The Development of Conversational and Communication Skills

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Thesis submitted for the degree of Doctor of Philosophy in the Department of Psychology, Faculty of Social Science, University of Glasgow, July, 1995.

Abstract

This thesis investigates the development of children's conversational and communication skills. This is done by investigating both communicative process and outcome in two communication media: face-to-face interaction and audio-only interaction. Communicative outcome is objectively measured by assessing accuracy of performance of communication tasks. A multi-level approach to the assessment of communicative process is taken. Non-verbal aspects of process which are investigated are gaze and gesture. Verbal aspects of process range from global linguistic assessments such as length of conversational turn, to a detailed coding of utterance function according to Conversational Games analysis.

The results show that children of 6 years and less do not adapt to the loss of visual signals in audio-only communication, and their performance suffers. Both the structure of children's dialogues and their use of visual signals were found to differ from that of adults. It is concluded that both verbal and non-verbal communication strategies develop into adulthood. Successful integration of these different aspects of communication is central to being an effective communicator.

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Acknowledgements

I would first like to thank my supervisor, Professor Simon Garrod, for all his help and advice throughout my research, and with the final version of the thesis.

I extend special thanks to Dr Anne Anderson for her invaluable assistance and constant support during my studies. Her interest in my work was a constant inspiration. I would also like to thank Joy Aked for her support and friendship throughout our time together at University. Thanks also to Jacqueline Kowtko and Steve Isard for allowing me to collaborate on Conversational Games Analysis, and to Gillian Kent for her help with Experiment 3.

In addition, I would like to thank my husband, James Sneddon, for his all important, constant encouragement and faith in me. Finally I would like to thank my parents, Mary and Stuart Doherty, for their support, and especially my Father for his advice with the final version of the thesis.

I dedicate the thesis to my daughter, Charlotte, just for being herself.

Declaration

I declare that this thesis is my own work carried out under normal terms of supervision.

Introduction

Research on the Development of Communication Skills

Communication issues are pervasive in psychology. Our abilities to communicate are central to our concept of what it is to be human. The way in which children acquire the ability to communicate is therefore a major question in many academic disciplines, including psychology.

The development of communication skills has often been considered in terms of how children acquire language. There is now a huge literature on the development of verbal referential skills, and an extensive sociolinguistic literature regarding how children learn to speak. The majority of this research has focused on the acquisition of syntax and semantics. Far less work has been done on the development of the pragmatics of language and communication.

Likewise, the development of non-verbal aspects of communication has been neglected in comparison to the acquisition of language. Non-verbal communication is thought to be more natural and therefore to require less learning. It is also considered that non-verbal communication strategies are more primitive and are secondary to linguistic strategies. Indeed the main role which non-verbal communication abilities are thought to serve in the development of communication is often considered to be in their role as precursors to language, which serve primarily to set the stage for linguistic development.

This thesis seeks to investigate the development of pragmatic aspects of language and the development of non-verbal communication. A functional approach is taken. Communicative competence involves a knowledge of how communicative functions can be achieved and when it is appropriate to do so. It is proposed that certain communicative functions are equally well served by both verbal and non-verbal means, and that communication involves an interplay between these two aspects of communication.

It is proposed that children master the pragmatics of communication over a period of time which extends far beyond their acquisition of considerable language skills. It is therefore expected that children will use neither verbal nor non-verbal strategies as effectively as adults. Likewise it is expected that verbal and non-verbal communication will become more closely related, in terms of communicative function, with increasing age.

The thesis reports analysis of the verbal channel in terms of a novel coding system called Conversational Games analysis. This gives a functional description of the structure of conversations. How individuals structure their conversations in terms of both what kind of functions are prevalent and the way functions are encoded will depend upon the level of communicative skill of the interlocutors and the communicative channels which are available. Conversational structure is therefore investigated in different age groups and in different communicative contexts.

Two types of non-verbal signal are investigated, gaze and gesture. Gaze may play many types of role within interaction. It's relationship to the verbal channel is investigated in a novel way by noting it's occurrence with the coded functions assigned to the verbal utterances which it accompanies. This gives further insight into the role which gaze plays both in terms of obtaining and transmitting information.

There are many different types of gesture, ranging from the kind of unconscious gesturing which is closely tied to speech and which continues when there is no visual channel, to more deliberate emblematic gesturing which serves a definite communicative function from the point of view of the speaker. It is the latter type of gesture with which this thesis is concerned. Several authors have suggested that non-verbal of information less complex and requires less information processing capacity. If this is the case then such gestures are expected to be more prevalent in the communication attempts of younger children than those of adults.

There are two main opposing views of non-verbal communication. One proposes that it is a primitive precursor to language and that with increased communicative competence it becomes nothing more than a redundant accompaniment of language. The other suggests that non-verbal signals function in their own right and play a significant role even in the communication of adults. It is hoped that by looking at the aspects of gaze and gesture which are investigated that these views can be reconciled. It is expected that deliberate communicative gesturing may be used when the speaker does not have the verbal abilities to transmit the intended information. This would therefore support the view that non-verbal signals are less complex than language. In contrast it is expected that the finely tuned use of gaze in interaction is a skill which will develop with increasing communicative competence. If these hypotheses are supported this illustrates that certain aspects of the non-verbal channel may indeed preceed language, while others are only acquired with much communicative practice long after language acquisition.

Conclusion

In conclusion, there are complex issues associated with the way in which communication abilities are acquired, and the considered relationship between verbal and non-verbal communication. This thesis addresses some of these issues by investigating the development of verbal and non-verbal communication in a novel way (to the best of the author's knowledge), using Conversational Games analysis to investigate the effect of different visibility contexts, and patterns of eye gaze.

Part 1 of the thesis covers theoretical issues regarding the relationship between verbal and non-verbal communication and some of the major theoretical approaches to explaining language acquisition. The roles which non-verbal signals, such as eye gaze and gesture, play in human interactions are also discussed. Finally, part 1 reviews empirical studies of the development of communication skills.

Part 2 of the thesis reports global performance and communicative process measures in the corpora investigated. This sets the stage for examining the interactions in more detail, by describing in general terms how the different subjects coped with the communication tasks in both face-to-face and audio-only interaction.

Part 3 begins with a review of the literature leading up to the development of Conversational Games analysis. The use of this analysis system to describe contextual and age differences in conversational structure, is then reported in the final 2 empirical chapters. Conversational Games are one way of describing communicative acts which interlocutors use to accomplish various conversational goals. The frequency with which individuals use various types of Games therefore describes the approaches those individuals take to the communication task. Comparing conversational structure between face-to-face and audio-only communication gives insight into the role which the visual channel plays in face-to-face interaction. This is based on the assumption that visual signals will be replaced by events in the verbal channel when there is no non-verbal channel available. Also reported is the detailed analysis of gaze patterns, which uses Conversational Games analysis to describe the verbal channel. By associating eye gaze with communicative functions (defined in the verbal channel) this offers information regarding the functions which eye gaze is related to.

This thesis is therefore an examination of the development of verbal and non-verbal communication skills, and at the same time is an investigation of the relationship between verbal and non-verbal aspects of communication.

The basic questions addressed are:

(1) Do children structure their conversations, in terms of the communicative functions which they use, in the same way as adults?

(2) a. Are visual signals important, in terms of communicative function, in the face-to-face interactions of adults, and does this therefore cause adults to

structure their conversations differently in audio-only interaction? If visual signals are replaced, in part at least, by verbal signals in audio-only interaction, this illustrates that non-verbal communication is a significant part of adult communication and that it is closely related to verbal signals.

b. Are the conclusions of (2,a) backed up by the analysis of eye gaze patterns across verbal communicative functions? If visual signals function in the ways which the answers to (2,a) suggest, then eye gaze should be more associated with certain communicative functions than others.

(3) a. Do visual signals have the same degree and type of impact on the interactions of children as they do for adults, and is this influenced by the age of the child? This illustrates developmental changes in the relationship between verbal and non-verbal aspects of communication.

b. Are the conclusions resulting from (3,a) backed up by the analysis of eye gaze patterns across verbal communicative functions?

Part 1: Review of Literature on the Development of Communication Skills and the Relationship Between Verbal and Non-verbal Aspects of Communication

Chapter 1: An Introduction to Language and Communication Issues

> "A conversation is one of the commonest
> phenomena we encounter, yet it is one which raises
> very great scientific problems, many still
> unresolved. It is so often our commonest
> experiences, which we take for granted, that
> are the most elusive of explanation and description."
>
> Colin Cherry (1966)

A. Communication: A definition

Communication in its widest sense is a term used to describe a diverse set of situations which may involve people, animals and even machines.

However a more systematic and generally accepted psychological definition of true communication is that it is an interaction, involving two or more participants, in which information is transmitted, with the sender having the intention to change the knowledge state of the receiver. This communicative act can be said to have been accomplished when the relevant mental representations of the participants have been aligned. In this vein, Grice (1969) emphasises the intentionality of communication in his definition of the 'highest sense' of communication which is as follows :

1) The sender voluntarily does the sending.
2) The sender understands the receiver is an agent capable of voluntary

action.

3) The sender understands the receiver understands the sender intends something, and that he can recognise this intention without fulfilling the senders' wants and goals.

1. Early Language and Communication

Harding (1983) suggests the following defining features of a communication situation:

1) There is some communicative effect, that is, the listener/observer reacts to the signal sent.

2) At least one participant interprets the situation as communicative.

3) The communication is intentional.

Harding suggests that intentionality develops over the first year of life through the infant learning that his/her actions have effects on others.

Traditionally cognitive concerns such as information processing capacity and knowledge representation will therefore be very pertinent to issues of communication and development of communication abilities (Bates, Benigni, Bretherton, Camaioni, & Volterra, 1979).

By definition communication involves more than one participant, therefore it is not only a cognitive event but also a social one. Shatz (1983) describes communication ability as the interface between cognitive, social and linguistic abilities. The term 'linguistic' is perhaps too limited in this context since there are certainly communicative acts which can be performed nonlinguistically. For example, some kinds of aphasics who communicate quite effectively despite having lost many of their linguistic abilities (Printz, 1980; Howard & Hatfield, 1987).

2. Language versus Communication

The distinction between language and communication is a useful one, since communication can occur without natural spoken language. There is also some reason to believe that language abilities can exist without communication abilities. Blank, Gessner, and Esposito (1978) report a case study of a 3;3 boy whose syntactic-semantic development were age appropriate, but who failed to communicate effectively. The child also showed no understanding of, nor ability to produce, non-verbal communication. Blank et al conclude that the structural and communicative aspects of language are based upon different sets of skills which may function independently.

Likewise, Fey and Leonard (1983) found that language impaired children actual performed better on referential communication tasks compared with peers matched for MLU. Fey and Leonard suggest that this results from the language impaired children's greater cognitive and social skills, suggesting an independence between language form and language use.

Autistic children show severe deficits in both their language skills and their communication skills. There may be a lack of speech (DeMyer, Barton, and Alpern, 1974) or the speech which does occur is not communicative, with such individuals having great problems with the pragmatics of communication (Messer, 1994). Like the child reported by Blank et al (1978), autistic children do not exhibit preverbal gesturing. Messer proposes that their communicative problems stem from their lack of ability to attribute mental states to either themselves or to other individuals.

Bierwisch (1980) suggests that it is useful to think of language and communication separately, for the reasons above and also because the rules and principles governing the linguistic and communicative facets of verbal communication are different. He equates communication with social interaction, and proposes that it is based upon different systems of knowledge compared with language. He contrasts two examples to illustrate this point. First, one may understand what someone is trying to communicate without understanding what they are saying, and second, one may understand what someone is saying without knowing what he/she is trying to communicate. He recognises the close relationship between these two concepts and suggests that speech act theory bridges the gap between them, since a speech act gives a linguistic utterance a "communicative sense".

Attempting to treat language and communication as separate concepts may obscure important relationships and similarities between language skills and communication skills (Shatz, 1983). The distinction is made here only as a reminder that language is not all about communication, and communication is not all about language use.

B. Communication as a Multi-Channel Phenomenon

An important feature of communication is that it is a multi-channel affair. That is, communication commonly involves many sources of information. For example, in a face-to-face interaction potential information sources include; the linguistic form of utterances, the paralinguistic features of these utterances, visual cues such as gesture and eye gaze, sociolinguistic information, discourse information and illocutionary information. Communicators make use of these information sources if they have the necessary knowledge to do so, that is communicators must use their knowledge about such information in order to interpret it. Restated in developmental terms the child developing as a communicator must acquire an understanding of all the information channels used by his or her speech community and integrate these into a complete functioning system.

To consider the development of communication one must therefore assess the development of the use of a diverse set of knowledge types as well as the development of cognitive and information processing abilities. This thesis will consider empirical evidence for the changing use of verbal and non-verbal signals with development, and the implications which this has for how well individuals communicate at different ages. The changing use of different knowledge types will therefore be investigated and considered with respect to cognitive and information-processing capacity issues.

Furthermore there is no reason to believe that all adults develop all this knowledge, or the strategies for using it, to the same level. Shadbolt (1984) and Anderson and Boyle (1994) suggest that speakers adopt different "communicative postures". In other words there is not necessarily one mature, efficient combination of skills which results in a mature, efficient communicator. Rather, there are likely to be several communication styles some more optimal than others. Just how effective a style is will depend on the communicative situation. Individuals may also adapt their style according to the communicative situation, and therefore another aspect of communicative development will be the acquisition of the pragmatic knowledge necessary to do so appropriately.

Before proceeding further it is necessary to discuss some of the theoretical issues which are prevalent when considering communication. It is evident from the above that even to provide a definition of what communication is, involves making certain theoretical assumptions. This is even more important when deciding what 'good communication' is, and how it is attained developmentally.

C. Theoretical Issues: Nativism and Empiricism

An old debate in communication is that which once raged between nativists and empiricists. Do we have an innate endowment which equips us for communication, or do we have to learn all the knowledge we will need for it? Most of the research surrounding this issue has focused on the acquisition of linguistic form, that is syntactic-semantic developments. Later in this chapter, more recent approaches will be discussed which encapsulate wider communicative issues. However the discussion of the nativist-empiricist debate is relevant here since there is a linguistic component to many, if not most communication events.

1. The 'Innateness' of Communication

Advocates of a strong nativist position are relatively rare. Fodor (1975) proposes that we are prewired for an internal, private language, that is, the language of our cognitive processes. He suggests that this is necessary for language acquisition and interfaces with the communicative environment, since language cannot be learned without first "knowing" it.

As previously mentioned most nativists have been concerned with the 'innateness' of language rather than communication. Chomsky's theory of an innate language acquisition device represents such an approach (Chomsky, 1957; 1965). Although superficially this offers an attractive explanation of the universality, rapidity, and creativity of language development, the theory does not provide satisfactory mechanisms for how the device operates upon the incoming input. This approach also detracts attention from the issue of what is an appropriate linguistic input, since it claims that with such a powerful innate mechanism in operation the form of the input is not important. Indeed, Chomsky emphasises the degraded quality of input with which children are provided. This argument is strongest when applied to the input the child receives indirectly from its linguistic community. Such input is distinct from the input that is specifically directed toward the child. This has been termed motherese by many investigators looking at the effect that caregiver speech has on the child's language acquisition (e.g. Cross, 1978). Motherese has some special and reliable features. Sentences spoken to young children are shorter and more elliptical, but at the same time are grammatical. This has been used as an argument against the need for the kind of strong innate acquisition device proposed by Chomsky. It has also been suggested that motherese is spoken and enunciated more clearly, although there is evidence to suggest that this is not necessarily the case (Bard and Anderson, 1983; in press).

On the whole there are many problems with Chomsky's earlier account, Messer (1994). In response to such criticisms many linguists now propose a new approach to language acquisition, called parameter setting (Chomsky, 1981; Gleitman & Wanner, 1982; Roeper and Williams, 1987). In this theory, linguistic rules are modularised, and some of them fixed at the onset of language acquisition. These are the innate principles. Other principles exist initially as a set of possible structures, or parameters, which through learning and experience become set according to the particular language being acquired. Parameters can therefore be thought of as predispositions to learning. These innate constraints act as 'perceptual scaffolding on which language-learning strategies can build' (Hirsh-Pasek, Kemler Nelson, Jusczyk, Cassidy, Druss, & Kennedy, 1987, p282).

Elliot (1981) concludes, from a review of evidence for the role of biological factors in language development, that such factors are not irrelevant to language-learning abilities, but that this relationship is more complex and elusive than earlier accounts, such as Lennenberg (1967), would have us believe. At the very least our genetic endowment provides us with the development of some necessary perceptual, cognitive and physical abilities. The role which innate rhythmical behaviour patterns play in scaffolding language and communication development is discussed shortly.

1.1 Natural and Conventional Signs

A related distinction is that between natural and conventional signs, or information units, (a distinction made by Grice, 1967;1975). Natural signs are those which are universally expressed and understood by members of a given species. They do not appear to require the same amount of learning, or at least the same type of learning as conventional signs. Ekman (1971) suggests that certain facial expressions are natural signs. In fact, Camras (1977) has found that children produce facial expressions which look and function like analogous expressions in nonhuman primates. In addition certain facial expressions such as smiling seem to be universally understood (Argyle, 1990).

Natural signs are not equivalent to automatic signs since there is a physiological distinction between them. Natural signs can be brought under the control of social reinforcement as Gerwirtz and Boyd (1976) showed with smiling and crying, whereas automatic signs, such as blushing, are normally outwith voluntary control (controlled by the autonomic nervous system). There is evidence (Argyle, 1990) for a neurological distinction between automatic signs and the more controlled use of signs. For example facial expression is controlled by the facial nerve nucleus in the pons of the brainstem. This nucleus is activated in two neurologically distinct ways. First, as a result of emotional arousal, activity comes from the hypothalamus and limbic system, in the lower brain, via the extrapyramidal tract, and this gives rise to spontaneous facial expressions. Second, activation comes from the motor cortex via the pyramidal tract, and this results in posed, socially controlled facial expressions. Smiling is an example of a sign which begins as an automatic sign and through learning becomes more consciously controlled. Further support for a dichotomous distinction between types of facial expression comes from comparisons between the facial expressions of blind and sighted individuals. Dumes (1932) found that there were no differences in the spontaneous facial expressions of blind and sighted individuals. However the same blind individuals were unable to act out facial expressions. This suggests that spontaneous facial expressions are largely controlled by innate mechanisms, whereas posed expressions result from learning from others within our social environment. This visual input is not available to the blind.

In contrast, the meaning of conventional signs depend upon culturally defined rules, and the meaning which an individual assigns to a conventional sign depends on that individual's knowledge of such rules. Conventional signs are not restricted to the verbal channel, but may also be carried in non-verbal channels (Shatz, 1983).

There may therefore be signals which are relevant to the communicative situation which are innate. The qualification of innateness is brought about by the universality of natural signs, not just intraspecies but also interspecies. Since the production and comprehension of such signals can occur, by their nature, without intentionality, it may be that they should not be treated as communicative. However recognising the innateness of natural signs makes it easier to accept an innate component of conventional communication. It may be that natural signs are part of an innate predisposition for conventionalised communication systems, and that they provide a framework within which conventionalised communication systems can develop.

2. The Influence of the Environment

The opposing empiricist view is just as problematic. Skinner (1957) proposed that language acquisition could be thought of as the learning of verbal behaviour, which occurs according to the same principles as all other learning. His account by its very nature does not consider the mental representation of knowledge, and the infant is not considered to bring any innate knowledge to his new learning situation. Skinner proposed that language is learned according to the principles of operant conditioning. The child learns what he/she receives reinforcement for. This account provides a candidate process by which language acquisition occurs, whereas Chomsky's early transformational Grammar approach does not. It does not however offer an explanation for why, in most individuals in all societies, language learning is so rapid, creative and apparently easy. It also falters in that the specification of the process which it proposes is very limited. For example, there is no systematic way to define what will constitute a reinforcer or a reinforcer's 'strength'. A fundamental problem with this approach is the simplistic process it offers as a mechanism for language acquisition. Given the inconsistent way in which adults reinforce their children's language attempts, it seems unlikely that reinforcement is the sole mechanism underlying language development.

The above approaches have two common problems. Firstly, they see the child as a passive recipient of environmental influence, and secondly, neither take into account the parallel cognitive, perceptual, and social developments which occur.

2.1 A Cautionary Point

Before continuing it is necessary to qualify what is to follow with some degree of reservation. When considering the research on how external experiences influence the development of the child, one should remember that most of these studies are based upon the practices of literate, usually Western societies. It must be recognised that our attempts to describe how and why language and communicative development occurs, are often constrained and guided by our cultural expectations about children.

Ochs (1983) reinforces this point, and contrasts both the child rearing practices, and the perception of children which adults have, between Western societies and the Samoan culture which she studied. She points out that many of our ideas about how environmental factors influence language development, do not seem relevant in the Samoan situation. For example, Samoan adults do not see their young children as having any ability for intentional behaviour. The patterns of interactions which the Samoan child is exposed to are therefore rather different from those which the Western child is exposed to, whose caregivers treat him as an intentional being often from birth. Since Samoan children acquire language at the same rate and in the same developmental sequence as Western children, it becomes a more difficult task to specify what are important environmental experiences.

2.2 The Influence of the Social Environment

Due to the inadequacies of both the nativist and the empiricist approaches, the psychological study of language development has shifted in focus to approaches putting more emphasis on the child as an active constructor of his or her language. This shift also incorporates a move toward studying the influences of the social environment on language acquisition. Although most of the work in this area shares the assumption that the child has some innate predisposition for using the linguistic input that he or she receives, it is at the same time concerned with environmental influences acting upon the child, although not in the restricted sense in which the behaviourists consider.

Although language and communication skills are in many respects different, language development occurs in a communicative context. It seems sensible therefore to take into account the effect which social interactions have on the development of linguistic forms. As linguistic forms develop, they become increasingly functional within interactions.

