudes of the Medical and Nursing professions towards psychological intervention in the neonatal unit.

Yours sincerely,

Aine de Roiste (Psychologist)

APPENDIX 12

PROGRAMMES OF TACTILE STIMULATION WITH HUMAN INFANTS

Where information was not found this is indicated by *

Authors	Procedure	Ss	Results
1.Brody 1951	20 mins extra handling daily from 6-30 days during each of the 2 hr periods midway tween feeds in morning & afternoon	*	1.greater interest in visual surroundings
2.Hopper & Pinneau 1957	10 mins. extra handling daily	*	1.decreased regurgitation
2.Ourth & Brown 1961	extra handling for 5 hrs daily in first 5 days	10e 10c	1.decreased crying
3.Hasselmeyer 1964	2 groups given stroking rocking and holding, daily for 14 days highs received 260 mins lows received 90 mins	lbws 30e 30c	1.highs spent more time in quiet states, lows spent more time crying before feeding 2.highs passed less faeces than lows
4.White & Castle 1964	20 mins extra handling daily from day 6 to 36	instit. infants 10e 10c	1.accelerated development of visual exploration
5.Casler 1965	20 mins extra handling daily for 5 d/wk for 10 weeks	instit. infants	1.better developmental scores than controls
6.Freedman et al 1966	stroking		1.inc wgt 2.greater general body tonus 3.longer periods of relaxation & eyes closed and smiling

Authors	Procedure	Ss	Results
7.Solkoff 1968	stroking and handling	infants 10e 10c	**1.**greater weight gain **2.**higher Bayleys at 6 months
8.Freeman 1969	stroking of body for either 5 mins/hr (grp1) or 5 mins after feeding (grp2) for 1-10 days	lbw grp1=8 grp2=16 cont=24	**1.**inc wgt **2.**inc formula intake **3.**dec no of feedings **4.**dec resp problems in grp2
9.Siqueland 1969	stroking	lbw ft	**1.**greater responsivity
10.Solkoff et al 1969	stroked 5 min/hr during first 10 days	5e 5c	**1.**faster regain of bwgt **2.**greater activity **3.**improved health **4.**at 18m more stimulating homes **5.**fewer dev. abnormalities
11.Largerspitz et al 1971	handling	11e 11c	**1.**sig.accel crawling up to 3 months **2.**positive transfer effects to later motor areas
12.Wright 1971	handling & contingency procedure in hospital and home		**1.**improved performance on conditioning tasks

Authors	Procedure	Ss	Results
13.Siqueland 1973	handling during 2 daily feeds with visual contingent stimulation of eye opening	pt	**1.**vis/audit. reinforcement control of their sucking behaviour shown only by handled infants
14.McNichol 1974	handling	pt 22e 8c	**1.**increased attentiveness to novel stimuli **2.**decreased attentiveness to familiar stimuli
15.Powell 1974	handling for 20 mins 2x daily from day 3 until bwgt regained then 1x daily until discharge e1=nurse handling e2=maternal handling	pt 13e1 11e2 12c	**1.**faster wgt gain **2.**better Bayleys at 4 or 6 months
16.Kattwinkel et al. 1975	rubbing extremities 5 out of each 15 mins for 3 hrs e1=preterms e2=ventilated preterms age at time of study was 2-35 days	pt 6e1 12e2	**1.**dec. apnea in e1,e2 when being rubbed as compared to when not being rubbed
17.Kramer et al. 1975	48 mins stroking 2-3 mins before & after each feed for 2 weeks	pt 8e 6c	**1.**improved social dev. on Gesell **2.**better motor skills when placed from incubator into cot **3.**no wgt difference **4.**no diff in plasma cortisol levels in response to stress