As it turns out, although most of the social interactionist work was motivated by the goal of finding the causal links between features of the social environment and the development of syntax, it has been rather unsuccessful in doing so. It has shown that a linguistic environment which is sensitive and in tune with the child's immediate semantic interests, is most correlated with language development but this development is not characterised by the development of syntax.

2.2.1 Motherese Hypothesis

The motherese hypothesis developed out of research which looked at the features which characterise the linguistic input children are exposed to early in life. There is a well documented speech register which describes this input, and many studies agree on what the critical features of the register are (for example Snow,1973; Cross,1977). As mentioned previously, Chomsky's suggestion that all the child's linguistic input is degraded is not upheld, motherese is characterised by sentences which are short, but grammatical, and are spoken and articulated clearly (although more recent research has shown that such speech is not actually more intelligible, Bard and Anderson, in press).

What the motherese hypothesis states is that the caregiver's input has a causal relationship with language acquisition (Garton and Pratt, 1989). Its strongest version proposes that the features of this speech register are necessary for language acquisition, its weaker version suggests that these features at least facilitate the acquisition process.

The interaction-based approaches therefore emphasise the role that the environment plays in the language acquisition process. These approaches imply that the innate, internal mechanisms involved in language acquisition have plasticity, and that language acquisition occurs through an interplay between these mechanisms and the influences of the environment, Shatz (1986). Shatz concludes that we must look at both the environment and how the child deals with it.

Similarly, Snow (1986) advocated that a more fruitful way of studying language learning mechanisms, would be to look at the child as an active processor of, what she called, 'Child directed speech'. This approach also involves combining the study of child directed speech with the study of other social aspects of language.

2.2.2 Social Interactionist Approaches: Vygotsky and Bruner

Vygotsky (1934, 1962) proposed a framework for studying several aspects of development from a Marxist viewpoint. His theory is based upon the assumption that individual mental processes have socio-cultural origins. He regarded sign systems, such as spoken and written language, as tools created by societies to fulfil human needs. This symbolic tool view of language is akin to Ammon's (1981) view of communication skills as tools for manipulating mental representations. Such sign systems are used for symbolic activities, which allow for greater intellectual accomplishments than the use of tools for practical purposes. Some support for this view is found in studies of language training in chimpanzees. For example Premack (1983) reports evidence for comprehension of abstract concepts in chimpanzees who had been language trained, which contrasts with a lack of such understanding in those who had not.

Vygotsky suggests that intellectual functioning originates on the social plane. The child internalises mental processes learned in social activities, thereby developing from interpsychological functioning to intrapsychological functioning. Notice the comparison with Piaget's view that development is in the direction from intrapsychological to interpsychological functioning. The preverbal child therefore has only non-verbal tools to use, but by interacting with other individuals who are competent with his culture's sign systems the child internalises symbolic sign systems. Vygotsky sees language as a means to the end of greater cognitive functioning, both intraindividually and interindividually. This contrasts with Piaget's view that cognitive functioning has to reach a certain maturity before language is possible, that language is an 'end' in itself, and that it is an intraindividual phenomenon.

Bruner's theory of cognitive growth is very much influenced by many of Vygotsky's ideas. He sees the child as an active constructor of language, testing hypotheses about language against new linguistic input (Bruner, 1977; Bruner, 1983). Like Vygotsky, Bruner emphasises how important language is to general cognitive development, with language allowing for planning, hypothesising, and thinking in abstract terms. He believes that children learn language for a purpose, and is primarily concerned with the functions of language and the development of communicative intent.

Bruner suggests that language acquisition is the product of the interactions the child experiences with adults, and proposes a mechanism called the 'Language Acquisition Support System' or LASS, which encapsulates this social interaction framework. Bruner calls the interactional framework 'scaffolding', and suggests that regardless of the amount or nature of the child's innate predisposition to language, this is a necessary feature of the child's experience if language is to develop.

In a somewhat similar vein, Schaffer (1977) suggests that the innate predisposition to language exists in the form of an innate predisposition to interact. For example, in infants there is innate temporal organisation, such as the periodicity of sucking when feeding, and the sleep-wake cycle, (Schaffer also highlights other innate abilities such as innate perceptual preferences for human face-like patterns). The temporal patterns, along with the infant's predisposition to attend to the stimuli the mother is offering, allow the mother to create, between herself and her infant, what is sometimes termed a 'pseudo-dialogue'. Even if one does not wish to accept such a strong analogy with mature interaction, these early interactions at least supply the infant with experiences, such as inter-individual responsivity, and the control which he/she can exert on another individual, which may, as Schaffer proposes, be necessary for communication abilities to develop.

D. Chapter Conclusion

Communication is a term which has been defined in several ways, although most psychological definitions now include the criterion of intentionality. Communication is not all about language even though most theories of communication development have centred around linguistic development. These theories have produced several possible mechanisms through which language may develop, and all of these offer some insight into the process. What must also be addressed is the development of communication skills which will encompass both linguistic and non-linguistic issues. Research into the role which non-verbal signals play in the communicative process will now be reviewed. The empirical work of this thesis relates to the role of both verbal and non-verbal aspects of communication.

Chapter 2: Non-verbal Aspects of Communication

A. The Relationship Between Verbal and Non-verbal Communication

A complete study of communication must involve verbal and non-verbal phenomena, and how these interact to produce an efficient set of communication strategies.

While much literature suggests that non-verbal communication plays an important role in facilitating communication development and, in general, interaction, it is popular to assume that non-verbal communication is either a primitive precursor or a redundant partner to verbal communication (Weiner, Shilkret, & Devoe, 1980). In contrast, the view which they advocate, and which is taken here, is that communication involves many different channels, for example the verbal, paralinguistic, gestural channels, all of which may be equally important in certain communicative situations.

Further support for this view comes from studies such as Goldin-Meadow, Wein, and Chang (1992). They asked children to explain their reasoning while doing Piagetian-type conservation tasks. They found that children transmit information via hand gestures that is not represented in the verbal utterances themselves. The kind of hand gestures they investigated were those called *illustrators* in Ekman and Friesen's (1962) system of analysis. These are spontaneous gestures which accompany speech. Adults observers are not only sensitive to this non-verbal information but actually add it to their verbal accounts of how well the child understood the conservation tasks they were talking about. So adults gained information about the children's understanding which they would not have had access to if they had only listened to the children's verbal responses. The adults were also found to transmit information in their gestures which was not found in their verbal descriptions. For example, in descriptions of liquid conservation their gesture and speech often each conveyed a different dimension. An example given by Goldin-Meadow et al is as follows:

Child says: "the dish is lower than the glass"
Child gestures: a wide C-hand near the dish and a narrower C-hand near the glass.

Goldin-Meadow et al (1992)

In this example the child verbalises the height information while gesturing the width.

If we think of a communicative act as one where information is grounded (Clark & Brennan, 1990), then various types of signal can be used for this grounding process to take place, with verbal and non-verbal signals being important for both children and adults. Communicative maturity involves both the development of several channels and the integration of these channels so that they can be used efficiently.

B. Developmental Issues Regarding the Use of Verbal and Non-verbal Communication

The development of communication skills therefore involves learning to use signals in different channels, learning to integrate these signals in appropriate ways, and learning how to apply and combine the signals in different communication situations. Rather than look for qualitative changes between young children and adults in their communication styles (with children being very non-verbal and adults very verbal) it may be more fruitful to look at changing patterns of both verbal and non-verbal behaviours. The fact that children are less articulate than adults with verbal communication is not the only reason for their poorer performance on communication tasks. Their holistic communication acts including verbal and non-verbal components will be different from those of adults. It is expected that young children's use of both verbal and non-verbal signals will be less efficient than those of adults. This is also suggested by Feldman, White and Lobato (1982) who propose that the ability to use non-verbal communication is one which develops into adulthood.

A related point is that the advent of apparent competence with the verbal channel does not signify communicative competence. A striking illustration of this is the case, previously discussed in Chapter 1, which Blank et al (1978) report of the communication abilities of a 3;3 boy. The child's syntactic-semantic development was age appropriate and his paralinguistic cues with these utterances were also appropriate to the function of his utterances, and yet he failed to use the language which he had to communicate. He also failed to understand or produce non-verbal communication. His impairment appears therefore to be a fundamental communication deficit.

Jancovic, Devoe and Weiner (1975) found evidence that non-verbal signals are a facet of communication which develops with age and with increasing communicative competence. They studied communicative hand and arm movements in children ranging in age from four to eighteen years. The gestures were classified into four categories; deictics, pantomimics, sematic-modifying, or relational. It was found that the first two categories decreased with increasing age, and the second two increased with age. Furthermore this led to an overall increase in gesturing with age. The frequency with which gesturing occurs (and in particular the frequency of semantic-modifying and relational gestures) therefore increases as children get older. It appears that the non-verbal channel is used increasingly as communication develops, but that functions which it serves also change.

Weiner et al (1980) also report that in both the verbal and the non-verbal channels there is an increase in both the forms of gesture and their complexity with age. For example, they report that child and adult usage of pantomimic gestures ("movements which copy or mimic some visual or kinesthetic attribute of a concrete object or event"), are very different. Often the children use such gestures in place of verbal naming, whereas adults use them to index a particular aspect of the verbal message they are sending. This research shows that not only do adults use as much, if not more, gesturing than children but that the functions they put it to are different. It is therefore be as important for us, as researchers, to study competence with various communicative functions, as to study the more specific forms of communication which carry these functions.

Pechman and Deutsch (1982) found that the use of pointing gestures in a referential communication task changed with age. When referring to distant objects surrounded by other potential referents, 4 year olds still used pointing, making the communication attempt ambiguous. In contrast 9 year olds and adults prefer to verbally name referents in these contexts, although they were just as likely to use pointing when referring to near referents and the context was less ambiguous. This suggests that it is not just isolated linguistic or non-verbal skills which are lacking in young children, but that there is also a lack of pragmatic knowledge about how to use such communicative tools efficiently. Increased linguistic skills offer more communicative options, but what also develops is an increased 'meta knowledge' about how to effectively employ skills which one possesses.

C. Continuity or Discontinuity in the Development From Preverbal to Verbal Communication?

There are two opposing perspectives as to how infants learn to communicate. The first of these assumes continuity between verbal and non-verbal behaviour. This view assumes that use of language is related to achievements in other domains such as cognitive and social competence, and that verbal and non-verbal communication share common underlying processors. The second opposing view is that there is discontinuity between verbal and non-verbal behaviour, with language acquisition depending upon specific processes which are different from those that control gestural behaviour. For example, a common assumption among psychoanalysts is that non-verbal behaviour reflects and is controlled by the unconscious, whereas language is controlled by conscious processes (Freud, 1915b). This approach proposes that language acquisition is not contingent upon development of prelinguistic, non-verbal abilities.

Most research on the relationship between speech and gesture has therefore been aimed at showing that language depends on either cognitive or social development, or upon the development of an independent system.

1. Arguments for Continuity in Development

1.1 Cognitive Development and the Development of Communication Skills

Piaget (1951) proposes that words emerge when the infant's cognitive abilities have developed to a certain degree, and he or she understands that both vocal and gestural signs can be used to represent things (at around one year of age). Piaget used non-verbal behaviour, such as eye gaze and facial expression to make judgements about cognitive development. He claimed that facial expression relates not only to emotion but also to representation, and therefore non-verbal behaviour reflects mental representations in the same way that words do.

Bruner (1983) discusses a strong version of the continuity approach, the precursor hypothesis, which suggests that grammar is a 'distillation' of non-linguistic knowledge. Another weaker version , namely the alerting hypothesis, suggests that a prior knowledge of the communication domain is necessary for language to develop. Unlike its stronger counterpart, this approach makes no predictions about the acquisition of specific grammatical forms. Bruner advocates the study of the "procedures for the realisation of communicative functions". That is, the study of how prelinguistic procedures for communication 'turn into' linguistic procedures for communication. He suggests that grammar is acquired in the context of communication, and therefore the study of the acquisition of linguistic form will be most fruitful in the context of the development of communication abilities.

McNeill (1975) proposes that action schemata, developed through the integration of actions, objects, events, and states, provide the basis for the semantic relationships underlying verbal utterances. He therefore, like Piaget, proposes that sensorimotor development is necessary for the development of language.

McNeill also suggests the concept of semiotic extension, which represents the development of mental representations beginning with sensorimotor schemata, and developing into formal operations. He suggests that gestures do not disappear as language becomes established, but rather their forms and functions will change. Adult gestures are therefore not simple elaborations of the verbal content of utterances, but actually relate to the underlying mental representations behind the verbal behaviour, and may represent "vestiges of the sensorimotor stage of early cognitive development", Feyereisen and de Lannoy (1991).

McNeill (1985) suggests that as language acquisition progresses so too does the facility with gestures. So the emergence of deictic gestures (pointing) is associated with the appearance of first spoken words, iconic gestures (gestures which are sematically parallel with the accompanying verbal utterances) with decontextualisation of meanings, and beats (gestures which give emphasis within the verbal message and are tied to the prosodic structure of speech) with the text coding stage.

Bates, Benigi, Bretherton, Camaioni, and Volterra, (1979) correlated various verbal and non-verbal measures in children between 9 and 13 months of age. They found that both 'communicative' gestures, for example pointing accompanied by gaze in a social context, and non-communicative gestures (not directed to another person) correlated with both production and comprehension vocabularies. The older children's correlations between the verbal and non-verbal measures were stronger than the younger children. This suggests that rather than becoming more divergent, these modes of communication become more closely related with development. This means that verbal and non-verbal systems of communication are interrelated as a continuity approach would assume.

1.2 Social Interaction

When considering the processes through which language develops within social interactions another possible avenue of continuity becomes salient. Through social interactions with others, infants develop an ability to form intentions to communicate. The step from prelinguistic to linguistic communication can be seen as a shift in strategy to realise these intentions.

Trevarthen's (1977) work with very young infants shows that as early as 8 to 12 weeks certain hand and arm movements are synchronised with mouth movements. This suggests that there may be an innate co-ordination of hand and mouth movement. Such innate abilities may, together with a responsive caregiver, provide a framework within which the infant learns the fundamentals of communication and from this language develops. Likewise early pseudo-conversations, established by innate temporal organisation of the infant's behaviour and the way in which caregivers 'fit' their behaviour into this sequence, may facilitate the acquisition of procedures necessary for verbal co-ordination, for example turn-taking mechanisms (Bruner, 1975a;b).

Advocates of the continuity hypothesis propose that communicative competence develops within and through the interactions infants have with their caregivers. Certain speech functions are accomplished within these interactions by non-verbal means such as pointing to establish reference. Later, establishing reference using speech illustrates a change from a non-verbal to a verbal communication strategy not the development of the function of reference making.

Feyereisen and de Lannoy (1991) suggest that the ability to establish reference about objects non-verbally, is a prerequisite for lexical development. The use of pointing gestures is established by 14 months of age, and these tend to be accompanied by some vocalisation and gaze. Feyereisen and de Lannoy point out that given the nature of pointing behaviour a continuity is assumed between it and early verbal naming. As the child's ability to produce verbal expressions of references improves, the need to use such gesturing to establish shared reference decreases.

However it has also been argued that there is discontinuity between non-verbal and verbal way of establishing reference. Finger pointing is observed as early as three months at which age we cannot assume an intent to establish reference. It may however be that form precedes function and that the function develops with increasing experience with social interactions, where adults respond to infant gestures with verbal naming procedures and thus give the infant the necessary linguistic input.

Jancovic et al (1975) report an increase in gestures between the ages of 4 and 18 years, suggesting that the use of gesture develops as linguistic skills also increase, therefore supporting the claim that verbal and non-verbal aspects of communication are related by a common underlying communicative competence.

1.3 Cognitive Capacity

Church and Goldin-Meadow's (1986) results showed that 6 year olds, who were on the verge of understanding conservation tasks, used gestures which showed a level of understanding of conservation not apparent in their verbal explanations. For example, when describing a liquid conservation task a child may focus on the height of the container in speech but on the width of the container in gesture, as follows:

Speech: " the dish is lower than the glass."

Gesture: the child produces a wide C-hand near the dish and a narrower C-hand near the glass.

Church and Goldin-Meadow (1986)

Children who were not yet at this point in cognitive development did not show understanding in either their gestures or their speech. It seems that young children can express new conceptualisations or difficult information through gesture before they can express it verbally. Again this suggests that gestures and speech are used to express the same cognitive representations, and that gestures are used first because they are easier for the children both to encode and decode.

Gestures may be a channel through which concepts can be expressed before they can be expressed verbally. The gestural channel may be a very important source of information regarding the knowledge of a child who is not yet expressing that knowledge verbally. This has important implications for professionals who have to make assessments of children's knowledge and understanding. Goldin-Meadow et al (1992) point out that teachers must be aware of information transmitted in children's gestures, but also of the potential of their own gestures to be a source of information for their pupils.

Further evidence for such a relationship between verbal and non-verbal communication comes from, for example, the work of Greenfield and Smith (1976). They studied the vocal and gestural behaviour of two year olds. Their data showed that early utterances were often accompanied by hand gestures which actually acted as substitutes for verbal expressions of, for example, actions and objects. These early utterances are only comprehensible when their non-verbal context is available, since their meaning is conveyed jointly with both non-verbal behaviour and verbal expressions.

1.4 Evaluation of Continuity Approach

Much of this research has attempted to find similarities between prelinguistic behaviour and later linguistic interactions. For example, Bruner suggests that the structures of early mother-child interactions are analogous to later conversational structures. However, as Shatz, (1983) points out similarity is neither a necessary nor a sufficient index of continuity. She suggests that the search for continuity should be abandoned in favour of exploring development of communication from other angles. She proposes that different communicative subsystems such as those concerning syntax, paralinguistic information, and non-verbal aspects develop in parallel and become increasingly "coupled" as development progresses.

Shatz also emphasises that, contrary to the continuist belief, children's communicative understandings are still very immature even when they are past the preverbal period. It therefore cannot be that preverbal communication simply sets the stage for language which then takes over. Shatz suggests that a more successful line of enquiry will be to consider language and communication as simultaneously developing subsystems. There may be, for example, syntax knowledge, speech act knowledge, and person knowledge, which are all developing subsystems, with no unitary course of acquisition. Part of the acquisition of mature communication is the coupling of these subsystems. This approach ignores the continuity/discontinuity issue.

Sugarman (1983) also doubts the traditional continuist claim about the relationship between preverbal behaviour and linguistic acquisition. She reports that by the end of the first year it is likely that preverbal communication is intentional and therefore shares at least one component of linguistic communication. Preverbal experiences may provide the basic knowledge about communication which motivates the learning of language. She concludes that the causal links between preverbal and verbal communication are more likely to exist at the general level of communication function, than at the level of specific verbal or non-verbal behaviour patterns.

This discussion is important because it illustrates again that language and communication must be measured multidimensionally. It is not sufficient to look for prerequisites of language in early communicative behaviour, nor to consider mature communication to be a linguistic matter. Instead we should be thinking about the development of a phenomenon with many faces, this phenomenon is communicative function. How this is carried out depends on the resources available to an individual at any one time, and these resources will be determined by both the communicative competence of the individual and situational variables.

2. Evidence for Discontinuity in Development

The above contrasts with the view that language acquisition results from specific, autonomous processes, and that language functions autonomously from non-verbal aspects of communication. One aspect of non-verbal behaviour which is investigated in this thesis is gesture. Werner and Kaplan, (1963), suggest that although gestures and early speech emerge at the same time and are used together in early productions, with development they become more differentiated. Gestures are considered a primitive mode of communication, while verbal expression is a more elaborate, mature communication medium. Instead of the development of a single system of representations, ontogeny will involve the development of separate sets of knowledge representation.

2.1 The Replacement Hypothesis

If gestures are more primitive then we would expect to see them being replaced by verbal expressions as verbal competence increases. Feyereisen and de Lannoy (1991) propose such a replacement hypothesis. They suggest that when gestures begin to be combined with words their function changes, and that as competence with spoken language increases the importance of gesture to the communicative process decreases.

Acredolo and Goodwyn (1988) found that between 10 and 21 months of age, references made purely using gesture decrease, while wholly verbal expression increase. This suggests that verbal expressions replace more gesturally based ones.

In contrast, Dobrich and Scarborough (1984) found no difference in the form and frequency of pointing gestures between two groups of two year olds who had either high or low MLUs. So their result suggests that linguistic ability does not affect the use of the gestural system, therefore supporting the discontinuity claim. However this claim may not be valid given that MLU is not necessarily an optimal measure of linguistic ability (Garton and Pratt, 1989).

Likewise Evans and Rubin (1979) found evidence for discontinuity in development when they found a U-shaped distribution of gesture frequency when comparing 6, 8, and 10-year olds. The task these children were required to perform was to explain the rules of a game to an experimenter, and while their gesturing behaviour differed their ability to formulate adequate rules did not, therefore in some form or another they transmitted the necessary information. They found that inadequate verbalisations were sometimes clarified by accompanying gestures.

Feyereisen and de Lannoy (1991) propose that there is both continuity and discontinuity between the development of verbal and non-verbal communication processes. Discontinuity and specialisation between the two systems may arise in terms of the referent. For example visual features may be referred to by gesture and taxonomic features by words. Continuity will exist where enhancements in one modality transfer to the other, for example an ability to stress a feature of a referent by way of gesturing may enhance one's ability to do this verbally. In other words there may be continuity between prelinguistic communication and some later language uses, but not necessarily all.

3. The Complexity Hypothesis

Many findings therefore suggest that gesture and speech should be thought of as distinct processing subdomains. Feyereisen and de Lannoy (1991) point out that such discrepancies between the development of gesture and speech may be explained in another way which is consonant with a common underlying mechanism. It may be that gestural and speech material differ in complexity, and young children prefer to process the less demanding information. In the case of speech and gesture, gestural symbols may be easier to cope with either because the hand movements are more directly related to context, or because they are easier to perform in terms of the motor procedures required. Information processing accounts are discussed in Chapter 3.

Saxe and Kaplan (1981) found that 4 year olds made fewer errors in counting when they were allowed to gesture than when this wasn't allowed. Younger children made errors regardless of whether they were allowed to gesture or not suggesting that their gesturing behaviour did not help their processing of the task. Older children performed without error regardless of accompanying gesturing behaviour, presumably because the counting procedure was so well learned for them and therefore less demanding. These results suggest that 4 year olds know how to count but that it is a demanding task in terms of information processing, and that performing gestures somehow decreases the processing load. An alternative explanation is that imposing the artificial inhibition of gesture increases task demands in itself, thus producing a decrement in performance (rather than gesture facilitating performance). For younger children the task is too demanding no matter what, and perhaps gestures themselves add to the processing demands rather than decrease them.

3.1 Comparisons with Deaf Children Acquiring Language

The complexity hypothesis can be evaluated by studying deaf-mute children since their language acquisition occurs in the gestural modality. These children develop a gestural communication in place of a verbal one, either spontaneously or by imitating adult models (Goldin-meadow, 1985).

Feyereisen and de Lannoy (1991) therefore propose that there is a greater similarity between the prelinguistic gestural behaviour of these children and their subsequent sign language use, than there is between their preverbal behaviour and speech of hearing children since there is no change in modality. The underlying assumption here is that although sign language is linguistic and the gestures produced are therefore qualitatively different from prelinguistic gestures, the motor mechanisms behind each have commonalties. It is supposed that it is a less complex process to learn sign language than it is to learn vocal language since the latter involves a change in modality.

If the complexity hypothesis is correct then deaf-mute children should avoid certain problems which the hearing children encounter when making the transition from preverbal to verbal communication. However Pettito (1987) found that children learning sign language showed the same sort of patterns of errors with pronoun usage as did hearing children with spoken forms of pronouns. This suggests that their 'preverbal' experience with gesture did not help their acquisition of a sign language. This suggests that the difference between preverbal communication and sign language is as great as the difference between preverbal communication and speech. The processing complexity hypothesis is therefore not supported.

There are also important differences between the gesture usage of hearing children and that of signing deaf children. For example hearing children do not normally combine gestures in a grammatical sequence, whereas sign languages have syntax. Feyereisen and de Lannoy (1991) propose that there is in general a lack of evidence for syntax in gestures produced by hearers, and that these gestures tend to be the companions of verbal representation of the same meaning. They take this as evidence for discontinuity between linguistic (both speech and sign languages) and non-linguistic modes of representation (preverbal gesture).

4. Processing Relationships Between Gesture and Speech

Feyereisen and de Lannoy suggest that preverbal gestures are characterised by being performed in the presence of their referent and are contextually bound. They therefore differ fundamentally from the gestures used by older children to accompany speech referring to distant referents. This suggests that the processes of speech and gesture are autonomous.

Although physical gestures and spoken language can on occasion be substituted for one another , it is difficult to use a single framework to account for their usages (Feyereisen and de Lannoy, 1991). The assumption of two independent systems is common to much of the work in the field of non-verbal communication. This sort of view is expressed by Freud: "He that has eyes to see and ears to hear may convince himself that no mortal can keep a secret. If his lips are silent, he chatters with his fingertips" (1905/1953,pp.77-78). This sort of observation illustrates that verbal and non-verbal means of expression may perform the same function, but that they appear to be under different sources of control.

In contrast authors such as Kendon and McNeill propose that there are common cognitive processes underlying both gesture and speech. It is proposed that both gesture and speech are symbolic representations and that these develop from "affective-sensory-motor patterns" during infancy (Werner and Kaplan,1963). It is suggested that manual gesturing while speaking by adults may reflect the difficulty speakers have with encoding global representations into the linear structure of speech (Feyereisen and de Lannoy, 1991).

Rime (1983) proposes that the relationship between gesture and speech is two-fold. Firstly, illustrative gestures may be analogous representations of meanings being expressed by speech, using perhaps shapes and movements to refer to objects and actions. Indeed it is proposed that the expression of experience in a verbal form is always accompanied by some relevant motor activity. Gestures are therefore produced during speech production because relevant motor schemata are activated during the attempt to express meaning. The second way in which gestures and speech are related is in their rhythmical properties, the prosodic structure of speech therefore relates closely to batonic type gestures. Rime (1982) suggests that such movements influence the structuring of speech production and are therefore not primarily aimed at transmitting information, but support the encoding activity of the speaker. The frequency of such gestures is therefore not affected by the communicative media of conversational partners, for example face to face versus by telephone. In fact, Rime and Schiaratura (1991) found that restricting hand movements produced an increased frequency of eyebrow and finger movements, suggesting that such movements are a necessary component of the speech production process. Rime therefore proposes that gesture is important, not for a primarily communicative function, but for the impact it may have on the speech production process.

McNeill (1985) suggests that speech and gesture share a computational stage and are therefore parts of the same psychological structure. He draws such a conclusion from four observations; firstly gestures are synchronised with linguistic units; secondly gestures and speech carry out the same semantic and pragmatic functions; thirdly aphasics lose their gesturing abilities as they lose their linguistic; lastly gestures develop together with speech. "The basis for synchronisation is not that gestures and speech are translations of one another, but that they arise from a common cognitive representation" (McNeill, 1985, p.353).

McNeill is therefore arguing for a general communicative ability which has both linguistic and gestural aspects. He also argues that the processes behind gestures and speech are the same and therefore will suffer the same sorts of decrements as a result of brain damage. However results from a sample of aphasic patients have shown that gestures can be used to compensate for a lack of linguistic ability, with communicative ability overall remaining remarkably intact given the level of linguistic impairment, (Merrison, Anderson, and Doherty-Sneddon, 1993). It appears therefore that gestures and speech are very closely related components of the communicative process but may not be as strongly linked as McNeill suggests. They may not share the same processing mechanism but may be linked by common 'meta-communicative' knowledge.

Kendon (1985) also proposes that the same conceptual structure underlies both gesture and speech, since both are used to express meaning. Kendon emphasises that gestures accompanying speech represent the organisation of discourse visually, whilst movements are used to mark various discourse boundaries such as 'prosodic units' and 'idea units'. However he emphasises that these different modes of communication are not equivalent, since their use can be affected by context, for example gestures may compensate for speech when speech reception is difficult for example in noisy conditions (or in the aphasic communication mentioned above). He also claims that gestures and speech do not operate according to the same turn-taking mechanism. Finally, Kendon notes that some types of information are more amenable to gestural expression, for example spatial relations, than others which may be more suited to verbal expression. Gesture and speech are both tools which can be used for communication.

Similarily, Butterworth and Hadar (1985) propose that the processing relationship between gesture and speech is more complicated than McNeill's account would suggest. They suggest that certain assumptions made by McNeill do not hold when one looks at the data. For example, gestures are not always found to be synchronised with linguistic units. Butterworth and Hadar agree that gesture and speech share computational processes, but they disagree that this is restricted to one early stage in the translation of thought to speech. Instead they propose that gesture and speech share at least 2 computational stages in the process of their production, and perhaps more. This model provides a more satisfactory account of the data, on for example the breakdown of gesture and speech in aphasia.

In summary, the proposal that gesture is in some way related to speech is generally agreed. However the nature of this relation and the importance of the different forms of expression for the communicative process is still controversial. Some authors support the notion that gesture has a primary communicative function while others see it more as a component of the speech management process. Some consider that gesture processing occurs independently from speech processing, others propose that there are common underlying mechanisms.

D. The Kind of Information Gestures can Carry

Kendon (1975a) proposes that gestures help mark discourse boundaries such as paragraphs, sentences, and propositions. Thus they illuminate both the grammatical and informational structure of the discourse being spoken. Duncan (1974) suggests that gesture plays an important role in turn-taking. He proposes that termination of gesture acts as a turn-yielding cue, and that continuation of gesturing can serve to hold a turn. Beattie (1981) points out that although termination of gesture can be quite an effective turn-yielding cue, its use as such is relatively infrequent. It does not therefore play a central role in turn-taking. He suggests that other verbal cues are more important.

Conventionalised forms of gestures can be used to convey predefined meanings, for example the shoulder shrug with palms up meaning "I don't understand", "I don't know", such gestures are often called emblems (Ekman and Friesen, 1969). Gestures may also play a role in the turn-taking mechanism whereby gesturing symbolises an intent to either keep the floor, if already holding the floor, or to take the floor if another party is at present in possession. Also non-verbal signals are often important sources of information regarding the emotional state or individual characteristics of communicators. For example, Ekman and Friesen (1969b) found that subjects could judge the emotional state of a depressed patient more accurately from a video of her body than from a video of her face.

Gestures such as pointing may help to disambiguate spoken utterances. In communicating one must use many sources of information, such as semantic, pragmatic and gestural information (Marslen-Wilson, Levy, and Tyler, 1982). Gestures may convey meaning in the same way as words do, or even if their meaning is tied to a verbal context, they may be integral to the meaning which that verbal context expresses. There are several categories of gesture. Among these are batons which serve to accent a word, pictographs which draw the shape of a referent in the air, and deictics which point to a referent (Argyle, 1990). In some cases it is noted that the gesture is redundant in respect to the verbal message for others the gesture plays an integral part in determining meaning, adding information which is not present in the verbal channel.

E. The Role of Eye Gaze in the Communicative Process

Boyle et al (1994) found that gazing at one another by adult interlocutors was significantly more likely at points in the dialogues when there were communication problems compared with when there were no communication problems. This suggests that one feature of non-verbal communication which is important for adults is gaze. An analysis of gazing behaviour of adults and children is reported in this thesis to see whether gazing is used equally and for the same functions in adult and child interactions.

1. Functions Which Gaze May Serve

Patterson (1982;1983) developed a functional classification of non-verbal behaviours. Five categories were proposed; firstly providing information; secondly regulating interaction; thirdly expressing intimacy; fourthly exercising social control; and lastly facilitating task goals. Patterson proposes that gazing behaviour can carry all of these functions and that gazes can be multifunctional. Some of these functions will now be discussed more fully.

1.1 Providing Information

The sorts of information which gaze has been hypothesised to carry in the literature are liking and attraction, attentiveness, competence, social skills, credibility, and dominance (Kleinke, 1986). Such informative gazes may be communicative or indicative depending on whether or not the gazer intends the gaze to have an informing effect or not (Patterson,1982). There is evidence that some of these informing functions may be learned. For example Abramovitch and Daly (1978) found that children do not use eye contact to judge friendship and liking until they are about 6 years of age. They found that while preschool children were able to make accurate judgements of affiliation based on head orientation, they did not use the presence or absence of gaze in making there preference judgements of which of two confederates they would like to interact with. This contrasted with children of around 6 years of age who showed a significant preference for the gazing confederate.

Gaze orientation may transmit information regarding an individual's mental state, and it can therefore be a mechanism in the application of theory of mind (Gomez, 1991; Baron-Cohen, 1994). The ability to use gaze orientation in this way develops with age. Baron-Cohen and Cross (1992) found that most 4 year olds, but only 30% of 3 year olds, used gaze orientation to judge whether someone was thinking.

Gaze has been found to be an important interactional device in several studies. For example, Kendon and Ferber (1973) observed that the amount of gazing experienced between interlocutors served as a cue as to whether or not they would pursue a conversation with one another. Also Kleinke, Staneski, and Berger (1975) found that interviewees judged their interviewers as more attentive, and gave longer responses when the interviewers gaze rates were relatively high rather than low. Gaze therefore appears to encourage conversation and interaction.

1.2 Regulating Interaction

Argyle and Cook (1976) have discussed how visual behaviour acts both to synchronise and regulate interaction. Condon (1980) observed synchronisation between verbal utterances and eye movements in normal adults. Such synchronisation was not found in communicatively deficient populations such as schizophrenics and autistic children. However the deficient use of gaze by schizophrenics has been brought into doubt. Williams (1974) found that while their gaze patterns were dysfunctional during interactions with psychologists or strangers, this was not the case when talking with people they were familiar with.

Kendon (1967) and Duncan (1972) found that in dyadic interactions speakers used prolonged gaze at the ends of utterances as turn yielding cues to their listeners. Likewise Levine and Sutton-Smith (1973) found that adults ended utterances with gazes, and that there were developmental changes in such patterns with children not following this adult pattern.

Some studies have found that individuals gaze more while listening than speaking (for example Argyle and Cook, 1976). This may partly be because while carrying out speech planning processes it is advantageous not to distract oneself with extra information to process. Evidence that gaze can be a distraction and something to be avoided during difficult tasks comes from a study by Stanley and Martin (1968). They found that gaze decreased when subjects attempted to recall material involving competing rather than noncompeting associations.

However in some communication contexts equivalent amounts of gazing while speaking and listening have been found. For example Ellyson, Dovidio, Corson, and Vinicur (1980) found this with interlocutors who were discussing subjects on which they had expertise.

Kendon (1967) concluded that gaze which occurred at the ends of speaker turns acted as a turn yielding cue. In contrast, Beattie (1978a) found that the effect of gaze within the turn-taking mechanism was much weaker. However, Beattie (1981) concludes that speaker gaze may facilitate turn-taking in certain contexts, for example in discussions of difficult topics (Beattie, 1979). Results from studies of naturally occurring conversation, for example Duncan, (1972) and Beattie, (1978a) have lead to the conclusion that visual signals play little if no part in the flow of interaction (Beattie, 1981). Beattie suggests that syntactic and paralinguistic cues are sufficient to fulfil the requirements of the turn-taking mechanism. The role which gaze plays in turn-taking is therefore less clear than previously believed since it depends upon context task goals (Beattie, 1979).

Kleinke (1986) points out that the function of gaze within interactions can only be fully understood when its relation to factors such as communicative context and personal factors such as status and motives are better understood. One aim of this thesis is to investigate the relationship between gaze and the conversational intention behind the accompanying verbal utterances in terms of some classes of Conversational Moves.

1.3 Social Control

Patterson (1982) suggests that gaze is communicative when used for social control because it is intentional. One example is with exertion of dominance. Exline, Ellyson, and Long (1975) concluded that conversants exert dominance by gazing while speaking, and gazing while listening primarily serves an information gathering function.

Argyle, Lalljee, and Cook (1968) found that decreasing visibility (from normal to dark glasses, mask, one-way mirror, to no visibility), decreased communicants satisfaction with the interaction when they were the ones who could not see the other. In contrast participants were quite happy to be the ones who were less visible. This suggests that the participants used visual signals to receive information about their partners, but did not necessarily intentionally use the visual channel to send information. Several studies have shown that gaze promotes co-operation. For example, Morley and Stephenson (1969) found that people in a negotiating situation were more likely to bargain and compromise when they communicated face to face rather than over the telephone. An exception to such an effect is when people in such situations use gaze to threaten and dominate one another. In such situations co-operation is increased when visibility is removed (Carnevale, Pruitt, and Seilheimer, 1981).

1.4 Facilitating Task Goals

Gaze can fulfil certain functions which affect task outcome. Two of these are information seeking and the facilitation of communication. These have been studied in situations highlighting interpersonal relations, learning, and bargaining. Burton, McGregor and Berry (1979), proposed that the increased gaze given by dependent people toward a non-reinforcing experimenter reflected their need for information and feedback. These people were therefore gazing to gain information regarding the interaction. Gaze can however also be a source of distraction within an interaction. Beattie (1981) found that gaze at another's face interfered with the production of spontaneous speech. Beattie proposes that this may be due to the gaze causing increased arousal, which interferes with speech production.

Rutter and Stephenson (1979) found that while completing a task-oriented interaction strangers looked more while listening than did friends. They therefore concluded that this gaze served more to collect information than to express affect. Gaze is also viewed as serving this function by interactionists such as Clark and Brennan (1990) who propose that many channels of information facilitate the grounding process.

Boyle et al (1994) found that face-to-face task oriented interaction was significantly more efficient compared to audio-only interaction. Significantly more words and turns were required to accomplish the task in the audio-only context. They conclude that participants must therefore have gained information from visual cues in the face-to-face context.

Kleinke (1986) points out that although all the above functions are important and may be recognised by interlocutors, there will still be a level of gaze in any given situation which is acceptable and appropriate. Violation of these expectations will result in an unstable interaction.

2. Developmental Studies of Gazing Behaviour

Developmental changes in gazing behaviour have been reported in several studies. Ashear and Snortum (1971) found, in their study of pre-school to eighth grade children, that in general gazing back at a constantly gazing adult decreased with age. It was concluded that gazing decreased in the older children because of an increasing self-consciousness when talking to adults. Harris (1968) found that gazing was higher for a younger group of subjects (3->4.5 years) compared with older children (4.5->5 years) especially when the adult partner was a woman rather than a man. This suggests that in general gazing decreases as age increases. These studies are however somewhat artificial and may lack validity. What is being measured is how children behave in response to an adult who is violating social norms of expected levels of gaze. The decrease in gaze may reflect children's increased awareness of such norms rather than a decrease in their general levels of gazing.

Scheman and Lockard (1979) found that younger children (from about 18 months to 4 years) were less likely to avert their gaze from a staring strange adult, than older children (aged between 5 and 9 years). The authors conclude that children do not learn to avoid gaze until after they are 4 or 5 years old. On the whole therefore, younger children gaze more. Developmental changes in gazing behaviour have been attributed to development in perceptions of social functions of gaze. It may also be the case that if young children are more dependent upon the visual channel for communication then they tend to gaze more in order to access visual cues.

2.1 Gazing Behaviour in Same Age Pairs

Rather than using adult confederates Levine and Sutton-Smith (1973) investigated gazing behaviour in interactions between subjects in four age groups; 4->5 years, 6->9 years, 10->12 years and adult. They found that gaze increased from the first to second age groups, decreased for the third group, and increased to its highest level for the adults. Levine and Sutton-Smith propose that many factors influence gazing behaviour in all the age groups, but that the factors will operate with differing strengths of effect depending upon the age group. In certain communicative contexts gazing is a communicative function which actually increases with age. This suggests that the functions which the non-verbal channel serves may change as communicative competence increases.

F. Non-verbal Signals in Different Communicative Media

One way to study the role of visual information in communication, is to look at that communication process when visual signals are blocked because the communication is occurring in an audio-only context, and compare this with face-to-face interaction. If visual signals have an effect on the communicative process then such a change in context should result in changes in the characteristics of the interactions in the different contexts.

If gestures are important in the information transfer process then one would expect that communicative media where visual signals are not present would result in the modification of behaviour, and perhaps that communicative performance would suffer. Rime (1983) found that gesturing behaviour was not affected by seen versus unseen communicative contexts, and therefore concluded that gestures are not produced to modify utterances, and are therefore not important for the comprehension of the listener.

However Feyereisen and de Lannoy (1991) point out that such a conclusion is based upon the assumption that gesture production is under conscious control. If however gestures are controlled by automatic processes then one would not expect a differential behaviour pattern between different communicative media. They propose that gesture production is likely to result from a combination of automatic and controlled processes.

If indeed non-verbal signals are important to the communicative process then one would expect a change in verbal behaviour in face-to-face and audio-only contexts. Rime (1982) did not find that speakers changed the number of words they required in the unseen context, and the use of adverbs for emphasis was also similar in both contexts. However in contrast to these findings Boyle, Anderson, and Newlands (1994) found a significant increase in both the number of words and number of turns required for pairs of subjects to accomplish a referential communication task in an unseen context compared with a seen context. This thesis reports various other ways in which the verbal and non-verbal behaviour of subjects changes in response to media changes.

Boyle et al (1994) investigated how both the verbal and non-verbal channels interact in the communication process in a referential communication task. They found that having access to the non-verbal channel, in a face-to-face context, resulted in dialogue pairs being more efficient in the information transfer process and the management of the turn-taking mechanism. They found that the incidence of eye gaze increased in areas of communicative difficulty compared with those of less difficulty. From their results it appears that eye gaze may be an important non-verbal signal in referential communication.

Rogers (1978,1979) also found that visual cues facilitated speech comprehension and that this facilitation was increasingly marked when there was a large signal-to-noise ratio in the speech signal (i.e. when conditions were noisy). This suggests that non-verbal signals do carry important information which is used by the listener especially if the quality of the verbal channel if degraded.

Many studies have looked at various dialogue features across such context changes, but have produced inconsistent findings. Argyle, Lalljee, and Cook (1968) found that in audio-only contexts interruptions and pauses were more frequent, whereas Rutter and Stephenson (1977) found the opposite pattern of results. Investigations into the effects of such context changes on task performance have also been inconclusive in their collective results (see Chapanis and Overbey 1974; Short, 1974; Williams, 1977; Chapanis, 1986; and Gale, 1990).

Boyle, Anderson and Newlands (1994) point out that this inconsistency is probably due partly to the often small number of dialogues used in the studies, for example Kendon (1967) looked at only two dialogue pairs. Other problems with comparing studies lie in the differing methodologies and tasks used.

G. Chapter Conclusion

It appears that there is considerable controversy in the literature regarding the relationship between verbal and non-verbal aspects of the communicative process. Controversy also centres around the relative importance of non-verbal compared to verbal signals in mature communication episodes, and the processing and developmental relationships between verbal and non-verbal aspects of communication.

There is also controversy as to the ontogenetic relationship between preverbal, non-verbal behaviour, and the acquisition of language. Some claim that common mechanisms underlie both, and that competence acquired with non-verbal behaviour facilitates language development. Others claim that language and non-verbal behaviour are independently functioning systems. It seems likely that both of these approaches has something to say about the development of communicative competence. It is possible that the development of non-verbal and verbal behaviour is related at least at a meta communicative level. If functions which both verbal and non-verbal signals serve are closely related, and become increasingly related with increased communicative competence, then this claim is supported.