Authors	Procedure	Ss	Results
18.Solkoff & Matuzak 1975	Stroking/flexing of limbs for 7.5 mins each hr for 16 hrs daily for 10 days	pt	**1.**inc NBAS **2.**higher dev. scores at 7m **3.**lived in more stimulating homes
19.White 1975	handling/stroking	6e 6c	**1.**increased appetite **2.**inc wgt gain
20.White & LaBarba 1976	stroking/rubbing/limb movement contingent upon the infant's physiological needs, 15 mins/hr for 4 hrs from days 2-11	pt 6e 6c	**1.**inc formula ingestion **2.**fed less often **3.**inc wgt gain **4.**no diff in hr,resp,temp, freq of stools
21.Rice 1977	cephalocaudal massage/rocking by mother, 4x daily for 1m, from day after discharge (10 min massage,5 min rocking)	pt 15e 14c	**1.**inc wgt **2.**better Bayley mental dev. scores **3.**maturer reflexes **4.**neurolog. maturer at 4m
22.Scott & Richards 1979	use of lambswool pads	6 lbw	**1.**increased weight gain **2.**less movement when nursed on pads
23.Terres 1979	15 mins holding/cuddling 3x daily	pt	**1.**inc oxygen levels over a week
24.Tryowski 1979	mouth touched during feeding	31 pt	**1.**inc formula volume **2.**inc sucking rate

Authors	Procedure	Ss	Results
25.Rose et al 1980	cephalocaudal massage for 3 20 min daily for 2 wks prior to discharge	pt 18e 18c 18ft	1.no deficits in info proc. at 6m unlike controls 2.visual recognition memory akin to fullterms
26.Rosenfield 1980	stretching/holding of trunk & extremities & stroking with textured materials	pt 39e 39c	1.inc alertness 2.inc maternal visiting rate
27.Rausch 1981	rubbing/stroking/flexing limbs of each part of body for 15 mins daily for 10 days begining 26 hrs after birth	pt 20e 20c	1.inc fluid intake 2.fewer abnormal stooling patterns
28.Jay 1982	cradling of head with 1 hand with other hand on abdomen for 12 mins 4x daily for 10 days	vent. pt 13e 13c	1.inc tcpo2 from 3-10 min of touch 2.no diff in wgt gain, apnea,temp stability, tolerance of oral nutrients, or incidence of neonatal complications
29.Schaeffer 1982	**placing of hands on** head & abdomen	**mech vent** pt 13e 13c	**1.sig higher** hematocrit levels & required less oxygen than controls
30.Macedo 1984	stroking using Tac-Tic procedure for 20 min 3x daily until discharge	pt\lbw	1.improved reflexes 2.higher dev scores

Authors	Procedure	Ss	Results
31.Field et al. 1986	stroking for s 15 min perioods at begining of 3 consecutive hrs for 10 weekdays, 12 strokes at approx 5 sec/stroke	pt 20e 20c	**1.**47% gtr wgt gain per day **2.**better habituation, motor, range of state items on Brazelton **3.**more active **4.**better Bayleys at 6 months
32.Koniak-Griffin & Luddington-Hoe 1987	Rice's (1977) stroking procedure		**1.**controls better on BNBAS
33.White-Traut & Carrier-Goldman 1988	Rice's (1977) procedure for 10 days/discharge with hr,resp,temp recorded before,during and after procedure	pt 17e 16c	**1.**inc hr **2.**inc resp **3.**dec temp

KINAESTHETIC/VESTIBULAR/PROPRIOCEPTIVE STIMULATION PROGRAMMES WITH HUMAN INFANTS

Authors	Procedure	Ss	Results
1. **Andre-Thomas & Autgaerden** 1953	Stepping movements from 0-6 months	1 ft	**1.** advanced motor dev.
2. **Koch** 1969	motor exercise from 2 wks	3 ft	**1.** advanced motor dev.
3. **Neal** 1968	oscillating hammock for 30 min 3x daily from day 5 until 36 wks postconceptual age	pt 31e 31c	**1.** inc wgt gain **2.** inc motor & general maturity **3.** inc auditory & visual functioning (Rosenblith) at 36 wks **4.** less irritable than controls **5.** no diff in tactile adaptive muscle tension
4. **Zelazo et al.** 1972	stepping movements from 2-8 weeks	24 ft	**1.** advanced walking
5. **Korner et al.** 1975	placed on an oscillating waterbed before day 6 for 7 days	pt 10e 11c	**1.** less apnea especially if placed before day 4
6. **Gregg et al.** 1976	proprioceptive stim. provided in the horizontal/semi-ventral upright position along with pacifier sucking		**1.** improved visual tracking
7. **Clark et al.** 1977	vestibular stimulation	pt	**1.** more rapid development
8. **Korner et al.** 1978	24 hrs on oscillating water bed during alternate 6 hr periods between day 7-day 28	8 pt (apnoeic)	**1.** dec apnea while on water beds

Authors	Procedure	Ss	Results
9.Field et al. 1980	mothers trained in caretaking, sensori-motor/cognitive & interaction exercises adapted from Brazelton, Denver & Bayley items & research on infant games biweekly 30 min home visits from discharge to 4 mths and monthly visits to 8 mths	pt 30e 30c	**1.**inc wgt **2.**inc length **3.**higher Denvers at 4 months & higher Bayleys at 8 months **4.**exp mums more realistic expectations & desirable attitudes **5.**higher home at 8 months **6.**exp mums rated their infants' temperament as less difficult than controls
9.Jones 1981	23 hrs on waterbed alternating 4hrs with & 4 hrs without oscillations	14 pt (apnoeic)	**1.**non oscill. bed assoc with less prolonged apnea
10.Korner 1981	12 hrs each on oscillating/ non-oscill. waterbeds compared with 2 12 hr control periods	very ill	**1.**very variable response
11.Edelman et al. 1982	oscillating waterbed (oscillations for 8 out of every 24 hours) or incubator mattress for 4 days	12 pt	1.inc quiet sleep 2.dec crying and fussing
12.Tuck et al. 1982	bed rocking for 3-4 hrs compared with control period from day 2-45	12 pt (apnoeic)	**1.**dec apnea **2.**decreased bradycardia **3.**dec hypoxia all when bed was rocking

Authors	Procedure	Ss	Results
13. Korner et al. 1982	oscillating waterbed or incubator mattress for 4 days	17 pt apnoeic	**1.** greater quiet & active sleep states **2.** fewer state changes **3.** dec restlessness, all while on waterbed as compared to mattress
14. Korner & Schneider 1983	placed on oscillating waterbed from day 4 to 35 wks conceptual age	ventil. pt 12e 8c	**1.** improved orientation **2.** improved motor maturity **3.** less irritability & wakefulness
15. Pelletier et al. 1985	oscillating waterbed or incubator mattress for 30 mins	e=11 pt c=11 pt	**1.** more hand to mouth behaviour in experimentals **2.** more grimace, startle, trunkal arch, finger splay, and salute in controls
16. Elliot et al. 1988	motorized carriage rocked for 4 min after continuous crying for 60 seconds grp1= 40 rocks/min grp2= 57 rocks/min	24 infants 42-56 days of age 12=excessive criers (>3 hrs/wk) 12=normal	**1.** less crying **2.** less variable resp. than post rock period **3.** no diff between grps 1 & 2

ORAL STIMULATION PROGRAMMES WITH HUMAN INFANTS

Authors	Procedure	Ss	Results
1. **Measel & Anderson** 1979	pacifier during & 5 mins after feeding	59 tube feeds	**1.** increased readiness for bottle **2.** inc wgt gain **3.** earlier discharge
2. **Bernbaum et al.** 1983	non-nutritive sucking during gavage feeding	pt	**1.** inc wgt gain **2.** no diff in formula intake
3. **DeCurtis et al.** 1986	non-nutritive sucking during gavage feeds	pt	**1.** no diff in fat absorption or intestinal transit time
4. **Hamosh et al.** 1989a	comparison of gavage feeds with/without non-nutritive sucking	pt 9	**1.** no difference in the lipase level of the stomach
5. **Hamosh et al.** 1989b	non-nutritive sucking during gavage feeds	pt 6e 4c	**1.** no difference in the lipase level of the stomach