It appears that there is convincing evidence that certain visual signals have significant innate components, for example blind children begin to use social smiles at the same age as sighted children (Freedman, 1964; 1965), at around 2->4 months (Spitz & Wolf, 1946). Blind children can also portray facial expressions as accurately as their sighted counterparts (Thompson,1941). If this is the case then we would expect that such visual signals will require less learning, and less processing capacity. Young children who are still linguistically limited would therefore be expected to encode and decode information more readily in a visual form. It would therefore be expected that there would be greater consequences, in terms of both communicative outcome and process, for younger children, when visual signals are not available. I do not wish to claim that growing linguistic competence results in a diminishing role for visual signals. In contrast I hope to show that language provides more strategy options alongside non-verbal options, and that development results in the integration of both verbal and non-verbal aspects of communication. In others words, the way in which visual signals function will change as communicative competence increases.

Two types of visual signals investigated in this thesis are gaze and gesture. Both of these types of signal have been shown to be multifunctional. The occurrence and functioning of these channels of communication will be investigated in adults and in children.

H. A Forward Look

This thesis investigates both verbal and non-verbal aspects of interactions; how these relate to one another and affect the communicative outcome of dialogues. This is done within four age groups: 4 year olds; 6 year olds; 11 year olds; and adults. Developmental changes in interactional features are included as part of the study.

The structure of the dialogues and the occurrence of various interactional phenomena such as eye gaze and hand gestures, are compared across two communicative contexts. In the face-to-face context the participants can see one another's faces and upper bodies. In the audio-only context no visual information is available. If variables are found to change across the contexts then it is inferred that non-verbal information is relevant to those variables.

Chapter 3: Review of the Referential Research Tradition

The referential research tradition is a body of research in which a huge amount of work has been done on children's communication skills. Many different aspects of the development of communication have been studied, making a review of this work relevant to any investigation of communicative development.

The referential research approach has grown very much out of the work by Piaget, and has been extensively influenced by researchers such as Glucksberg and Krauss and their colleagues, and Flavell and his colleagues. It is based upon a particular experimental methodology and system of quantitative analyses.

A. The Referential Paradigm

The referential communication paradigm developed by Glucksberg, Krauss, and Weisberg (1966) has been used in many studies of children's referential communication skills. The basic paradigm involves one person describing a referent object to another person, in such a way that the second person can pick out the target object from an array of possible referents. The number of correct choices is then taken as the measure of communicative success. The describer may be the child subject or the experimenter, only a few studies have used pairs of child subjects.

The main experiments to be reported in this thesis do not actually use the referential paradigm, however they share certain of its characteristics. For example, I shall describe studies which use a controlled setting to elicit dialogue and use a quantitative methodology. One study reported in Chapter 4 of this thesis uses a variation of the original task designed by Glucksberg et al (1966). In this chapter I will describe the main findings from studies using the referential paradigm.

B. Referential Communication Performance

A general conclusion from work in this area is that referential communication improves with age. I shall now summarize some of the suggested reasons why different levels of performance exist. These range from language limitations (Asher and Wigfield, 1981), to cognitive restrictions (for example Glucksberg, Krauss and Weisberg, 1966, Flavell, Botkin, Fry, Wright and Jarvis,1968, Asher and Park, 1975), interactional deficits (for example Cosgrove and Patterson, 1977, and Ironsmith and Whitehurst, 1978a), and differing task perceptions across individuals (Cosgrove and Patterson, 1978).

1. Language Limitations

Improved communicative performance could be due to the child's acquisition of a more extensive vocabulary and world knowledge with which more effective messages can be constructed and understood. However little work has been done to investigate the relationship between such aspects of a child's cognition and communicative development (Asher and Wigfield,1981).

Templin (1957) concluded, from extensive cross-sectional studies, that an average 6 year old knows and uses around 13,000 words, while an 8 year old has a vocabulary of around 28,000 words. Most referential communication tasks involve discriminating between relatively simple items, and most of the children are at least 5 to 6 years of age. It is therefore unlikely that a lack of known lexical items is a primary cause of the communicative problems found.

2. Cognitive Limitations

There have been several proposed cognitive reasons for variable referential abilities across individuals. These include differing levels of: egocentrism; comprehension monitoring; comparison activities and ambiguity detection; and information processing capacity.

2.1 Egocentrism

Egocentrism has its origins in the work of Piaget (Piaget,1926), and Flavell and his colleagues (Flavell et al 1968). Both Piaget and Flavell propose that a large component of being a good communicator is an ability to decentre or to be able to look at things from a viewpoint other than your own. The improvement of children's referential communication performance with age (Glucksberg, Krauss,and Higgins,1975), was attributed to the acquisition of this skill, or in other words a decrease in childhood egocentrism.

Flavell et al (1968) proposed a model of communication which also places considerable importance on the communicator's ability to take roles, and as a result grasp attributes of another individual. Flavell (1974) suggests there are four component skills in role taking not just one as Piaget suggests. Firstly, the child must be able to appreciate that other people may have different perspectives and different psychological attributes. Secondly, the child must be able to appreciate that the analysis of the other's perspective is important in certain situations. Thirdly, inferential skills are required to allow the child to make inferences about other peoples' perspectives. Finally, the child needs skills to translate these inferences, made about others' perspectives, into appropriate behaviours, in other words he requires meta-knowledge in order to take this knowledge, which he has about taking other people's perspectives, into account. Flavell calls these four components of role taking skill: Existence, Need, Inference, and Application.

So according to Flavell, children's communication failures may be due to problems of inference or application as well as failure in awareness of different perpectives. Flavell's account offers an explanation of some of the empirical findings which go against a simple egocentrism account.

More recent research has suggested that attributing children's communication failures to an inability to decentre may be inadequate. There are many studies which show that even preoperational children (in terms of Piaget's developmental stages) are capable of, and do take their listener's perspective. For example, Shatz and Gelman (1973) showed that 4 year olds adjust their messages depending on whether they are communicating with adults or with other young children. When talking to 2 year olds their MLUs are shorter and their sentences are linguistically simpler compared with their speech to adults.

The following are examples given in the paper with a 4 year old (A.M) talking about a toy to either an adult or a 2 year old.

A.M to adult:... "You're supposed to put one of those persons in, see? Then one goes with the other little girl. And then the little boy. Here's the little boy and he drives. And then they back up. And then the little girl has marbles.....And then the little girl falls out and then goes backwards".

A.M to younger child:..."Watch,Perry. Watch this. He's going back in here. Now he drives up. Look, Perry. Look here, Perry. Those are marbles Perry. Put the men in here. Now I'll do it".

(Shatz and Gelman, 1973)

From these examples it can be seen that AM's speech to the adult consists of utterances which are about twice as long as those he directs to the 2 year old child. A feature of this speech which I have noted is that AM is constantly making sure that the younger child is paying attention to him. On four occasions he tells the child to watch him, while he checks the adults attention only once by appending "see?" to the end of the first utterance. This may reflect AM's awareness that 2 year olds' attention must be kept in check.

Maratos (1973) also found that children gave different kinds of messages to blindfolded listeners than to sighted listeners. Even at the young ages of 1;11->3;0, Gallagher (1981) and Garvey (1977) have shown that children are sensitive to various constraints of certain questioning procedures. It is difficult to imagine how such a mechanism could be in place if children were completely egocentric. This is however a complicated issue in that there may well be degrees of egocentrism. For example, adults can on occasion be egocentric in their communication.

So when children's messages are uninformative this may not simply be due to a lack of an ability to decentre. Further evidence for this comes from a study by Asher and Oden (1976). They had 8-> 10 year olds perform a word pair task to an imaginary listener. The word pairs contained a referent and a similar nonreferent, for example: "dog-puppy"; "mitten-glove". The child had to provide their imaginary listener with a clue as to which word was the referent. After completion of the task each child then acted as the listener and had to select referents on the basis of their own clues. This was done immediately and after a 2 week delay. Similarily adults acted as listeners using the children's clues.

Asher and Oden found that the clues were ineffective for both the children (after the time delay) and the adults. Since the children had problems with their own messages after the time delay, this suggests that the messages were not simply conforming to private meanings. The clues were communicatively poor, not because the speakers were egocentric but because they lacked some other skill or set of skills, such as the ability to produce contrastive messages.

2.2 The Component Skills Approach

The component skills approach focuses on the child's ability to cope with various aspects of communication tasks, and the different demands associated with them. For example, Rosenberg and Cohen (1966) proposed a two-stage model of communication which attempts to specify the processes which will be common to most referential communication tasks. The first of these stages is that of response sampling from a hierarchy of word associations, to the referent which is to be communicated. The second stage involves the comparison of the response to both the referent and the nonreferents. If the association to the referent is stronger than the association to the nonreferent then that response is likely to be used, otherwise a new cycle of sampling-comparison is begun. Problems in referential communication may, in this model, arise from either response sampling deficits or difficulties the child has with comparing referents.

The task-analytic approach is useful in that it forces us to recognize the complexity of the communicative process. By analysing tasks according to their subdemands it offers insight into the cognitive processes required to accomplish them.

Children's abilities to engage in referent versus nonreferent comparisons may explain developmental differences in communicative performance. Asher and Parke (1975) found that there is an increase in such comparison activity with increasing age. Other researchers who have investigated comparison processes in children are, Whitehurst (1976) and Whitehurst and Sonnenschein (1978). They found that although older children (around 9 years of age) are more likely to produce discriminating messages than younger children (around 4 years of age), these messages also tended to contain redundant information not essential for referent identification. Whitehurst (1976) suggests that the older children follow the path of least effort in trying to distinguish referents from nonreferents rather than producing contrastive messages which contain only relevant information.

2.3 A Training Methodology in Studying Referential Communication

The studies discussed above use a methodology which concentrates on developmental changes in performance to make inferences about the developmental changes in the skills required for effective communication. An alternative methodology used in the referential communication field is that of training. Here researchers hypothesize about what communication skills are likely to be missing in children, attempt to train these skills, and see whether there is any improvement in performance as a result of this training. If improvement is evident, then this is taken as evidence that the skill in question is a relevant communication skill not possessed by the pretrained child.

Asher and Wigfield (1981) investigated whether one could teach children to do the comparisons necessary for success on a referential communication task (word pair task), and whether such training resulted in an improved performance. A word pair task involves a subject giving clues as to which of a pair of words is the target word, to a second subject. The training procedure consisted of the children watching a video of a model doing the task. An example of a model's script is as follows, the word pair is child-**baby** (referent in bold);

"Let's see there's child and baby, and baby has a line under it. How about play as a clue? A baby plays. No that's no good, because a child plays too, and the person won't know because a baby has a mother. No, a child has a mother too. Oh, I've got one. 'Rattle'. Because a baby plays with a rattle and a child doesn't. 'Rattle'."

Asher and Wigfield (1981)

The second part of the training was for the child to practise some word pairs with the experimenter, who gave feedback as to the adequacy of the clues offered.

They found that third-grade (8 year old) and fourth-grade (9 year old) children's communication accuracy in a word pair task did improve as a result of receiving training about comparison activity and this effect was still present a month after the training procedure. They also report that, although the trained children did better than the control subjects, the performances were still rather poor. It appears that, even for referential communication tasks which are based very much around comparison of items, comparison activity is only one aspect of competent referential communication. Asher and Wigfield suggest that other possible factors might be children's lack of specific strategies for thinking of clues, and their limited knowledge about some of the lexical items.

Whitehurst and Sonnenschein (1981) distinguish between what they call novel and accustomed elements of skills. The part of a skill which can be constructed from subskills already possessed by the individual is known as the accustomed element and the part which requires the acquisition of new elements is known as the novel element. Skill elements of a task are said to be accustomed if they are exhibited by an individual in other tasks or can be elicited by simple instructions. If skill elements are not evident under such circumstances then they are said to be novel. Whitehurst and Sonnenchein point out that the teaching of tasks which are composed of many novel elements compared with accustomed elements will be difficult compared with the teaching of a task for which the child already possesses many accustomed skills. They propose the developmental sequence to go from novel skill, to accustomed skill to metacommunicative knowledge about the application of these accustomed skills.

They report findings which suggest that comparison skills are accustomed skills in 5 year olds rather than novel. The children performed a task in one of two conditions: first, in the context of a communication task where they were asked to tell their listener which triangle was the referent (a communication task); and second, in the context of a perceptual task where they were asked to say how the triangles differed in terms of how they looked. They found that the children in the perceptual instructions task produced significantly more informative messages and contrastive messages than the children in the communication task. Whitehurst and Sonnenschein conclude that children of this age know how to compare, but do not know that such comparison procedures are relevant to communication tasks.

2.4 Information-Processing Approaches

The component skills approach shares a problem with both the Piaget and Flavell accounts, in that it takes an all-or-none stance on communicative abilities. That is, a subskill is either present or absent, rather like the ability to decentre is present or absent. These approaches still cannot explain why an individual may exhibit a given subskill at time x and not exhibit it at time x+1. Shatz (1983) suggests that a general communication deficit is unlikely to be due to complete lack of a subskill. She suggests that a given skill may sometimes be evident and sometimes not and this will depend on 'meta skills' which organise the deployment of different primary skills according to the processing demands of the task.

Asher and Wigfield (1981) recognise this possibility. They suggest that children's failure to generalize skills exhibited on the tasks they have been trained on, may be due to a lack of metacommunicative ability to analyze task demands. The deployment of skills may also be affected by the processing demands which the task entails and the processing capacity of the communicators. Two information-processing explanations will now be discussed.

Pascual-Leone's (1976) account offers a less all-or-none approach (Pasual-Leone, 1976; Ammon, 1981). According to his functional theory, performance is broken down into subskills, with each subskill requiring a certain amount of processing capacity. Overall processing capacity (M-power) reflects the amount of mental resources an individual possesses, and every task can be assigned an M-value which represents how much processing capacity is required to accomplish it. This account offers two main explanations as to why an individual may sometimes exhibit a subskill and sometimes not. First, it may be that a subskill will be apparent at time x because there is enough processing space available to use it, but not at time x+1. The second is that each subskill is said to have a releasing component, which represents the contextual cues which activate the skill and put it into use. For example, the releasing component for a "question asking" skill for requesting information to disambiguate a partner's previous utterance, will be in a context where a message has more than one plausible interpretation. Other aspects of the releasing component may come from the social context in which the ambiguous message is encountered. For example, the skill may only be activated if doing so does not violate politeness maxims. So this approach offers a possible explanation of interindividual and intraindividual in the exhibition of skills.

According to the model young children have less M-power than mature processors, and therefore will not be able to deal with tasks of a high M-value (Case 1974). M-power increases with maturation and therefore more complex tasks can be accomplished. The releasing components of various skills are learned through experience in different communicative situations. A child may therefore possess a skill but not exhibit it in a given context because he/she does not yet possess the appropriate releasing component for that skill.

Shatz (1977) criticizes the 'limited processing capacity' explanation of development. She suggests that children have the same processing capacity as adults, but that their 'information-handling techniques' are not as well learned. Given the assumption that less well learned procedures will require more processing space, then it follows that children will be able to handle fewer of these procedures at any one time. Shatz accounts for development in terms of partial learning, with communicative competence increasing as more and more procedures becoming well learned, and therefore requiring less of the available processing capacity.

The information-processing approaches such as those proposed by Case (1974), Pascual-Leone (1976), and Shatz (1977) seem very promising cognitive accounts of communicative development. A very important issue which such models address is the difference between *knowing how* (the practical knowledge of a skill) and *knowing about* (the knowledge necessary for application of the skill), Ammon (1981).

In summary, popular hypotheses to explain children's poorer referential communication skills as speakers are: they lack certain cognitive abilities, such as an ability to decentre; they cannot or do not carry out appropriate comparison processes; they do not have sufficient available processing capacity to use such skills; they do not have the necessary meta knowledge to appropriately apply their skills.

3. Listener Skills and Communicative Performance

Early referential studies, for example Glucksberg et al (1966) found evidence that even young children could be effective listeners. Preschool children were found to perform well on a referential communication task when their speaker was an adult confederate who gave adequate messages. However performance deteriorated when the speaker was another preschooler producing spontaneous messages. It was therefore considered that children's communication deficits were primarily due to inadequacies on the part of the young speakers.

In contrast, Patterson and Kister (1981) suggest that there are a number of listener skills which are not developed in preschool children, which develop considerably over the early school years. These are the ability to evaluate message adequacy and the ability to respond appropriately to informative and uninformative messages.

3.1 Verbal Responses to Adequate Messages

Positive verbal feedback is often an important part of the communication process, assuring the speaker that he is understood and is still being attended to (Dittmann, 1972). Most referential communication paradigms do not require their listeners to give verbal feedback to adequate messages, and few investigators in this field have looked at such phenomena. Karabenick and Miller (1977) did investigate the occurrence of confirmations made by 5-, 6-, and 7-year olds during a referential communication task. They found that confirmations were rare and there were no age trends in the sample they used.

In contrast, Lloyd (1992) found age differences in the use of back-channels. He found that 10 year olds and adults used significantly more backchannels compared with 7 year olds in a referential task completed over the telephone. He concludes from this that success in such communication task depends, not only on participants abilities to encode and decode messages, but also on "...having the pragmatic competence to play the role of a supportive interlocutor...".

Dittman (1972) studied verbal confirmations in naturalistic samples of conversation in two age groups; i) 6->12 year olds; ii) 14->35 year olds. The older subjects used more than double the verbal confirmations than did the younger subjects. Perhaps this is a conversational mechanism which develops with age, or perhaps it is a phenomena which is just more likely to occur as the communication becomes more effective. Dittman also found that his younger subjects' listener responses tended to be badly timed in the discourse, resulting in interruptions. He contrasts this with the more precise nature of adult interactions, which he suggests is a result of conversational experience.

It appears that one aspect of conversational structure which may show developmental trends is the use of back-channel responses to ensure the flow of the communicative process. This reflects the development of a general awareness of the importance of being a supportive communicative partner.

3.2 Verbal Responses to Inadequate Messages

Although one may be able to get by without verbal responses to adequate messages, over an extended interaction this would seem rather strange. In contrast performance within an interaction will be severly affected if responses are not made to inadequate messages. There may be serious consequences for the communicative outcome if listeners do not indicate that there is a problem with a message and what that problem is. Studies of adult subjects as listeners have shown that adults both indicate that there is a problem and specify what further information is required, for example Krauss and Weinheimer (1966), Lloyd (1992).

Cosgrove and Patterson (1977) investigated children's abilities to respond to messages of varying adequacy. In the referential communication task they used there were four potential referents. An adult stooge gave child listeners, of different ages, equal numbers of either adequate, partially informative (referring to two potential referents), and uninformative (referring to all four possibilities) messages. The four age groups investigated ranged from preschool to the fourth grade. They found that fourth grader listeners were significantly more likely to request clarification of ambiguous messages than were any of the three younger age groups, who did not differ from one another. This also meant that the oldest children made more correct referent choices than the younger children, although the younger age groups did perform as well when the messages were adequate.

Further evidence for such a developmental trend in appropriate responses to inadequate messages was found by Ironsmith and Whitehurst (1978a). They found that it is by the fourth grade (about 9 years of age) that children begin to respond appropriately to ambiguous messages by requesting more information before selecting a referent.

Similarily Lloyd (1992) found that 7 year old Instruction Givers produced more inadequate messages compared with 10 year old or adult Instructon Givers, and that 7 year old Instruction Followers were less able to ask for clarification in a way which resolved the communicative problems compared with the 10 year old and adult Instruction Followers.

3.2.1 Comprehension Monitoring

Another aspect of listener skills is the ability to monitor one's own comprehension. Markman (1981) points out that a failure to do this is likely to be a phenomenon common to adults, but to be more pervasive in children. She reports several findings which suggest that children often fail to notice when they don't understand. Markman (1977) found that when asked if they understood how to play a game, and if the rules given were not comprehensive, young children (first graders- approximately 6 years of age) reported that they knew how to play the game even though this could not be possible. By third grade (approximately 8 years of age) children were more aware of the incompleteness of the instructions they were given.

In another study Markman (1979) found that elementary school children evaluated essays as comprehensible even when they contained logical inconsistencies. An example of such a passage is the following;

" Fish must have light in order to see. There is absolutely no light at the bottom of the ocean. . . . When it is that dark the fish cannot see anything. They cannot even see colors. Some fish that live at the bottom of the ocean can see the color of their food." (Markman 1979).

Likewise, Garrod and Clark (1993) found evidence that children fail to monitor their communicative success. They used a cooperative maze game to elicit dialogue between pairs of children. In order to accomplish the game the participants had to describe locations in the mazes to their partners. Garrod and Clark found that 7->8 year olds failed to monitor whether their partners had understood their description exchanges. In contrast 9->10 and 11->12 year olds showed that they monitored how successful their descriptions had been.

If such findings are due to a lack of comprehension monitoring then we need to consider the underlying cognitive reasons. Markman (1981) suggests that there are many different definitions of understanding, and that they vary according to both the material to be understood, and our goals for understanding. Given that the criteria for assessing comprehension are vague, it would not be surprising if children find it difficult to apply these criteria. She suggests that there may be some confusion between comprehension and rote memorization but reports that no empirical work has been done on this topic. She also suggests that when reading a text and judging their comprehension of that text, children monitor their understanding of each sentence, but do not consider the higher order structure associated with the text. The child therefore may judge a text to be comprehensible as long as it is composed of sentences which individually make sense, without regard to the meaning of the text as a whole. So children may be poor at monitoring their comprehension because they cannot or do not incorporate information into larger meaningful structures.

3.2.2 Comprehension Monitoring and Ambiguity Detection

Another aspect of comprehension monitoring is the recognition of ambiguity. Markman (1981) points out that in order to recognise ambiguity one must realise first that there is more than one possible interpretation for the message, and that this cannot be resolved simply through contextual cues.

As mentioned previously, children's failure to ask for appropriate clarification in response to ambiguous messages is well documented (for example Cosgrove and Patterson, 1978; Ironsmith and Whitehurst, 1978a). There are several possible explanations of such findings, for example they fail to compare referents with non-referents (Asher and Parke,1975). But in terms of comprehension monitoring the child may fail to request more information because he/she does not recognise the possibility of alternative interpretations and realize that the choice between these alternatives would be arbitrary without the additional information (Markman, 1981). There is evidence that children tend to settle on the first coherent interpretation which they come up with and either ignore, or do not recognise the existence of alternatives, (Dickson,1979).

3.2.3 Comparison Processes and Ambiguity Detection

Being able to recognise ambiguity in a referential task involves evaluating the context of a message against the set of potential referents. So ambiguity detection involves comparison. Several studies, for example, Flavell et al (1968) and Bearison and Levey (1977) have found developmental increments in performance of ambiguity reporting and detection from third-graders to eleventh-graders. Also within a given age group detection of ambiguity may be affected by a number of factors. Patterson, O'Brien, Kister, Carter, and Kotsonis (1980) found that messages were more likely to be judged as inadequate the more ambiguous they were. That is, second and fourth grade children were more likely to judge a message as inadequate when it could refer to four potential referents than when it referred to only two or three. It is therefore not only age which affects ambiguity detection but also the extent of the ambiguity of a message.

Likewise, Whitehurst and Sonnenschein (1981) point out that deficits in listener skills may be due to a lack of mobilization of comparison skills on the part of the listener. Whitehurst and Sonnenschein conclude that such comparison skills in listeners are 'accustomed' (that is they already exist in some form in contrast to being 'novel') given the ease with which modelling of and instruction on the these skills results in improved performance.

3.2.4 Message Evaluation and Communicative Outcome

Another factor which affects message evaluation is the outcome of the communicative episode. Robinson and Robinson (1977a) found that young children (6.5->7.9 years of age), tended to judge ambiguous messages as adequate when they resulted in task success (by chance), but this was not the case when failure occurred. 'Getting it right' may be a more salient cue to message evaluation for young children than the message content itself.

It may be that young children are more influenced by the surface flow of conversation than the quality of the information transfer. This contrasts with the Robinsons' results for 8->9.4 year olds who judged messages independently from the task outcome. They suggest that children must first recognize that communication failure can be caused by inadequate messages before they can then analyze the properties of messages.

Brown and Yule (1983) make the distinction between transactional and interactional communication. The main goal of transactional communication is the accurate transfer of information, while the main goal of interactional communication is the maintenance of social relationships. A dialogue may therefore function on an interactional level as long as the participants follow various conversational rules, such as being attentive and responding to questions. However this is necessary but not sufficient for the accurate transfer of information. We have all experienced 'empty' conversations. For example a listener may keep an interaction going by automatically giving back-channels while not really listening or taking in any information. In order for a dialogue to function transactionally, both participants must collaborate in their efforts to ensure that mutual knowledge is established to a sufficient degree (Clark and Wilkes-Gibbs, 1986). In other words, they must make sure that they understand one another. It may be that children acquire the ability to communicate interactionally before acquiring transactional skills. This is a plausible course of events since interactional skills will afford them experience which will teach them transactional skills.

3.2.5 The Influence of the Task and Task Perception

Patterson and Kister (1981) note that many studies in this field have found different levels of message appraisal in children of the same age. They suggest that one reason for this is that the different studies use potential referent arrays of different sizes and clarity. For example Bearison and Levey (1977) found a lower age for the emergence of such skills using an array of only two possible referents. This contrasts with Markman (1977) who used several nonreferents in her paradigm. It may be that younger children can perform the necessary comparison processes to detect ambiguity when the number and complexity of these processes is minimal, but when complexity increases they do not have the procedures or processing capacity to cope. Information processing approaches would suggest that young children do not have the sufficient processing power, Case (1974), or the information-handling techniques required for the task are not well-learned enough and therefore take up too much processing space (Shatz, 1977).

Whitehurst and Sonnenschein (1978) investigated comparison failure in 5 year olds in a task where the children were pretested on their vocabulary and were found to have an adequate vocabulary for the task. There were three levels of complexity in the task, from the simplest in which the referents varied only on the relevant dimension across trials, to the most complex which varied across trials on both relevant and irrelevant dimensions. They found that the 5 year olds produced informative messages, resulting from a comparison between referent and nonreferent in the simplest condition. In contrast when any variation in dimensions between trials occurred no comparison behaviour was evident. It appears that when faced with complex stimulus arrays young children cannot, or at least do not compare referent and nonreferent before attempting to communicate the referent. The above results therefore provide support for the information processing approaches.

The same types of issues are likely to be important for the evaluation of the adequacy of any message, not just the contrastivity of messages referring to sets of potential referents. In any communicative situation interlocutors must evaluate whether they have understood messages to a sufficient degree for their purposes. Their ability to do so will be affected by the complexity of the situation.

3.2.6 Failure to Recognise Ambiguity or to Respond?

Findings that younger children do not respond to ambiguous messages may reflect their inability to detect ambiguity as discussed previously. Alternatively they may recognize it but not be able to deal with it and ask a resolving question. Evidence for this is given by Cosgrove and Patterson (1977). They investigated 10, 8, and 6 year olds, and found that giving instructions to the two older age groups, as to the importance of requesting more information if a message is inadequate, resulted in the listeners asking more questions and therefore selecting more correct referents. This was not the case for the 6 year olds.

They concluded that the problem prior to training had not been one of task perception, i.e the children thinking that they were not allowed, or supposed, to ask questions. Instead they suggest that this communicative situation simply did not elicit question asking in these children until the question asking plan was made explicit. In the terminology of Whitehurst and Sonnenschein (1981) such question asking skills appear to be accustomed rather than novel, but are not yet functioning at a metacommunicative level for children from about age 8 onwards. For younger children this appears to be a skill which is still novel.

Further evidence that the children's initial response deficits were 'action deficits' rather than 'comparison deficits' comes from a study done by Patterson, Massad, and Cosgrove (1978). They found that giving instructions to elementary school children regarding the importance of making comparisons between the information in the message and the potential referents had no effect in increasing requests for information or performance. However, instructions, regarding requesting information if a messages was inadequate, resulted in the children asking more questions and improving their performance on the referential task. Such effects were still evident on a delayed test two weeks later.

It is often difficult to determine why children fail to ask questions, for example, does a child fail to ask a question because he/she does not know how to ask the appropriate question? Or he/she doesn't see the opportunity to ask the question? In other words, does he/she lack the conversational skill to ask a question or the meta communicative knowledge regarding the use of questions. Alternatively, he/she may fail to notice the need to ask a question due to a failure to monitor the conversation. Finally the child may not possess sufficient processing power to cope with question asking in the given communicative situation (or the necessary information-handling techniques are not sufficiently well-learned, Shatz, 1977).

Like Patterson et al (1978), Cosgrove and Patterson (1978) found evidence to suggest that children's failure to ask questions in response to ambiguity is more a matter of missed opportunity, rather than a lack of comprehension monitoring or comparison processes. They found that training first grade children, either by modelling question asking or by making question asking an explicit strategy to use in a referential task, increased its incidence, (the children in the modelling condition viewed a video tape of an adult confederate doing the referential task, the adult noted aloud when she did not have enough information and asked questions to obtain the necessary information). Their results suggest that questions were not asked prior to training because they were not considered an appropriate communicative strategy. Interestingly such increased question asking did not improve the children's communicative efficiency immediately, but it did so 2 or 3 days later. It appears that given time to consolidate and 'practice' their new found strategy they became competent users.

4. Speaker Responses to Listener Feedback

A related issue is whether speakers respond appropriately to such requests for additional information and offer more informative messages. For communication to be effective it is essential that both the listener and the speaker respond appropriately to areas of communicative difficulty in the discourse.

To investigate this Glucksberg and Krauss (1967) provided kindergarten, first, second, third, and fifth-grade children and adult speakers with general feedback, from an adult confederate listener, indicating that the listener could not identify the referent. All groups of speakers offered verbal responses to such listener feedback, therefore even the youngest children were sensitive to their 'responsibility' to give a response to such feedback. However the youngest children were more likely just to repeat their original message rather than offer new information, whereas the older children and adults were more likely to offer new information.

Peterson, Danner, and Flavell (1972) had 4- and 7-year olds perform as speakers in a referential task. Adult confederate listeners provided one of three types of feedback, indicating that the message received was ambiguous, on certain trials. One type of feedback was facial expression, but this was ineffective in eliciting reformulations from any of the speakers. The second type of feedback was implicit verbal feedback, for example "I don't understand". Most of the older children offered clarification of their messages when they received such feedback, but it had no such effect on most of the 4 year olds. When the feedback was explicit verbal, for example "what else does it look like", then clarification attempts were evident in all the children. The results suggest that the younger children did not recognize the implicit feedback as requests for more information. It also appears that the kind of visual information which Peterson et al provided was in fact not salient to children as young as this in this particular situation. This runs counter to the view that non-verbal communication is somehow more 'basic' and is mastered before verbal communication (see chapter 2 for a discussion of this issue). In this thesis evidence is presented which suggests that adults use the visual channel for this feedback function, while children do not.

Likewise, Copple, Coon, and Lipscomb (1977) found that even kindergarten speakers clarified their original messages after seeing that their listener had chosen incorrectly, and without this visual feedback only very specific verbal feedback induced effective clarifications.

In summary, it appears that older children are more likely to respond effectively to listener feedback than younger children (Glucksberg, and

Krauss, 1967; Peterson et al, 1972). Also specific feedback is more effective that general feedback (Cosgrove and Patterson, 1979; Peterson et al, 1972). Speakers as young as 5 years attempt to respond when their listener requests more information, even though their responses tend to be ineffective (Cosgrove and Patterson, 1979; Glucksberg and Krauss, 1967). When the listener feedback is specfic enough even 4 year olds produce clarifying messages (Peterson et al, 1972). This may again reflect children's ability to function interactionally, rather than transactionally, if a question is made specific enough, the response will seem appropriate simply because the child responds, not because he/she has fully evaluated and understood the situation.

Outwith the referential paradigm studies, in a more sociolinguistic tradition, Gallagher (1977) found children responding to their listeners' feedback at an even earlier age. Spontaneous conversation samples between the experimenter and child in the child's home were investigated. Intermittently the experimenter pretended not to understand the child by saying "What?". Gallagher found that by stage 1 of language development (Brown, 1973) children recoded their utterances most of the time in response to such feedback. This suggests that the lack of responsiveness of children to listeners' requests for additional information, in referential tasks, may be due in part to the artificial communicative situation. It may be that referential tasks do not provide the necessary releasing cues (Pascual-Leone, 1976) for such communication skills in young children, or that they impose higher processing demands, therefore allowing less effective use of the communication skills which children possess. Likewise, McTear (1985) found in his naturalistic conversations between two 4 year old children that when communicative problems arose, the addressee would usually initiate a repair sequence, to which the speaker could usually reply appropriately and specify the referent more accurately.

Wilcox and Webster (1980) also investigated the effects which different types of feedback had on children. The age of the speakers ranged from 17 to 24 months and they were all in stage 1 of language development (Brown, 1973), with at least one productive syntactic coding rule for two word utterances. These children were classified into 4 subject groups; 1) low vocabulary, low syntax, 2) low vocabulary, high syntax, 3) high vocabulary, low syntax, and 4) high vocabulary, high syntax. As in the Gallagher study above, the data was collected during a play session between the experimenter and child in the child's home. At certain points in the session the experimenter 'produced' communication failures by responding to the child's request either by saying "What?", or by deliberately misinterpreting the intent behind the child's utterance.

The ‘misunderstanding’ feedback was more likely to be abandoned than the question feedback. For the elicitation of repetitions the question condition was the most effective. Wilcox and Webster conclude, that since the children rarely abandoned the questioning feedback, they are already aware of the acceptable speaker responses to such elicitation. They are aware that some repetition or recoding is required, therefore they are functioning interactively. The children appear to accept that it is acceptable to abandon one's own attempt at communication if your listener misunderstands you, since the listener does not show signs of being aware that communication failure has occurred, hence the higher incidence of abandoned communication attempts in the 'misunderstanding' condition. This suggests that the children are more likely to communicate interactionally than transactionally.

The ways in which the children recoded their utterances was also investigated. It was found that vocabulary size and syntactic ability did not significantly influence whether the children recoded or abandoned their communicative attempts. Wilcox and Webster conclude that these structural aspects of language develop independently from rules governing socially appropriate communication.

It appears that even at the young age investigated, children are capable of responding differentially to listener feedback, and that they are aware, and use, social conventions for speaker behaviour in their conversational interactions. However it must be noted that these were all interactions the child had with an adult, their response patterns may prove very different when interacting with another child.

The success of a referential communicative interaction is therefore not determined solely by the ability of the speaker to produce an effective contrastive message, as the early referential literature suggested (for example Glucksberg et al, 1966). Success depends upon the interlocutors establishing mutual knowledge about a referent, and to do this it will often be necessary for the listener to inform the speaker about information he/she lacks. If such a request is then responded to appropriately by the speaker mutual knowledge can be established. It is the interplay between both parties which is important for communicative success. In this vein, Clark and Wilkes-Gibbs (1986) propose that it is this collaboration between interlocutors which determines the success of communication.

C. Children's Understanding of Communication Failure

The Robinsons have investigated how children understand communication failure, (for example, Robinson, 1981; Robinson and Robinson, 1976a; 1976b). The procedure they use is a referential communication task which, when resulting in communication failure due to message inadequacy, is followed by a "whose fault" sequence of questions.

The Robinsons found age trends in blame assignment with 5 year olds being mainly listener blamers even when the messages were rigged to be inadequate. By 7 years of age children are beginning to blame speakers, and 11 year olds always blame the speaker when appropriate (Robinson and Robinson, 1976a, 1976b). They suggest that the listener blamers do not compare the informational content of the messages with the choice of referents, and that the need for contrastivity in messages is not appreciated.

Robinson (1981) reports a series of experiments which try and relate children's blame assignment tendencies and their responsiveness to their listeners' misunderstanding. It was found that speaker blamers gave significantly more helpful information following their listener's request for help than listener blamers. Even though listener blamers responded to such requests by saying more, they did not offer information which reduced the ambiguity in their original message. This situation was shown to be rectifiable by giving the listener blamers more information about what kind of help was needed, that is by pointing out the inadequacies in the original message. For example, telling the child that four potential referents fitted his/her message resulted in an effective elaboration. It appears that listener blamers do not analyse the informational content of messages appropriately, and therefore do not recognise the inadequacies of messages, however when the appropriate information is made salient then their message evaluation improves.

D. Chapter Conclusions

The communicative process differs for children compared with adults in several ways. For example, young speakers do not produce messages which are sufficiently contrastive, while young listeners often do not attempt to resolve such ambiguitites. When requests for additional information are made they are often unsuccessful. The most successful requests tend to be very specific, and this perhaps reflects the young speakers' greater interactional rather than transactional skills.

There are many different explanations as to why children's communication is like this. These range from cognitive deficits such as egocentrism and a lack of processing capacity, to a lack of knowledge about using comparison processes and question asking.

From the literature it appears that in a situation where task demands are not too great, and if they have the relevant meta knowledge, even very young children are capable of functioning at an interactive level. For example they will ask and respond to questions. The effectiveness of such questions and answers will depend upon the children's cognitive abilities in information handling. McTear (1985) points out that while children have strategies to accomplish certain functions, they are often not capable of finely tuning their interactions.

Naturalistic data, such as Dore's (1977a), illustrates clearly how well structured, even very young children's, conversations can be. McTear (1985) gives an example of an interaction of an adult with a child of only 2;6, who shows an ability and intention to ground information. This involves clarifying and offering further information, which in turn requires the child to infer what the adult's knowledge about a subject is. The following extract contains this example.

Child: [daimn] [daimn]

Adult: What's a [daimn]

Exchange repeated several times

* **Child:** [^pa 'tps] bus in house

Adult: Oh Stephen

Child: [daimn]

McTear (1985)

In this example the child is trying to refer to her friend Stephen (daimn). When her mother fails to understand her utterance she offers clarifying information in the utterance marked with *. Here the child refers to 'up steps' and 'bus in house'. This information is sufficient to make her mother understand since to go into Stephen's house you go up steps, and he has a toy bus in his house.

1. A Meta-Description of the Referential Literature

Dickson (1981) reports the results from a meta-analysis of the referential literature which describe some typical characteristics of referential studies. He points out that most of the studies have used white, English-speaking, middle-class children of about 5 or 6 years of age. Also in most of the studies the children communicated with the experimenter, not with other children. Where child-child pairs were used the children were often not allowed to see one another, talk interactively or ask questions. The referential tasks used usually involved only about nine trials, and used a set of about four pictures (typically abstract line drawings) to be described or chosen. There is therefore a gap in the literature relating to spontaneous, truely interactive communication between same age interlocutors, and the comparison as to how different aged communicators cope with different communicative media.

Dickson also points out that the ecological validity of referential research may have decreased due to the decline in subject-to-subject designs in favour of more tester-to-subject and subject-to-tester designs, which although may allow more control over certain variables, decrease how spontaneous and natural the interaction can be.

Two types of experimental design result in data about individual listeners and speakers, rather than dyadic performance. The first of these, used frequently in the referential literature is to hold the messages constant, either having a confederate speaker (to study listener skills), or a confederate listener (to study speaker skills). However this method clearly interferes with the natural interaction process which may be crucial for effective communication (see for example Clark and Wilkes-Gibbs, 1986). Although many useful and important findings have resulted for using this methodology, some described in the previous sections, these should only be interpreted alongside interactional analyses.

The second way of studying individuals' skills is by repeatedly pairing subjects with different partners, both as speakers and as listeners. This design allows for more natural interaction but is difficult to employ in research. Dickson, Miyake, and Muto (1979) used this methodology with a block assembly task, to investigate whether individual's listening and speaking scores correlated. They found that this was the case.

Another way of investigating individual speaking and listening skills is to look at natural interaction, but rather than just investigate the performance which that interaction yielded, also measure various interactional features which each individual brings to the process. For example, what proportion of the interaction is contributed by each individual, what are the nature of these contributions, and can these features of the interaction be used to predict the level of performance which results. This is the type of data which this thesis deals with. Natural, spontaneous communication is investigated between subject pairs, and several interactional features are studied.

Part 2: Global Performance and Process Measures

Chapter 4: Communication Performance and Process in Different Age Groups and in Different Communicative Contexts

A. Introduction

1. Aims and Objectives

The aim of this thesis is to investigate the development of interactional communication skills and the development of the relationship between verbal and non-verbal communication. As described in previous chapters, there are many different ways to investigate and measure both the verbal and non-verbal channels. The verbal channel of the dialogues investigated is analysed using Conversational Games analysis (this is introduced in Chapter 5). The transfer of information in hand gestures is also investigated, as are gaze patterns in the interactions.

The relationship between the verbal and non-verbal channels was investigated in two ways. First I investigate the effect of removing access to visual information on dialogue structure and the occurrence of non-verbal signals. Second, in Chapters 6 and 7, the co-ocurrence of eye gaze and certain dialogue functions is investigated in order to illuminate which communicative functions are carried by non-verbal signals in face-to-face interaction.

The previous chapters show that there is much controversy in the literature regarding the relationship between verbal and non-verbal communication and what bearing this relationship has on the development of communication abilities. I wish to look at how children and adults cope with face-to-face and audio-only interaction. By doing this I hope to show the importance of the non-verbal channel for different age groups.

The interactions were elicited using the Map Task. This task provides content-controlled, extended dialogues where the goals and subgoals of the participants can be inferred from progression in the task. This is an important feature for present purposes since the conversations produced are subject to Conversational Games analysis (Kowtko et al, 1991). This involves assigning utterances speech act like functions. McTear (1985) points out that utterances within naturalistic conversations are often very difficult to code for illocutionary force (speaker's intended function). The task also yields an objective measure of communicative performance which will be discussed shortly.

The purpose of this chapter is to report some preliminary data which will set the scene for the more detailed analyses which follow in the remaining two empirical chapters. First, the performance scores from the different age groups in the different communicative contexts are reported. This shows whether communicative performance is affected by removing visual information. Second linguistic performance is measured in terms of how much verbal material is produced per interaction in each age group and in each context. Previous research has shown that when visual information is not available adults require significantly more verbal material to attain the level of performance which they reach in a face-to-face context (Boyle et al 1994). Third, a preliminary analysis of the occurrence of eye gaze is reported to see how much the participants actually look at one another. Fourth, the use of communicative gestures by children and adults performing the Map Task is investigated. Finally, a second study, involving a different group of children and a different communication task, is reported in order to illustrate the replicability of these findings, which are foundational to the thesis. In the first study the Map Task is used since this allows comparison of results with other previous research, (e.g. Boyle et al, 1994).

The subjects in Study 2 are younger children, and pilot work revealed that the Map Task was not suitable for children under five, with many pairs failing to understand the task even with extensive training. A different task was therefore used in Study 2. This task is based on the Glucksberg et al (1966) task.

2. Previous Research using the Map Task

The Map Task is now a well established tool for investigating communication skills. It was originally devised by Brown, Anderson, Yule, and Shillcock (1983). Brown, Anderson, Shadbolt and Lynch (1987) used the task as one in a battery of tests to investigate and train listener skills in adolescents. They found that this was a motivating task for many of their young subjects, and yet their communicative performance was rather poor. This was accounted for partly by the young listeners failing to challenge inadequate instructions from their speakers, as well as speakers failing to respond appropriately to clarification requests on the few occasions when they did occur. They found that practise on this type of task and experience of being both an Instruction Giver and an Instruction Follower were beneficial to both listener and speaker behaviour.

Anderson, Clark and Mullin (1991) used the Map Task to study the development of interactional skills in children between the ages of 7 years to 14 years. They found that 7 year olds performed significantly more poorly (measured by their deviation scores) than the 9 year olds and 14 year olds, who did not differ. This would be predicted from the findings in the earlier referential literature. However it was found that only the subjects performing within the top 25% of each age group showed this age effect. In other words, the best 14 year olds were significantly better than the best 7 year olds, while the worst 14 year olds were no better than the worst 7 year olds.