AUDITORY STIMULATION PROGRAMMES WITH HUMAN INFANTS

Authors	Procedure	Ss	Results
1.Katz 1971	tape of mum's voice for 5 mins 6 x per day at 2 hour intervals from day 5 until 36 weeks post-conceptual age	pt 31e 31c	1.increased auditory & visual function at 36 wks
2.Segall 1971	tape of mum's voice 30 mins daily until 36 weeks post-conception age	pt 30e 30c	1.greater inc in hr to white noise at 36 wks in quiet period 2.greater dec in hr to tape of mum's voice while crying
3.Chapman 1978	grp1=tape of mum's voice grp2=tape of Brahm's lullaby from day 5 until wgt=1.8 kg (mean duration=34 days)	pt grp1=50 grp2=51 cont=52	1.faster wgt gain in grp2 than grp1 or controls 2.no diff in limb movements
4.Chapman 1979	5-10 min of taped mum's voice alternating with Brahm's lullaby played midway between feeds from day 5 until discharge with 10 month home programme to teach infant stimulation to parents after discharge	pt 17e 18c	1.greater Bayleys at 9 & 18 months 2.inc Stanford Binet at 36 mths
5.Malloy 1979	same as Chapman 1978	pt grp1=40 grp2=44 cont=43	1.grp1 & grp2 discharged 6-9 days sooner than controls 2.at 9 months higher Bayleys in grps 1 & 2 than controls

MULTIMODAL STIMULATION PROGRAMMES WITH HUMAN INFANTS

Authors	Procedure	Ss	Results
1. **McGraw** 1935	enriched environment & stimulation	twins 1e 1c	1. accelerated motor dev. 2. accelerated physical skills & competence
2. **Korner & Grobstein** **1966**	infants when crying picked up and put to the shoulder	ft	1. reduced crying 2. increased alertness
3. **White** 1967	handling and a visually enriched environment	79 institutional infants	1. improved visual & prehensile development
4. **Greenberg et al** 1968	a stable & changing visual pattern against which a target approaches from 5 weeks on	10 ft	1. dev of blink to approaching target depends on background properties
5. **Brackbill & Fitzgerald** 1969	heartbeat sound at 85 db, 80 watt fluorescent light, light swaddling & an elevated room temp. of 80 degrees farht	ft	1. the more the stimulation provided, the more the nrem sleep and the less the crying
6. **Brossard & DeCarie** 1971	15 mins daily of either social (caressing, playing with, talking or singing to) or perceptual (mobiles, tape of various sounds) stimulation over a 10 wk period	2-3 mth olds mentally retarded institutional infants	1. brought into normal range of behaviour at 4-5 months 2. social stim. tended to be more influential than perceptual on the dev. of social responsiveness

Authors	Procedure	Ss	Results
7.Barnard 1972	rocking bed & a heartbeat recording 15 mins/hr for 2 weeks	pt 7e 8c	**1.**inc maturation on Dubowitz **2.**inc wgt gain **3.**inc quiecence **4.**less activity & alertness **5.**no diff in sleep
8.Groom 1973	grp1= visual mobiles grp2= rubbing & passive limb stimulation grp3= both of the above grp4= routine care	*	**1.**no group differences
9.Scarr-Salapatek & Williams 1973	mobiles,tactile & vestibular stim. during feedings & when awake, from birth to discharge with weekly home visits to teach infant stimulation for 10 months	pt 15e 15c	**1.**higher Catell scores at 1 year **2.**improved interaction responses on Brazelton Neonatal scale **3.**inc wgt gain at 1 month
10.Siqueland 1973	mothering for 10 mins 2x daily,contingent stimulation for eye-opening 11 mins/day, handling during 2 daily feeds	pt 10e 10c twin pairs	more optimal performance at 4 mths on: **1.**visual reinforcement control of sucking **2.**a similar auditory reinforcement task
11.Fredrickson and Brown 1975	on shoulder position	ft	**1.**inc visual alertness
12.Korner et al. 1975	oscillating waterbed	pt 11e 10c	**1.**dec apnea