Among the dialogue measures examined by Anderson, Clark and Mullin were the ways in which features in the map were introduced. They found that forms of introductions of features which questioned both the existence and locations of a partner's feature increased with age. However even the oldest children used this form of introduction very rarely. Similarly, the proportions of introductions of this kind were also found to increase with age, with 7 year olds using significantly fewer than the two older groups, and in general the best performers used more introductions by question than the poorer performers. This type of negotiation which establishes mutual knowledge explicitly, therefore appears to reflect communicative competence. Another predictor of successful communication was active participation of the Instruction Follower, measured in terms of how many features were introduced during the course of the interaction.

In general questioning correlated with performance, the best pairs producing more questions, (there was no effect of age). However, the proportion of questions answered did not predict communicative success, even though the younger Instruction Followers' questions were ignored by their partners more than the Instruction Followers in either of the two age groups.

It appears that there is a general development of interactive skills with age, but there is also a very important effect of communicative skill. The differences between good and poor communicators are greater than the differences found between older and younger communicators (Anderson et al, 1991), at least between the ages of 7 an 14 years, and within an audio-only context.

This chapter reports a study of communication abilities in three groups of children and a group of adults, using the Map Task. Performance data from both a face-to-face and an audio-only condition are examined to see how the different age groups cope with these different circumstances.

B. Study 1: Face-to-Face and Audio-only Communication for 6-, 11-year olds, and Adults

1. Subjects

Twenty 6 years olds (age range 5;8-6;7, mean = 6 years), and twenty-four 11 year olds (range 10;3-11;2, mean = 11 years), from Glasgow Primary schools, served as subjects. Parental consent was obtained and the children were brought to a recording studio in Glasgow University for testing.

2. Design

A mixed design was used, with Visibility Context a within-subjects factor (each pair of subjects completed the task in both the face-to-face and the audio-only condition), and Age, a between-subjects factor. Half the pairs did the face-to-face conditions first, half the audio-only.

Both groups of children came from areas with similar social economic backgrounds and there was no reason to believe that either age group had more or less experience of using the telephone (which might influence performance in the audio-only context).

3. Task

The task used was the Map Task (Brown, Anderson, Shillcock, & Yule, 1984). This task elicits natural, spontaneous and yet content-controlled dialogues.

Two pairs of maps were used each consisting of an Instruction Giver and an Instruction Follower map. The map landmarks were portrayed as line drawings and the maps themselves were reproduced on A3 sized paper (297mm by 420 mm), see Figure 4.1 for examples of maps. The maps were identical to the maps used by Boyle et al (1994) in terms of complexity. The only difference was that the present maps had features which were labelled with lexical items which young children would find easier to read. For example a feature labelled on the children's maps as "hut" was called "thatched mud hut" on the adult maps.

Each map in a pair shows a start point, but only the Instruction Giver's map has the route and the finish point marked. There are a number of features in common on both maps but also a number of features which differ, for example, because they are present on only one participant's map, or because they are in differing locations.

Subjects are told that the aim of the task is for the Instruction Giver to tell the Instruction Follower about the route so that he or she can reproduce it on his or her map as accurately as possible. They are informed that there may be differences between the maps. Instructions to subjects were as follows:

"You both have a map of the same place in front of you, so your maps are very similar. However they were drawn by different explorers so they might be a bit different. So some things you have (directed to IG) on your map your partner won't have. And some things you have (directed to IF) your partner won't have. Okay? So they might be a bit different but they're basically the same. Now you (IG) have a path drawn on your map, and this is the only safe way through this place. Your partner doesn't have a path on his/her map, and your job is to tell him/her where it is so that he/she can draw it onto his/her map. So you (IF) have to listen to what your partner says so that you can draw the route onto your map as well as you can. Do you both understand?. . . ."

Further reiterations of instructions and clarification were given if required by the subjects, until the experimenter felt sure the subjects understood what they were to do.

A useful feature of the Map Task is that it provides an objective, quantifiable measure of communicative success. The Instruction Giver's Maps are copied onto A3 (cm^2 grided) acetates. These are over-laid on each of the corresponding Instruction Follower's Maps. The area (in cm^2) between the original 'correct' Instruction Giver route and the route which is drawn by the Instruction Follower is calculated by counting the number of cm^2 grids which lie between the 2 routes. A map deviation score is thus produced for each dialogue. The larger the deviation score for a map the poorer the performance of that dialogue pair.

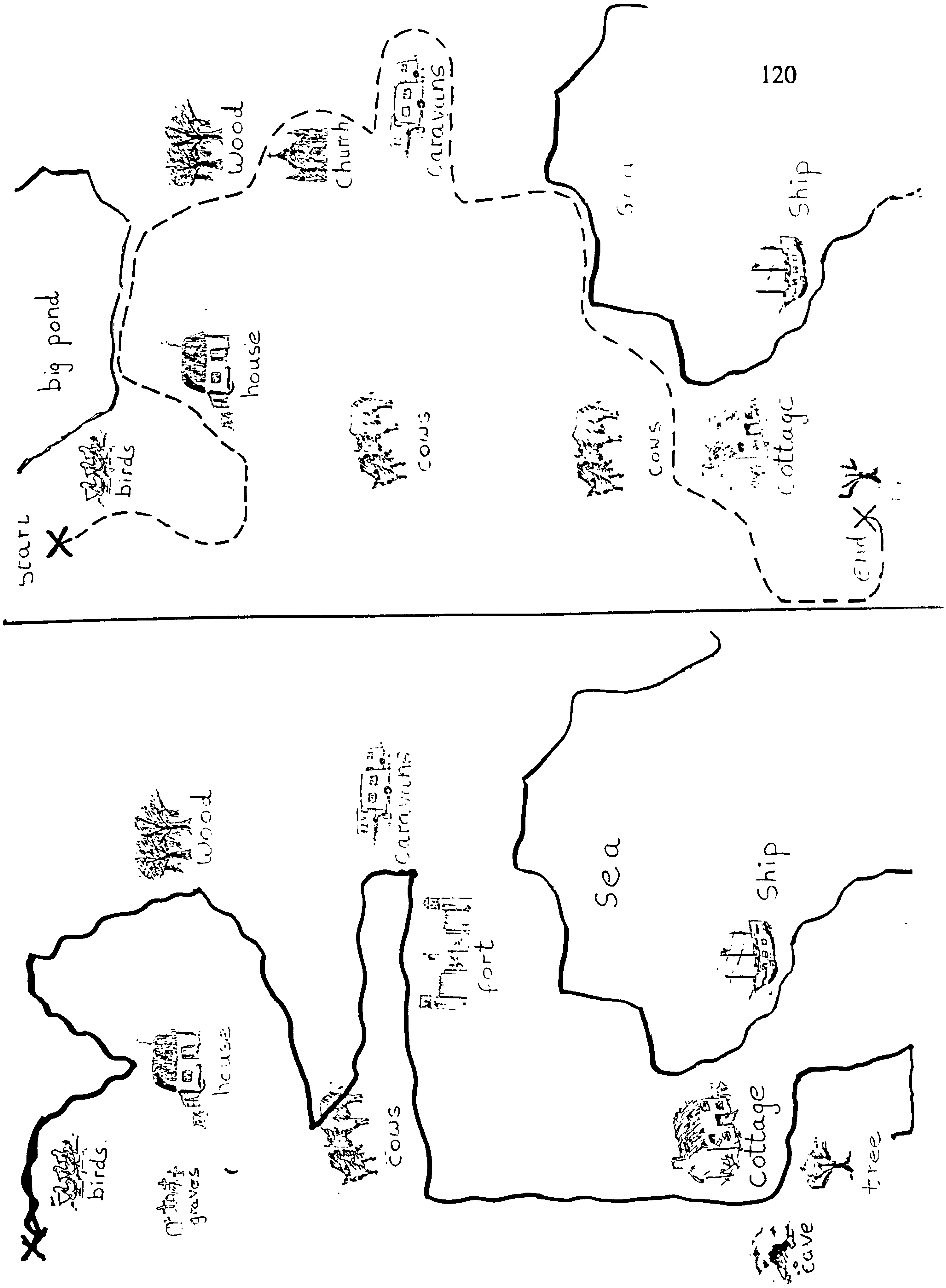


Figure 4.1: Examples of Maps used with the child pairs [1].

[1] The maps used with the adult pairs were identical in format and complexity. The map on the left is a completed Instruction Follower map. The map on the right is the corresponding Instruction Giver's map. The full set of adult maps used is given in Appendix 2.

4. Procedure

While doing the task subjects sat facing one another about 3 feet apart with their maps resting on a 2-way easel between them. One subject was assigned the role of Instruction Giver, the other the role of Instruction Follower. In the face-to-face condition the subjects could see one another's faces and upper bodies. In the audio-only condition a cardboard screen was erected between them adjusted to just block their views of one another's face.

All of the dialogues were recorded on a DAT (Sony DTC1000ES) using Shure SNIOA microphones. The interactions were also video-recorded using 2 cameras (1 for each subject, JVC 880E). Inputs from these cameras were mixed using a vision mixer (JVC KM2500) and recorded on a VHS video recorder (JVC BR-S810E).

5. Video Analysis.

Gaze and communicative gestures were coded from the video recordings of the interactions. The angle of the easel meant that it was impossible for the children to see each other's hands unless they raised them in a deliberate attempt. When hands were raised in order to 'show' a gesture to a partner this was coded as a communicative gesture. These gestures fit into the categories of 'illustrators' and 'pictograms' as defined by Ekman and Friesen (1969b), and 'iconics' as defined by McNeill (1985). 'Batons' (Ekman and Friesen, 1969b) were not found to occur above the level of the easel. For present purposes the definition of a gesture as communicative was based only on the fact that it occurred when made deliberately visible to the interlocutor, and no categorisation decisions were made based on the form of the gesture. Two coders independently coded a dialogue for gesture and agreed on 95% of incidences that a gesture had occurred and whether it was deliberately communicative.

6. Results

6.1 Task Performance.

A square route transformation was carried out on the deviation scores. A 2-way ANOVA was used with 1 within-subjects factors, Age (2 levels: 6 year olds and 11 year olds), and 1 between-subjects factor, Visual Context (2 levels: face-to-face and audio-only).

The deviation scores ranged between 35 cm^2 and 558 cm^2 with a mean of 255 cm^2. A significant effect of Age was found, $F(1,20) = 7.46$, $p<.05$. The mean deviation score for the 6 year old subjects was 297cm^2, and for the 11 year olds it was 213cm^2, therefore the 6 year old Instruction Follower routes deviated from the Instruction Giver routes around 39% more than the 11 year olds. Of the 6 year olds, 15% were as good or better than the 11 year olds average, and 17% if the 11 year olds are as bad or worse than the 6 year old average. This corresponds with the Anderson et al (1991) findings that in an audio-only context older children do better than younger children on the Map Task, but that there is a proportion of subjects at the lower end of the range whose performance does not improve with age.

Table 4.1 Map Task Deviation Scores for Children: Face-to-Face and Audio-Only Performance

Age	Face-to-Face	Audio-Only
6 Years	$252cm^2$	$360cm^2$
11 Years	$243cm^2$	$203cm^2$

A significant interaction between Age and Visual Context was found, $F(1,20) = 6.57$, $p<.05$ (the means are illustrated in Table 4.1). Simple effects analyses showed that there was no difference in performance between the age groups when interacting face-to-face, however the 6 year olds did much worse when they were communicating in the audio-only context than the 11 year olds, $F(1,40) = 14.02$, $p<.01$. Finally, the 6 year olds' performance was significantly worse in the audio-only context compared to their own face-to-face performance, $F(1,20) = 5.37$, $p<.05$. The present results therefore extend the work reported by Anderson et al (1991) and show that age differences are significantly reduced when visual signals are available to children.

In summary, 6 year olds can communicate as effectively as 11 year olds when interacting face-to-face, however they cannot adjust to the audio-only context in the way that 11 year olds do, and their task performance suffers. Boyle et al (1994) report that the mean score for adult subjects on this task was 61 cm^2, and that there was no change in task performance between face-to-face and audio-only communication. Adults therefore perform this task better than either group of children and like the 11 year olds can adapt to audio-only interaction.

6.2 Gesture.

6.2.1 Subjects. One pair of 11 year olds could not be gesture coded due to loss of video data. The data for ten pairs of 6 year olds and 11 pairs of 11 year olds is therefore reported.

A 2-way ANOVA was carried out with Age a between-subjects factor (2 levels: 6 years and 11 years), and Visibility Context a within-subjects factor (2 levels: face-to-face or audio-only). The dependent variable was the frequency per 100 words with which speakers used communicative gestures.

Visibility Context had a significant effect on the frequency with which communicative gestures were used, $F(1,19) = 4.52$, $p<.05$ (mean face-to-face = 2.57, mean audio-only = 1.43). Simple effects analyses showed that this was only significant for the 11 year old subjects, $F(1,19) = 6.61$, $p<.05$ (mean face-to-face = 2.31, mean audio-only = .4). The frequency of gestures did not change between contexts for the 6 year olds, (mean face-to-face = 2.84, mean audio-only = 2.46).

As a comparison, 16 dialogues from the corpus which Boyle et al (1994) analysed (Anderson et al, 1991) were coded for communicative gesture. Half of these were face-to-face conversations and half were audio-only. In face-to-face interaction adults used only 0.25 communicative gestures per 100 words, and they never used such gestures in audio-only conversations. The amount of communicative gestures used by the adults was therefore negligible.

6.3 Verbal Contributions: Number of words, Turns and Words per Turn.

Words per Dialogue. The number of words spoken by each participant was taken as a measure of the amount of verbal effort made. Boyle et al, 1994 showed that adults doing the Map Task produce 20% more words when they can't see one another compared with face-to-face interaction (face-to-face mean = 1049 words, audio-only mean = 1261). Repeated words are included in these word counts. Incidents of non-task related talk were extremely rare and were not included in the word counts. The only significant incident of non-task talk occurred between a pair of 6 year olds. This was a philosophical discussion of why they were having difficulty with the task. They concluded that God made things easier and the Devil made things difficult. This lead to a brief discussion of how to kill the devil: with something cold because the Devil is hot and God is cold.

Boyle et al conclude that communication is more efficient when visual cues are available. Furthermore they report that Instruction Givers play a significantly more dominant verbal role in the task than Instruction Followers. These phenomena are investigated to see whether this would also be the case for the 2 groups of children. If the 6 year old Instruction Givers are transmitting information visually, which is not verbalised, then it would be expected that they would produce relatively smaller verbal contributions. Also since the 11 year olds manage to maintain their performance when they can't see one another, it is predicted that they, like the adults, will increase the amount of verbal material in this context.

A 3-way ANOVA was carried out with 2 between subjects factors: Age (2 levels; 6 year olds and 11 year olds), and Task Role (2 levels; Instruction Giver and Instruction Follower). Visibility context was a within-subjects factor, (2 levels; face-to-face and audio-only). The dependent variable was the total number of words spoken by each participant in each dialogue.

No significant main effects or interactions were found although there was a trend towards an increase in the number of words in the audio-only context (face-to-face mean = 508 words; audio-only mean = 572 words), a 13% rise. The interaction between Age and Task role was investigated using simple effect analyses. It was found that while 6 year old Instruction Givers and Followers contributed equally to the dialogues (271 and 220 words respectively), 11 year old Instruction Givers contributed more than twice as much as their Instruction Followers, $F(1,40) = 3.88$, $p = .056$ (403 and 186 respectively).

Turns per Dialogue. All utterances in the dialogues were defined as turns, even if very short. A change in speaker turn was defined as a change in speaker. A 2-way ANOVA was carried out on the number of turns produced in each dialogue. Age was a between-subjects factor (2 levels; 6 years or 11 years), and Visibility Context was a within-subjects factor (2 levels; face-to-face and audio-only). No significant effects were found although there was a trend in both age groups for an increase in the number of turns spoken in the audio-only context (a 22% increase for the 6 year old pairs, and a 12% increase for the 11 year old pairs).

Words Per Turn. A 3-way ANOVA was carried out on the mean number of words per turn for each participant in each dialogue. Age and Task Role were between subjects factors (Age 2 levels: 6 years or 11 years; Task Role 2 levels: Instruction Giver or Instruction Follower). Visibility Context was a within-subjects factor (2 levels: face-to-face and audio-only). The means are presented in Table 4.2.

Table 4.2 Words Per Turn for each Participant by Age Group and Visibility Context.

		Instruction Giver	Instruction Follower
6 Years	Face-to-Face	7.5	5.3
	Audio-Only	8.0	5.4
11 Years	Face-to-Face	10.8	4.1
	Audio-Only	10.2	3.6

Visibility Context did not affect the mean length of turns for either age group. The was a significant effect of Task Role, $F(1,34) = 18.85$, $p<.001$, with Instruction Givers using longer turns (9.1 words per turn) than Instruction Followers (4.6 words per turn). Finally there was a significant interaction between Age and Task Role, $F(1,34) = 4.2$, $p<.05$. Simple effects analyses revealed that the above Task Role effect only held for the 11 year old pairs. Boyle et al (1994) report that adult Instruction Givers turns were on average 10.17 words in length, and adult Instruction Followers were 4.12 words. The 11 year olds are therefore similar to the adults in their turn construction while the 6 year olds are not.

7. Conclusions

Adults say more than the children, and their verbal messages are therefore likely to be more elaborate and numerous. Adults attempt to transfer verbal information more than either group of children. The following examples illustrate the more extensive verbal contributions offered by the adults. The first comes from a face-to-face dialogue between a pair of 6 year olds, the second is from a face-to-face adult pair.

1.

Instruction Giver: Right do you know where to start Jasper?

Instruction Follower: No yeah /

Instruction Giver: Well that cross. From that cross /

Instruction Follower: yes

Instruction Giver: go round do round a wee bit

Instruction Follower: Round?

Instruction Giver: Yeah go two lines

2.

Instruction Giver: Right, ehm, you've got to take the line down from the start to just vertically to just to the left of burnt forest.

Instruction Follower: To the left of burnt forest?

Instruction Giver: Mhm

Instruction Follower: So its not far down?

Instruction Giver: No its a tiny way. Okay and while you're doing that go in to your right a bit, but it doesn't really matter.

From these examples it is seen that the adult Instruction Giver offers far more detailed instructions that the 6 year old Instruction Giver. Similarly queries which the Instruction Follower asks are more detailed in the adult dialogue than in the 6 year olds' dialogue. It is therefore not surprising that the adult performances are so much better. The apparent lack of linguistic input by the children is not due to an inability to speak. An average 6 year old has a vocabulary of around 13000 words (Templin, 1957), but it appears that they find it difficult to use the language skills they already possess to communicate appropriately in the present situation. One purpose of this thesis is to investigate the types of communicative function and conversational structures which are found in the speech contributions of these three groups of subjects performing this communication task.

Second the significant increase in amount of verbal material in response to the change in communicative media is made only by the adults, although the children show a trend in this direction. Boyle, Anderson and Newlands, (1994) suggest that possible reasons for such a change is that the visual channel is an important contribution to the management of the interaction. For example, visual cues such as eye gaze may be important contributors to the turn-taking mechanism, making the interaction and information transfer process smoother, and therefore face-to-face interactions require less verbal material than audio-only interactions of the same communicative adequacy. Visual information may also play an important part in gaining feedback from one's interlocutor regarding how well the interaction is going. When such information is not available it may be necessary to obtain this information verbally. What the present results show is that whatever causes the differences, between face-to-face and audio-only interaction for adults, has less of an effect in child interactions. The kinds of communicative functions, which are responsible for the increase in verbal material in the audio-only context, are investigated in Chapter 6. Whether the same kinds of alteration in communication strategy are exhibited by the children is investigated in Chapter 7. These analyses along with the analyses of gaze reported in Chapters 6 and 7 offer some explanation of why face-to-face and audio-only interactions are different, and why the change in communication medium has differing effects on children compared with adults.

Boyle et al (1994) report that adult Instruction Givers play the dominant role compared with the Instruction Followers in terms of their verbal contributions. Both adults and eleven year old Instruction givers produce more verbal information than their Instruction Followers, this is reflected both in the number of words spoken and the length of turns produced by Instruction Givers and Followers. This verbal information is more extensive than that produced by the six year old Instruction Givers. The 11 year olds have the same distribution of contributions between IG and IF as the adults have; responsibility for about 2/3s of the interaction lies with the IGs and 1/3 with the IFs. The majority of information being transmitted therefore comes from the IG in the adult and 11 year olds' interactions, and the remaining third is contributed by the IF. In contrast the 6 year olds distribute contributions evenly between IG and IF. This is both because their IGs say less than the 11 year old IGs, and because their IFs say more than the 11 year old IFs. It may be the case that the 6 year old IGs' contributions are so impoverished that their partners are forced to contribute more to the interaction in attempting to accomplish the task satisfactorily. The 6 year olds therefore do not understand, or do not act upon the role structure inherent to the Map Task in the way that adults and older children do, and therefore assign responsibility more evenly.

Given that the IG is the one who holds the knowledge about the route, the most successful interactions tend to those where the dialogue centres around the information which he/she has to offer, with the IF contributing in order to gain a full understanding of the IGs' messages and to inform the IG about how effectively mutual knowledge is being established. IFs who introduced information which is not relevant to the route run the risk of wasting processing capacity and confusing the issue. Skilled IGs will therefore give clear, route relevant information, and skilled IFs will focus on that information and help to ground it.

It is possible to use a very different role structure to good effect. Merrison, Anderson and Doherty-Sneddon (1993) found that when aphasic IGs played the Map Task with non-impaired IFs these IFs contributed proportionally more than the IFs from the non-impaired corpus. Even though these aphasics' linguistic abilities were extremely deficit the performances were comparable with non-impaired 14 year olds, therefore it appears that the more dominant role which their IFs played was used to support and facilitate the aphasic IGs contributions. The 6 year old IFs do not appear to be facilitating their interactions in the same way. Even with their more dominant role, task performance is still very poor. This contrasts with the relatively good performance obtained when aphasic IGs' contributions are supported by a non-impaired IF.

One reason why task performance is not influenced by the removal of the visual channel for adults or eleven year olds but is for the younger children, is that the adults transmit a lot of information verbally (and they also use very little communicative gesture) and this results in relatively good performance in both contexts. The eleven year olds do not say as much, but say enough to maintain their relatively poor performance regardless of whether or not visual signals are available. Six year old Instruction Givers rely the most on visual signals and hence say even less than the eleven year olds. They cannot or do not verbalise this information when the visual channel is unavailable and therefore their performance suffers. This is reflected in their persistence in using communicative gestures in the audio-only context and their relatively impoverished verbal contributions (illustrated in the examples given on page 127). The younger children therefore transmit a significant amount of information non-verbally which is not expressed verbally. The following is an extract of a face-to-face dialogue between 6 year olds. The underlined words represent speech which was accompanied by communicative gesture. The speech marked by * represents non-verbal vocalisations which were used to add affect to the gestures which they accompanied.

Turn 1	**Instruction Giver:** Ehm, now do three straight lines.
Turn 2	**Instruction Follower:** Straight?
Turn 3	**Instruction Giver:** Uh huh.
Turn 4	**Instruction Follower:** <u>Like this</u>?
Turn 5	**Instruction Giver:** <u>No.</u>
Turn 6	**Instruction Follower:** <u>Like this</u>, l<u>ike this?</u>
Turn 7	**Instruction Giver:** <u>No * "dunk"</u> "dunk" * <u>straight down the way.</u>
Turn 8	**Instruction Follower:** <u>Down?</u> Then*<u>do</u> <u>do</u> <u>do</u>*.
Turn 9	**Instruction Giver:** <u>No just</u> three <u>lines straight down the way</u> just three.

This example illustrates how poor the verbal attempts could be, and how poor the comprehension of the listener could be. The Instruction Giver wants the Instruction Follower to draw three straight lines vertically down. He does not at first specify that the direction is down. In Turn 4 the Instruction Follower shows that he has misinterpreted the instruction to mean horizontal straight lines when he accompanies his utterance with a gesture showing a horizontal line straight across. In Turn 5 the Instruction Giver says "No" and gestures straight lines vertically down the way, but has not yet verbalised the downwards information. The Instruction Follower then asks "Like this, like this?" while gesturing curving lines first vertically down and then horizontally across. The Instruction Giver repeats his instruction in Turn 7, this time verbalising that the lines are to be drawn down the way, and again accompanies the utterance with gestures designating straight lines vertically down the way. The Instruction Follower is still confused and accompanies his utterance "Down?" with a downwards gesture, but accompanies "do, do, do" with horizontal curvy gestures. The exasperated Instruction Giver then repeats his instruction accompanying his verbal utterance with vertical down ward gestures, and for the first time verbalises all the relevant information. The Instruction Follower does eventually draw the straight vertical lines. The Instruction Follower never verbalised the 'curvy line ' information, indeed it is very difficult to describe this in words. The Instruction Giver nevertheless was in no doubt as to what the Instruction Follower meant making it clear that his instruction was being misinterpreted.

The children are not good at using their linguistic abilities to perform the Map Task to a level anywhere near that of the adults. Neither group of children makes a verbal media adjustment in the way which adults do, and finally the 6 year olds do not seem to have grasped the very basic interactional structure which both the 11 year olds and adults implement.

The following section investigates the use of gaze in the interactions. If visual signals are being used, as the above results suggest, then participants must look at one another. What follows is a report of how frequently this occurs. In Chapters 6 and 7 the co-occurrence of gaze with predetermined communicative functions is investigated.

C. Study 2: Incidence of Gaze in Child and Adult Interactions

The approach to gaze taken here is interactional in Clark and Brennan's terms (1991). So an underlying assumption is that gaze is an integral part of the information transfer process as well as with the turn-taking mechanism.

1. Subjects

One pair of 11 year olds and 6 year olds were not included in the sample due to a lack of visibility of one subject's eyes on the video recoding of the interaction. Therefore 8 pairs of adults (from HCRC corpus), 10 pairs of 11 year olds, and 9 pairs of 6 year olds are included in these sets of analyses.

2. Procedure For Gaze Analysis

The precision of gaze coding allowed by the video recordings and referred to in this chapter is that of face-gaze, which is gaze in the direction of another's face, rather than being definite eye-gaze, which can be said to be directed at another's eyes. Mutual gaze refers to two individuals simultaneously gazing in the direction of each others faces. These definitions are proposed by Harper et al (1978). The technique used to video record the interactions between the children employed 2 cameras one directly behind each participant. The outputs from these cameras were then mixed with a vision mixer to give a split screen recording. Beattie and Bogle (1982) report that this is the most reliable and valid way of measuring gaze out of the 3 techniques of recording which they compared.

Each video was run through for gaze coding twice, firstly for the IG gaze, and then for the IF gaze. When gaze was observed its occurrence was marked onto a printed transcript of the dialogue. The period on the interaction which involved gaze was noted by high-lighting the verbal text. If only one word in a turn was accompanied by gaze, as when there was a very short flick, this word was highlighted. In contrast some instances of gaze spanned more than one turn, and here all relevant text would be high-lighted with the continuity of the gaze also marked on the transcripts. Different coloured pens were used for the IG and the IF to allow the distinction between IG gaze and IF gaze. Mutual gaze was said to have occurred when there was a co-occurrence of IG and IF gaze on the same section of interaction. The precision of coding was at the level of the word, that is if gaze began or ended within some part of a word then this word was highlighted, but detail within words was not recorded.

3. Interjudge Reliability of Gaze Coding

One dialogue from the adult corpus was selected at random and coded for gaze. The interjudge reliability between two independent coders was 92% of words coded as having gaze were mutually agreed (subsample of gaze; 184/199 words with gaze were agreed upon).

The frequency with which subjects initiated a gazing episode with one another was the dependent variable investigated. The null hypotheses were that there would be no difference in the frequency of gazing behaviour between the age groups, nor in the frequency of gazing behaviour between the different roles played within the map task interactions.

4. Results

A 2-way ANOVA was carried out, with Age as a between-dialogue factor (3 age groups), and Gaze Type a within-dialogue factor (6 levels; IG gaze while speaking, IG while listening, IF gaze while speaking, IF gaze while listening, and mutual gaze). A by-dialogue design was used which is why Gaze Type is a within-dialogue factor. This allowed the category of mutual gaze to be included for comparison with individual gaze.

Gaze frequency was calculated by dividing the number of gazes of each type by the number of words on which that type of gaze could occur. For example "IG gaze while speaking" was determined by dividing the number of IG gazes by the number of IG words of the interaction. Differing lengths of contributions from the different roles within the interactions, and the differing lengths of the interactions themselves was therefore controlled for.

The effect of Age was almost significant, $F(2,24) = 3.1$, $p = .06$ (mean frequency of gaze: 6 year olds = 4.11; 11 year olds = 5.65; adult

= 2.95). Both groups of children, especially the 11 year olds, gaze more than the adults.

Table 4.3 Incidence of Gaze While Speaking and Listening for Instruction Givers and Instruction Followers

Participant Gazing	Instruction Giver Turns	Instruction Follower Turns
Instruction Giver	7.03	3.97
Instruction Follower	4.16	6.59
Mutual Gaze	1.86	1.83

There was a significant effect of Gaze Type, $F\ (5,120) = 13.5$, $p<.0001$. The means are presented in Table 4.3. Planned comparisons t-tests revealed that Instruction Givers were more likely to gaze while speaking than while listening, $t(120) = 1.68$, $p<.05$. The same trend existed for Instruction Followers, but did not reach significance. Mutual gaze was the least frequent form of gaze, although its frequency was greater than would be expected by chance (1.18 mutual gazes per 100 words). The level of mutual gaze expected by chance was calculated by multiplying the frequencies of IG and IF gaze in order to estimate how often IG and IF gaze would co-occur by chance, and this was compared to the observed total mutual gaze for each interaction. A 2-way ANOVA was used to make this comparison, with one, 2-level within-dialogue factor (observed versus chance frequency of mutual gaze), and one between-dialogue factor, Age (6 year olds, 11 year olds, & adults). A significant difference between observed and chance levels of mutual gaze was found, $F (1,24) = 21.98$, $p <.0001$ (observed total mutual gaze = 3.69 per 100 words; estimated chance level of mutual gaze = 1.36 per 100 turns). Simple effects analyses revealed that this was only the case for the children ($F (1,24) = 12.32$, $p <.01$; $F(1,24) = 8.78$, $p<.01$) and not the adults. In other words, both groups of children engaged in significantly more mutual gaze than would be expected to occur by chance. In contrast adults engaged in less mutual gaze and this did not differ from the level expected by chance in their interactions.

5. Conclusions

The present results suggest that the frequency of gazing is not determined by task role. Instruction Givers and Instruction Followers gaze to the same extent. Gazing therefore serves some function(s) for both IGs and IFs. Instruction Givers gaze significantly more frequently when speaking than when listening suggesting that they are using gaze to monitor the Instruction Followers' reactions. These results contrast with earlier studies, for example Argyle and Cook (1976) who found that individuals gaze more while listening than while speaking, and with studies showing equivalent amount of gaze while listening and speaking (Ellyson et al, 1980). Exline, Ellyson, and Long (1975) propose that gazing while speaking serves to exert dominance, and that gazing while listening serves an information gathering function. The higher frequency of gazing while speaking compared with listening by the Instruction Givers may therefore reflect their more dominant role within the task.

An alternative explanation is that Instruction Givers gaze relatively less while listening than would be expected since when they are listening to, e.g. Instruction Followers' queries, they are attending to the task materials in order to answer said queries. If this is the case it might explain the apparently higher frequency of gazing while speaking seen for the Instruction Givers.

A related question is whether task complexity influenced gazing behaviour. Although not analysed presently, Boyle et al (1994) showed that Instruction Follower gaze increases during points of communicative difficulty. Likewise Instruction Givers may also gaze more during communicatively difficult sections of the Map in order to monitor more closely the level of understanding and agreement obtained from the Instruction Follower.

In contrast to expectations, there were no significant differences between the age groups in their levels of gazing, although there were trends for the children to gaze more than the adults, and to engage in more mutual gaze. More detailed analyses of gaze patterns are offered in Chapters 6 and 7 in order to see whether the gaze which occurs serves the same functions in the different age groups.

D. Study 3: Face-to-Face versus Audio-only Communication for 3-4 year olds

The purpose of Study 3 was to investigate whether the face-to-face benefit found in Experiment 1 for the 6 year olds would be found with younger children using a different task (pilot work at Glasgow and Stirling University found that pre-school children could not cope with the Map Task). A simpler referential task, the Glucksberg task, was used. The Map Task is more complex than the Glucksberg task in several ways. For example, the children must deal with many dimensions of information simultaneously, such as the identity and locations of map features plus the direction and shape of the route. The task is also more continuous and ongoing, with the children often having to remember and take into account information which was discussed some time before. The Gluskberg task is divided into shorter, discrete units, which describe one item at a time.

1. Subjects

Twenty-six 3-4 year olds (mean age 44.2 months, range: 36.5 -> 54 months) from a resident playgroup in the Psychology department, University of Stirling, served as subjects.

2. Design

A within-subjects design was used. The subjects were paired, and each pair was tested in both the face-to-face and audio-only contexts (the order of the contexts was counterbalanced across the pairs).

3. Task

The task used was a variation of the referential task designed by Glucksberg, Krauss, and Weisberg (1966). Although based upon this earlier task the present task differs in several respects. The task will be described without explicit reference to these differences.

The children were randomly assigned the role of Instruction Giver or Instruction Follower. The Instruction Giver was given a set of 5 blocks stacked in an opaque dispenser. The Instruction Follower had an array of 13 blocks in front of them, but to the side, where they are occluded from the view of the Instruction Giver by a screen. Appendix 1 shows one set of blocks which were used.

Each block had an individual design on one of its faces, see Appendix 1 for examples of these designs. The designs were chosen on the basis that the correct referent would not always be readily identifiable as some ambiguity would exist between two or more blocks in the Instruction Follower's array. The different shapes and colours meant that children of this age would find describing them a fairly demanding but not impossible task.

Five of the Instruction Follower's blocks matched exactly the designs on the 5 blocks which the Instruction Giver possessed. The task involved the Instruction Giver removing his/her blocks one at a time from the dispenser and describing them to the Instruction Follower so that he/she could choose the correct matching block from their referent array. The Instruction Follower then placed the chosen referent into their own stacking container so that the order of choices could be later checked by the experimenter. There were 3 different sets of stimuli which were randomly used across the 2 conditions with no pair receiving the same stimulus set twice.

The experimental set up was designed to allow the children to see one another in the face-to-face condition without seeing one another's materials. A low table was used and the children sat opposite one another. The table was sectioned in front of the children by a screen. In the face-to-face condition a section of this was removed so that they could see one another. Materials for each child were placed on the far side of a further screen to the left of the child and perpendicular to the central screen. This meant that the children could not see one another's test materials. The lower half of the central screen consisted of flaps which enabled the Instruction Follower to push his/her blocks through to the Instruction Giver, if they wished, in order to check if the correct one had been chosen.

4. Procedure

The children were brought to the testing room in pairs. They were introduced to the task by the experimenter using practice blocks on which there were pictures of farm-yard animals. This was done to familiarise the children with the task itself without giving them practice describing the kinds of shapes they were about to use in the test proper. The children were informed that the Instruction Follower could pass blocks which they thought were correct through the 'flap screen' so that the Instruction Giver could check whether the intended block had been selected.

When the experimenter judged that the children had grasped the principle behind the task, the test proper began. If a pair obtained a very low score they were allowed to try again if they wished up to a maximum of 3 trials in each context. Some pairs therefore completed only 1 trial per context while others did three.

All of the dialogues were recorded using 2 microphones (Sony F-V610) and a Sony TC-FX320 analogue tape deck.

5. Results

5.1 Task Performance

The task score was the number of target referents (out of a possible 5 per trial) which were correctly chosen by the Instruction Follower. Although some pairs completed more than 1 trial per condition this did not improve performance. A by-trial analysis was carried out on the scores using a 1-way ANOVA , with 1 between-subjects factor, Trial Number (5 levels; trials 1-5 {only 1 pair completed more than 5 trials between the 2 conditions}). Performance did not change across trials. Furthermore trial ordering did not differ between the face-to-face and audio-only conditions, the mean trial number for face-to-face was 2.4, and for audio-only it was 2.2. There was therefore no systematic advantage or disadvantage for either condition. The mean score for each pair in each context was taken as the dependent variable.

A 1-way ANOVA was carried out with Visibility Context a within-subjects factor (2 levels: face-to-face and audio-only interaction). A significant effect of Context was found, $F(1,12) = 9.59$, $p<.01$. The children performed significantly better when they interacted face-to-face (mean score = 4.01) compared with audio-only conversation (mean score = 2.55). The face-to-face benefit found for the 6 year olds in Study 1 is therefore replicated for 4 year olds in the present study.

5.2 Verbal Contributions: Words, Turns, and Words Per Turn

Words per Dialogue. A 2-way ANOVA was carried out with 1 between-subjects factor, Task Role (2 levels; Instruction Giver and Instruction Follower), and 1 within-subjects factor, Visibility Context (2 levels face-to-face or audio-only). The dependent variable was the mean number of words spoken by each subject in each condition.

A significant effect of Visibility Context was found, $F(1,22) = 4.22$, $p<.05$. The audio-only dialogues were significantly longer (mean = 147.3 words) than the face-to-face conversations (mean = 109.2 words).

Turns per Dialogue. A 1-way ANOVA was carried out with the number of turns as the dependent variable, and Visibility Context a within-subjects factors. There was no significant difference between the two contexts, although there was a trend for an increased number of turns in the audio-only context, (mean face-to-face = 31 turns per dialogue, mean audio-only = 46 turns per dialogue).

Words Per Turn. A 2-way ANOVA was carried out on the mean length of conversational turns produced by each participant. Task Role was a between-subjects factor (2 levels: Instruction Giver or Instruction Follower), and Visibility Context was a within-subjects factor (2 levels: Face-to-face and audio only). Visibility Context did not affect the mean length of turns. Task Role had a significant effect, $F(1,22) = 6.69$, $p<.05$, with Instruction Givers producing longer turns (7.18 words per turn) compared with Instruction Followers (4.43 words per turn). This is a similar effect to that found with the Map Task Instruction Givers and Followers.

6. Conclusions

It was found that the 4 year olds' communicative performance is significantly affected by the presence or absence of visual signals. It appears that, as for the 6 year olds in Study 1, visual signals play a central role in the communication of 4 year olds. In Study 1, there was a trend for more verbal material to be produced in the audio-only context (18% more words for 6 year olds and 9% for 11 year olds; 22% more turns for 6 year olds, and 12% for 11 year olds), this corresponds to the increased length of audio-only Map Task dialogues between adults reported by Boyle et al (1994). Similarly, the 4 year olds in

Study 3 invested significantly more verbal effort, in terms of the number of words spoken, in their communicative attempts when they could not see one another. In face-to-face interaction visual signals of feedback, e.g. head nods and facial expression can be used to express understanding or the lack of it, and furthermore can be accessed by the interlocutor as a gauge of mutual understanding. It is therefore expected that at least a substantial amount of the extra talk found in audio-only interactions will pertain to the expression and monitoring of mutual understanding. Analyses reported in Chapters 6 and 7 will investigate whether this is the case.

It appears that all ages of interlocutor have to say more when they cannot see one another when doing tasks such as these. The reason that this does not benefit the 2 younger groups of subjects may be that the listeners in these age groups handle the processing of messages better when visual signals such as gesture, gaze, facial expression, and lip configuration, are available. An alternative explanation is that the extra speech produced by the 4 and 6 year olds does not provide useful information.

E. Chapter Conclusion

This chapter has shown that visual signals play important roles in both child and adult dialogues. While older children and adults can adjust to audio-only communication, children as young as 4 and 6 years cannot. The significant effect on task performance caused by visual signals is found for 4 and 6 year olds, and for 2 different problem-solving tasks which involve children communicating information to one another. This supports previous claims that non-verbal communicative strategies are easier for young children (for example Goldin-Meadow et al, 1992; Feyereisen & de Lannoy, 1991). The present results are also congruous with Beattie (1981). Beattie proposes that differences between face-to-face and audio-only conversations should only be evident in certain communicative situations, for example cognitively demanding discussions. The negative effect of removing visual signals from the younger children may therefore reflect that the tasks are more demanding for them than for the older children and adults.

The face-to-face benefit for young children may be due to two aspects of the communicative process. First, the speaker finds it easier to convey information non-verbally and conveys information in his/her visual signals which is never expressed verbally. Second the young listeners may find it easier to process visual signals than they do verbal messages, for example a shape drawn in the air may give them a more comprehensible representation of an object than a verbal description of that object. When the verbal descriptions are opaque the listener's difficulties will be compounded.

Differences in communication strategies between the age groups exist in both verbal and non-verbal respects. Adults verbalise more information than the children and this is one likely reason for their greater communicative success. In Chapter 6 a more detailed analysis of the verbal communication strategies of the adults will be discussed. The reasons for this are two fold: firstly to attempt to explain in more detail how they adjust their communication style to fit the context; secondly to illuminate functions which non-verbal signals serve and how they are replaced verbally by adults. The final empirical chapter reports this analysis of verbal communication in the child interactions to illustrate differences between child and adult communication.

The children were also found to use communicative gestures more frequently and to gaze more frequently than the adults, suggesting that their communication strategies are more non-verbal. In particular children were more likely to engage in mutual gaze. This suggests that they are less affected by social norms regarding this. More detailed analyses of the use of gaze is reported in Chapters 6 and 7 in the hope that this will reveal further qualitative differences in the use of the visual channel.

It therefore appears that there is a trend for children to use visual signals more than adults. However the effects which the presence or absence of visual signals have on communicative process and outcome change with age. While communicative gesturing is not a strategy used by adults in these interactions, both 6 and 11 year olds use a substantial amount of gesture. Garnica (1978) found that the amount of gesture which mothers used while making requests of their children decreased with increasing age of the child, and verbal instructions became more prevalent. Results such as this have been taken as evidence that non-verbal signals such as gesture are less complex and require less processing capacity than do verbal messages (for example McTear, 1985).

The 11 year olds differ from their younger counterparts in that they have the ability to alter their communicative strategy when forced to communicate without visual signals. In contrast the 6 year olds do not decrease their gesturing behaviour in the audio-only context, suggesting that they cannot verbalise this information. The 4-year olds and adults significantly increased the amount of verbal material which they produce in the audio-only context compared with the face-to-face context, and the 6- and 11-year olds showed trends in this direction. This illustrates that visual signals are important for all the age groups, since they all attempt to verbalise more information when such signals are unavailable.

However the results show that visual signals have particular importance for younger children. Both 4 and 6 year olds were found not to adapt effectively to the audio-only context. This may be because visual signals are easier to produce and use, or because they are easier for receivers to understand compared with verbal language.

Part 3: Conversational Games Analysis

Chapter 5: Conversational Games Analysis

A. Introduction

The aim of this chapter is to introduce a form of dialogue analysis. This analysis system is used extensively in the thesis to describe the verbal channel of communication. It is used in Chapter 6 to investigate the effect that the communicative situation, and familiarity of interlocutors has on adult communicative style. In Chapter 7 it provides a way of describing developmental changes in the use of conversational tools. In both of these chapters the role of eye gaze in communication is investigated, with the system providing a description of the verbal channel which eye gaze accompanies.

The first two sections of the chapter give an outline of some related work. The third section introduces the analysis itself, which is called Conversational Games Analysis. An inter-judge reliability study is then reported in the final sections.