Authors	Procedure	Ss	Results
13.Kramer & Pierpont 1976	rocking waterbed for 1 hr prior to each feed & tapes of heartbeat sound & woman's voice during rocking from day 2-7	pt 11e 9c	**1.**inc wgt gain **2.**inc head growth **3.**inc appetite **4.**inc activity
14.Brown et al. 1980	grp1=received tactile, visual, auditory & vestibular stimulation from experimenters for 18-30 min, 2x daily, 5 days a wk grp2=received stimulation from mums trained in this by nurses grp3=received both of the above	pt grp1=13 grp2=14 grp3=14 cont=26	**1.**no diff in wgt gain, discharge, interaction behaviour, Brazelton, Home score, Bayleys at 1 yr **2.**mums of grps 2 & 3 had higher visiting rates than controls
15.Leib et al. 1980	visual mobiles, rubbing, talking, rocking during or after feeds, 5 min music box after feeds from when wgt=1.7 kg until discharge	pt 14e 14c	**1.**inc Bayleys at 6 mths **2.**fewer caloric intake **3.**no diff in wgt gain or Brazelton
16.Naqvi & Hyatt 1980	tactile stimulation of chin & mouth, toys, music box, parental voices, for 30 min daily, 5 days a wk, from admission to intermediate care until discharge	pt 15e 15c	**1.**stronger sucks **2.**inc wgt gain **3.**earlier discharge
17.Barnard & Bee 1983	grp1=15 min rocking & heartbeat sound/hr grp2=15 min rocking & heartbeat sound after each 90 seconds of inactivity grp3=15 min rocking & heartbeat sound after each 90 seconds of inactivity but only once/hr from 3-15 days for 21 days approx.	pt grp1=26 grp2=23 grp3=10 cont=28	**1.**dec rates of activity in first 8 days in grps 1-3 then inc rates **2.**fewer abnormal reflexes **3.**better orienting responses **4.**higher Bayleys at 24 months **5.**more favourable responses

Authors	Procedure	Ss	Results
18. Widmayer & Field 1981	observation of the Brazelton assessment and use of MABI weekly for 1 mth by parents (grp1) MABI used weekly for 1 mth only (grp2)	pt grp1=10 grp2=10 cont=10 ft=10	1. grps 1& 2 showed more optimal face-face interactions & feeding at 1m
20. Koniak-Griffian & Luddington -Hoe 1987	grp1=stroking(Rice) grp2=multi-sensory hammock for 1 month	81 ft grp1=27 grp2=27 cont=27	**1.** less mature orientation, motor & state regulation **2.** positive corr. between quantity of stim & favourable maternal perception of infant behaviour

TACTILE STIMULATION PROGRAMMES WITH INFANT ANIMALS

Authors	Procedure	Ss	Results
1.Hammett 1922	gentling	rats	1.6x more likely to survive a thyroidectomy 2.less timid or aprehensive
2.Greenman & Duhring 1931	handling	rats	1.inc survival of a throidectomy
3.Bernstein 1952	handling for 10 mins daily for 10 days	rats	1.improved maze learning as adults
4.Bennett et al. 1964	daily handling from preweaing for either 30 days (grp1) or or 6 days (grp2)	rats grp1=12 grp2=12	1.no cerebral changes
5.Ruegamer et al. 1954	handling & individual petting	rats	1.greater wgt gaim
6.Brooker 1955	handling for 21 days grp1=5 mins daily grp2=10 mins daily grp3=20 mins daily controls	rats	1.greater wgt gain than controls 2.max gain by grp2
7.McClelland 1956	gentling,handling or stroking	rats	1.all show greater wgt gain than controls 2.no diff between the 3 forms of tactile stimulation
8.Ruegamer & Silverman 1956	handling	rats	1.better food utilization

Authors	Procedure	Ss	Results
9.Weininger 1956	gentling for 10 mins daily for 10 days	rats	1.inc body wgt & skeletal length 2.inc ambulatory activity 3.dec emotionality in an open field situation 4.dec organic damage under severe stress eg water/food deprivation or immobilization
10.Levine 1957-58	from birth-weaning grp1=handled grp2=shocked controls	rats	1.after water deprivation for 18 hrs, grps1 & 2 drank more 2.controls were more emot. upset by novelty of drinking & thus drank less
11.Rosen 1958	handling	rats	1.increased social dominance
12.Bovard 1958	handling	rats	1.took longer to starve to death
13.Levine & Otis 1958	preweaning vs postweaning handling compared to controls	rats	preweaning showed: 1.inc wgt gain 2.inc suvival rate
14.Levine et al. 1958	handling	rats	1.earlier ability to respond to cold with a significant depletion in adrenal ascorbic acid
15.Denenberg & Karas 1959	handling on days 1-20	rats	1.inc activity & timidity in maze 2.inc survival on food & water deprivation

Authors	Procedure	Ss	Results
16.**Ehlrich** 1959	handling & restricted enriched environment	rats	1.greater maze exploration 2.no effect from type of environment
17.**Meier & Stuart** 1959	handling	siamese kittens	1.more active & aggressive when confined 2.superior in discrimination tasks 3.precocious in dev of colouring, eye-opening, emergence from nest and synchrony of eeg 4.more quiescent when confronted with novel & varied stimuli
18.**Bell et al.** 1961	handling	rats	1.respond quicker to stress 2.effects of stress do not persist as long
19.**Denenberg** 1962	handling for 1-5 days (grp1) or 6-10 days (grp2)	rats	1.grp2 superior to controls on avoidance learning & equal to grp1
20.**Denenberg & Morton** 1962	handling	rats	1.no effects on problem-solving (Hebb-Williams maze test)
21.**Levine & Broadhurst** 1963	handling	rats	1.explored more freely & defecated less in a novel environment as adults (more adaptive)

Authors	Procedure	Ss	Results
22.**Levine & Mullins** 1966	handled,picked up & put into a new cage for 3 mins & the returned	rats	**1.**more rapid & greater steroid response to a brief but intense electrical shock in adulthood
23.**Denelsky & Denenberg** 1967	handling	rats	**1.**greater exploratory behavior as adults
24.**Ader** 1969	handling during preweaning	rats	**1.**dec emotionality as adults **2.**attenuated plasma corticosterone response to novel stimuli
25.**Altman et al.** 1968	handling	rats	**1.**decreased brain weight
26.**Hucklebridge & Nowell** 1973	handling during preweaning,days 1-20, at day 60 given electric shock & encounter with a trained fighter mouse	mice	**1.**more elevated plasma ne levels to elect shock in handled mice **2.**more marked elevation in plasma e to fighter mouse in handled mice **3.**no diff in body wgt,adrenal wgt & adrenal e content in handled vs control
27.**Greenough** 1976	handling	rats	**1.**inc synaptic connections **2.**enhanced neuron growth **3.**inc ratio of cortical over subcortical tissue
28.**Benjamin (Montagu** 1978)	carressing & cuddling	rats	**1.**better learning **2.**faster growth **3.**heavier brain wgt **4.**greater cortical dev.

Authors	Procedure	Ss	Results
29.**Evoniuk et al.** 1979	stroking with a camel hair brush	maternally deprived rats	1.inc growth hormone levels up to pre-deprivation levels (approx)
30.**Schanberg & Field** 1987	stroking with a camel hair brush	maternally deprived rats	1.inc odc levels up to pre-deprivation levels (approx)

VARIOUS OTHER STIMULATION PROGRAMMES WITH INFANT ANIMALS

Authors	Procedure	Ss	Results
1. Melzack & Scott 1957	isolation vs enriched environment	terriers	1. enriched learnt an avoidance response 4x quicker than the isolated terriers
2. Rosenzweig et al. 1972	enriched environment from day 25-day 105	rats	1. inc brain wgt 2. enhanced brain morphology in the hippocampal area
3. Thoman & Korner 1971	swaddling for 10 mins per day for first 2 weeks of life (grp1) as above with rotation on a noiseless drum while swaddled (grp2) routine care controls (grp3)	rats	1. grp3 showed gtst wgt gain at weaning 2. earliest eye opening in grp3 3. grps 1 & 2 showed significantly more exploratory behav on a visual cliff at day 20 than grp 3
4. Horn et al. 1973	various types of training	various	1. positive effects on brain morphology, physiology and biochemistry
5. Creutzfeld & Hegelund 1975	visual stimulation	cats	1. enhanced occipital cortex
6. Greenough 1975	enriched environment from 23-55 days	rats	1. positive effects upon occipital cortex morphology
7. Ferchmin & Eterovic 1977	motor skill training with/without an enriched environment	rats	1. inc wgt of diff brain areas only if training was accompanied by an enriched environment
8. O'Brien et al. 1978	electrical stimulation of soleus muscle from day 6-13	rats	1. decrease in polyneural innervation