B. Conversational Analysis and the Corpus Analysis Approach

The study of discourse structure in interpersonal communication has progressed down two main, often opposing, avenues. Firstly there is the psychological approach, and secondly there is the study of naturalistic data advocated by conversational analysts.

The psychological approach is based on the use of experimental, quantitative data collection and analysis, and involves the classification and categorisation of discourse phenomena elicited under controlled conditions. Duncan (1969) termed the approach the 'external variable' approach because it involves relating aspects or features of the communication to variables external to the communicative process, for example studies of different media for communication (Chapanis, Ochsman, Parrish, & Weeks, 1972).

In contrast, conversational analysis is a descriptive, qualitative technique which has developed within the ethnomethodology framework. Hence conversational processes are studied by observing natural, ordinary conversation. This approach makes three assumptions: first, that conversational structures are a result of certain social conventions; second, that contributions to interactions are 'context-shaped'; and third that these contributions are 'context-renewing'- that is, contributions cannot be understood without reference to the context in which they occur, and each contribution provides the context for the next contribution. Duncan (1969) termed this a structural approach, where behaviour is analysed in terms of its sequential and hierarchical organisation. Researchers taking this approach have made many important contributions to the study of conversation. For example an infamous model of turn-taking adapted and adopted by many other researchers is that proposed by Sacks, Schegloff and Jefferson (1974). Aspects of this model are discussed in the next section as are approaches which have integrated ideas from this model. These authors have also produced detailed analyses of, for example, conversational openings (Schegloff, 1968) and conversational closings (Schegloff and Sacks, 1973) proposing rules which govern such occurrences.

Whereas conversational analysts often run the risk of overgeneralizing from a qualitative analysis of relatively small samples of data, psychologists may oversimplify communication processes by ignoring certain crucial features of communication events.

C. Approaches to Analysing Conversational Structure

The following is a summary of work relevant to the system of analysis to be described in this chapter. These approaches to discourse analysis are influenced by both of the frameworks described above.

1. Speech Act Theory

Most approaches to conversational analysis rely ultimately on the notion of the speech act. Austin (1962), the pioneer of speech act theory, came to believe that all utterances have some function which may be implicit or explicit. The intention of an utterance is known as its illocutionary force and the hearer's perception of this force is its illocutionary uptake. A speaker is then said to have performed an illocutionary act when his utterance's illocutionary force is taken up.

In speech act theory, Searle (1969), draws a critical distinction between the 'sentence' and the 'act' it is used to perform. He formulates the necessary and sufficient conditions for the performance of a number of illocutionary acts, taking into account the following conditions:

1/ Propositional content conditions: the propositional content of the utterance must be suitable for the act to be performed.
2/ Preparatory conditions: the circumstances must be appropriate.
3/ Sincerity conditions: the speaker's intentions and beliefs must be appropriate.

For example, for a question, the content of the utterance must be a proposition or propositional function, the preparatory condition is that the speaker of the utterance does not know the answer, and the sincerity condition is that he wants to know the answer. So the utterance only counts as a question if all of these conditions are satisfied. Searle proposes that illocutionary acts, like other acts, such as marrying and selling, are constituted by social conventions, therefore they are fundamentally different from certain other acts, such as boiling an egg, which operate independently from social conventions.

Searle,1971, suggests that in performing an illocutionary act, the speaker intends;

1/ To produce a certain effect.
2/ To produce this effect by getting the hearer to recognise his intention to produce the effect.

3/ To get this recognition by using expressions who's rules for use associate the expressions with the desired effect.

Searle therefore proposes that the unit of linguistic communication is not the word or sentence, but the production of these to perform speech acts. So an important contrast which speech act theory makes is between content and function; there is no one-to-one mapping of content or syntactic structure to function. This contrast is recognised in all the following accounts of conversational structure.

2. Adjacency Pairs

There has been considerable work done on how turns are managed and allocated in conversation, for example, Sacks, Schegloff, and Jefferson (1974); Schegloff, Jefferson, and Sacks (1977); Schegloff, 1982. These authors propose a model of the turn taking mechanism consisting of rules describing how turns change between speakers and how turns are allocated. One of these rules is as follows: "If the turn so far is so constructed as to involve the use of a 'current speaker selects next' technique, then the party so selected has the right and is obliged to take the next turn to speak, no others have such rights or obligations, and transfer occurs at that place".

One of the 'current speaker selects next' techniques is the use of the first part of what they call 'adjacency pairs'. These are pairs of utterances produced by different speakers, where the second is a response to the first, for example, greeting-greeting, question-answer sequences.

They suggest that these pairs are subject to conventional rules. So the first part of an adjacency pair requires an appropriate second part, and this they call conditional relevance. If the second part is not produced it will be conspicuously absent, and its absence will be interpreted as meaningful by any witnesses of the interaction. It is this conditional relevance which powers the 'current speaker selects next' technique.

However as Power (1979) points out, the term adjacency pair, is rather misleading, since the conditional relevance between two utterances can span several intervening utterances. The following small dialogue illustrates this point.

1 Mary: Do you like apple pie?

2 Sam: What home made ones?

3 Mary: Yeah.

4 Sam: Yes of course I do.

Utterances 1 and 4 obviously constitute a pair in the way Schegloff and Sacks intend, despite the fact that there is another, second adjacency pair (utterances 2 and 3) embedded in between the two. Sam has simply followed a conversational maxim of truthfulness, and has endeavoured to discover what class of apple pies he is being questioned about before answering Mary's question. Such embedded sequences were called insertion sequences by Schegloff (1972) and side sequences by Jefferson (1972).

Power also points out that structures such as adjacency pairs are an important unit of conversation, more useful than the utterance, since it is through the operation of such structures that conversational and communicative goals are realised.

It is therefore essential that we not only look at how discourse functions are realised in terms of units like acts, but also describe exactly what structures these combine to form and how it is that these higher structures accomplish our communicative goals. By using concepts such as the adjacency pair and conditional relevance, more meaningful structures may become visible.

3. Moves, Acts and Exchanges: A Higher Level Approach

Bellack, Kleinbard, Hyman, and Smith (1966) produced a functional and structural analysis of the discourse occurring between teacher and pupil in classroom interaction. They propose a hierarchical structure for lessons with four units; games which consist of subgames which consist of cycles which consist of moves. The two higher units are pedagogically defined, while cycles and moves are defined in discourse terms. There are four types of moves;

1/ Soliciting : Elicit either a verbal, cognitive, or physical response.

2/ Responding: Fulfil the expectations of the soliciting moves.

3/ Structuring: Set the context for subsequent behaviour, for example, they may focus attention on the topic to be discussed.

4/ Reacting: These moves are brought about by any other type of move, but are not directly elicited by them. They clarify, expand or rate what has previously been said.

Cycles are formed by the combination of moves; a structuring or soliciting move followed by one or more responding or reacting moves, until a new structuring or soliciting begins a new cycle.

Sinclair and Coulthard (1975) point out some shortcomings of this system. Firstly, not all of the teacher utterances fit any of the move categories. Secondly, the reacting category catches everything which doesn't fit into the other three move types.

A third criticism of Bellack's system is that it does not describe embedding of same level units, such as the embedding of cycles within other cycles. Embedding of same level units is an important phenomenon in discourse, and this is recognised by several authors in the field of dialogue analysis (Schegloff,1972; Jefferson, 1972; Kowtko, Isard and Doherty-Sneddon, 1992).

A somewhat different approach to conversational analysis is that of Sinclair and Coulthard (1975), working within the field of sociolinguistics. They were very influenced by Bellack's system when constructing their own analysis system for classroom interaction. They point out that the linguistic literature has little to offer the study of the structure of spoken or written discourse, its main concern being language structure up to the level of the clause. They therefore propose a model of spoken discourse structure based on a hierarchy of higher level units.

Sinclair and Coulthard (1975) base their model of discourse analysis on a minimal unit, the speech act, and they define a small number of these acts, according to their function within the discourse. Different speech acts can then be combined to form higher units. So their central concern is with such questions as whether or not an utterance is intended to evoke a response, or whether it is a response to another speech act.

The model assumes a rank scale where units at a given rank are composed of units of the rank below. Their system of analysis consists of five ranks. Units at the lowest rank are known as acts, and these correspond to grammatical clauses. However, as mentioned previously, the classification of acts is not by grammatical form but by discourse function. Information regarding the grammar, the situational context, and the position within the discourse all feeds into the classification of acts.

They propose 22 categories of acts, some of which are likely to be specific to the classroom situation which they were analyzing. The following are 4 of the acts and their abbreviated definitions:

Starter: Realized by a statement, question or command. Its function is to provide information about or direct attention to an area to make a correct response to the initiation more likely.

Elicitation: Realized by a question. Its function is to request a linguistic response.

Prompt: Realized by a closed class of items e.g '**go on**', '**come on**', '**have a guess**'. It functions to reinforce a directive or an elicitation.

Bid: Realized by a closed class of items e.g '**Sir**', '**Miss**', **raised hand, finger clicking.** Its function is to signal a desire to contribute to the discourse.

Acts then combine to form moves which are the next rank in the system. There are 5 categories of move: **framing, focusing, opening, answering,** and **follow-up.** The following is an example of the structure of an **opening** move:

Class of Move		**Class of Act**
Opening	A group of people use symbols to do their writing. They used pictures instead of words.	**Starter**

Do you know who those people were?	**Elicitation**
I'm sure you do.	**Prompt**
Joan.	**Nomination**

Sinclair and Coulthard (1975)

Moves then combine to form exchanges, where a typical exchange might involve initiation by the teacher, followed by a response from the pupil, followed by feedback from the teacher (**Opening, Answering,** and **Follow-up** moves). These move categories correspond closely to Bellack's soliciting, responding and reacting moves.

There are five categories of move, which combine to form two categories of exchange- **Boundary** and **Teaching**. From examining the discourse Sinclair and Coulthard observed that boundaries in lessons are marked by **Frames**, which are words like 'right', 'well', 'good', and 'O.K' followed by metastatements about the discourse which they called **Focus** moves. **Framing** and **Focusing** moves formulate **boundary exchanges**, while **Opening**, **Answering**, and **Follow-up** moves realize teaching exchanges. There are eleven sub-categories of teaching exchange, each with a specific function and unique structure. The following is an example of a **teacher elicit** exchange.

Class of Exchange	Class of Move		Class of Act
Teacher Elicit	**Opening**		
		What's the name of the cutter?	**Elicitation**
		Hands up.	**Cue**
		Non-verbal.	**Bid**
		Janet.	**Nomination**
	Answering		
		Hacksaw.	**Reply**
	Follow-up		
		The hacksaw.	**Evaluate**
		And I'll put that one there.	**Aside**

Sinclair and Coulthard (1975)

This illustrates the teacher-elicit exchange which consists of three moves: opening, answering, and follow-on. These moves each consist of various acts as shown.

There are 5 types of boundary exchanges. They function to signal the beginning or end of the stages in the lessons. A typical structure for a boundary exchange is as follows:

Class of Move		Class of Act
Framing	Well,	**Marker, silent stress**

Focusing	Today we're going to learn about an ancient civilization ..	**Metastatement**

Sinclair and Coulthard (1975)

The existence of boundary elements was taken as evidence for discourse structures above the level of exchanges, which were named transactions. Exchanges combine to form transactions, but the authors make no definite claims about either transaction types or structures.

The highest unit of classroom discourse in this system of analysis is the lesson which consists of several transactions.

This system of discourse analysis is impressive in many respects, for example the way in which it reflects the data. However, commendable though the Sinclair and Coulthard system is, their analysis is governed by the context of what they are analyzing, i.e classroom interaction.

In terms of how generalizable this system is, it is obvious that the higher ranks, such as lessons, are pedagogically defined and therefore do not apply to the analysis of other types of discourse. The sort of exchange structures found may be classroom specific, since they are very much evoked by the special role-structure which exists between teacher and pupil.

A final point is raised by the fact that this system works on a fixed rank basis, with components of a given rank structure being elements of ranks lower in the hierarchy only. In other words embedding of the same level rank structures is not accounted for in this system.

Another system of coding discourse structure, which is based very much on the Sinclair and Coulthard model, is proposed by Sutcliffe and Cooper (1990). They apply the concepts **act, move and exchange** to dyadic, explanatory discourse between adults, (one is an expert, the other a novice). Thus their set of discourse acts differ from the set used by Sinclair and Coulthard, since the nature of the interactions being studied is different. An act is defined by its communicative function. The structure of moves is not accounted for in any detail in this model, with a move consisting of as many acts from the one person as is necessary to accomplish a conversational goal. In reality most moves are single acts. An exchange is made up of moves, and relates to the content of what is being said. The following is an example of coded text given by Sutcliffe and Cooper. They studied dialogues between experts and novices, where the expert was to explain Electronic mail to the novice. Forward slashes (/) represent boundaries between different acts.

Exchange Beginning

Expert: Okay. / We'll start with sending a mail message to someone. / To stop bothering people I'll send it to myself. / Okay. Right. / Its just like mail where you just instead of typing 'mail person' you type 'ream'. / And that- that prompts you for a subject, that's 'subject' and it puts you into you favourite editor.

Acts: Propose / Invite / Confirm / Invite / Report

Novice: Oh. Right.

Act: Continue

Expert: Now unlike ream where you - / er, unlike mail, sorry, where you just / - it puts you into a straight text, this ... ah... puts you into, in this case, micro-emacs.

Acts: Invite / Correct / Invite

Novice: Right. / So that means you edit the . . .

Acts: Continue / Check

Expert: Yep, / you can edit all the headers, the cc's ...

Acts: Confirm / Invite

Novice: edit all the 'from', 'to' and everything, right, but not- but not the address.

Acts: Check

Expert: Yeah, / you can change anything.

Acts: Confirm / Invite

Novice: Oh. Oh, right / so you can do . . .

Acts: Confirm / Check

Exchange End

This example illustrates the relationship between the discourse acts and exchanges which Sutcliffe and Cooper use in their system of analysis. This exchange is concerned with getting the novice started with the e-mail system, getting from doing the address to the point of formulating a message.

Sutcliffe and Cooper make some interesting comments, using their data, about future designs of human computer interfaces. They illustrate with real data the importance of incorporating certain features of natural dialogue into computer systems which interact with people. For example, the importance of allowing explainees to interrupt a flow of information to check their understanding of the information they are receiving.

What the model lacks is a definable measure of conversational-goal accomplishment. Although moves are said to function to accomplish such goals, in reality it is often a sequence of moves which will in fact result in goals being realised. Exchange boundaries were marked in terms of topic changes. There is no explicit description of whether or not the information is grounded. Also the model does not allow for embedding of exchange type structures, and therefore much of the structure is lost in long sequences of moves and acts.

Alternatively, rather than structure spoken discourse into topic based exchanges, one may think about structure purely in terms of how speakers come to mutually understand one another's contributions. In this view, participants will construct a collaborative discourse structure determined by the establishing of mutual understanding. The following section discusses some approaches which are along these lines.

4. The Collaborative Approach to Conversational Analysis

Clark and his colleagues (Clark and Schaefer, 1987; Clark and Wilkes-Gibbs, 1986; Isaacs and Clark, 1987; Clark and Brennan, 1990) have investigated how conversational structure is determined by speaker/listener knowledge states.

Their approach builds upon the notion of mutual knowledge as detailed by Schiffer (1972). This is a term used to refer to knowledge which individuals share, and also know that they share (Schiffer, 1972, Clark and Marshall, 1981). Schiffer's definition is as follows:

A and B mutually know that p=def

(1) A knows that p.

(1') B knows that p.

(2) A knows that B knows that p.

(2') B knows that A knows that p.

(3) A knows that B know's that A knows that p.

(3') B knows that A knows that B knows that p.

et cetera ad infinitum.

Clark and Wilkes-Gibbs (1986) suggest that this is established through what these authors call the *grounding process*. Information is said to be grounded when the communicants believe that they have understood, to some criterion sufficient for their present purposes, what a contributor meant. This often involves the use of embedded conversational structures. Consider the following dialogue;

Utterance 1. Bob: Do you have a pet poodle?

Utterance 2. Brenda: A poodle?

Utterance 3. Bob: Yes.

Utterance 4. Brenda: No I don't actually, I have an alsatian.

The function of utterance (1) is to find out whether or not Brenda owns a poodle. However this question is not in fact asked, or does not achieve its conversational function, until after utterances (2) and (3) are accomplished. Only once Brenda has made sure she has understood the original question (after utterance (3)) can she answer the first question felicitously.

Clark and Schaefer (1989) proposed a model of the grounding process based upon the work on turns and repairs by Sacks, Schegloff, and Jefferson, (Sacks, Schegloff, and Jefferson, 1974; Schegloff, Jefferson, and Sacks, 1977; Schegloff, 1982). The contribution model proposes two phases in a conversational contribution:

1. A presentation phase: 'A' presents an utterance to 'B'. He assumes that if 'B' gives evidence of understanding (to a certain criterion), that 'B' has understood what 'A' meant by his contribution.

2. An acceptance phase: 'B' accepts 'A's contribution by giving evidence that she believes she understands what 'A' meant. She assumes that when A registers this evidence that he will also believe that she understands.

Only once both phases are accomplished is the contribution complete.

Utterance (2) "a poodle?" in the dialogue example is an embedded presentation phase of an embedded contribution in the acceptance phase of the main contribution. The embedded contribution is accepted in utterance (3) with Bob's acceptance of utterance (2).

Conversational structure is therefore considered to be constructed via 'adjacency pair' type units, with each contribution having a presentation and an acceptance phase. Another way in which the grounding process affects the structure of conversation is the way in which positive evidence of understanding is exhibited. The contribution model assumes that people seek positive evidence for understanding rather than just operate on the basis of not encountering negative evidence. Clark and Brennan (1990) discuss three common expressions of positive evidence;

1. Acknowledgements; items such as *uh huh, yeah, mhm,* often known as back-channel responses. Schegloff (1982) proposes that such items are used by partners in conversation to show that they have understood their speaker's turn so far.

2. Relevant next turn; if the conditionally relevant, appropriate second part of an adjacency pair is given by 'B' in response to 'A's first part, then this is positive evidence that 'B' has understood that first part (Sacks et al, 1974).

3. Continued Attention; 'A' gains positive evidence of 'B's understanding of what he is saying if 'B' is at least attending to 'A'. If such attention is broken or lost then 'A' can be pretty certain that 'B' will not understand what he is saying since 'B' is not listening to it.

We would therefore expect that conversational structures will include: pairs of utterances which have a conditionally relevant relationship, with the possibility of embedding; feedback which gives evidence of understanding in the form of back-channel responses, and signals of continuing attention, such as eye gaze and body orientation.

Clark and Brennan (1990) note that in a conversation, the interlocutors have some collective purpose, for example plan an activity, instruct, learn and so on. They suggest that grounding will change with changing purposes, in that the 'criterion for sufficient understanding', and the techniques employed will change. They also suggest that techniques for grounding information may change depending on the medium of communication. For example, in computer supported communication the use of back-channels, such as *right* or *okay,* may actually interfere with the communication process if there is a delay between their sending and their reception by the receiver. Through such delays a backchannel response may not be associated with the intended part of the discourse and may cause confusion and interruption of the information flow.

The grounding process proposed by Clark and his colleagues is therefore another way of describing conversational structure. The model does this using concepts of adjacency pair, conditional relevance, embedding of sequences, and positive evidence of understanding. It gives a general basis for structure, in terms of optimising the grounding process. However, although the functions of the first and second parts of adjacency pairs are considered these are secondary. Explanations of why utterances follow each other are made solely on the basis of conditional relevance. The particular utterance functions which are paired by conditional relevance described. How the functional composition will change with different communicative media is not predicted even though the model makes predictions about different grounding structures in different media.

What I am suggesting is that the grounding model is a very useful, general model of conversational structure, but it would benefit from a more detailed analysis of utterance function.

4.1 An Application of the Collaborative Approach

One further model of conversational processes, which develops Clark's ideas about the grounding process in this way, is proposed by Traum and Hinkelman, (1992). They analysed human-human conversations to gain insights into the development of a human-machine system of communication.

Their approach to dialogue is a generalization of speech act theory: what they call a theory of *Conversation Acts.* They question certain assumptions of speech act theory: first that utterances are heard and understood correctly by the listener, and that this is expected by both participants; second that speech acts are single agent plans executed by the speaker and passively received by the listener; and finally, that each utterance encodes a single speech act. Traum and his colleagues suggest that these assumptions are too strong. Like Clark and his colleagues they point out that, not only are utterances often misunderstood, but that this is the nature of conversation itself. Traum and Hinkelman propose that assumptions about understanding are not made unless there is positive evidence, for example feedback in the form of backchannels, or in the form of the second part of an adjacency pair. Conversational Acts represent discourse as a set of joint speaker-hearer actions, the actions ground meaning to the satisfaction of both participants.

Four levels of action (Conversation Acts) are proposed. From lowest to highest levels these are; turn-taking acts, grounding acts, core speech acts, and argumentation acts. Traum and Hinkelman emphasize that these are *levels* of language description and not ranks. That is, there are no grammatical relations between the different levels. This contrasts with Sinclair and Coulthard's model which is based on a fixed rank system.

The basic turn-taking acts are keep-turn, release-turn, and take-turn. A single utterance may consist of several turn-taking acts. For example it may have take-turn, keep-turn, and release-turn parts. These are realised by many different speech patterns, for example " I'd just like to say something" to take a turn, "mmh" as a turn filler to keep a turn, and "what do you think?" as a turn releaser. These and a few other types of turn-taking acts are proposed to model the turn-taking process suggested by Sacks at al, (1974).

The discourse level on which grounding acts are represented is the utterance. Utterances are defined here as more or less continuous speech by the same speaker. Each utterance corresponds to one grounding act. Grounding acts make up what are called Discourse Units in this analysis. They consist of as many utterances, from each party, as are necessary to fulfill the grounding process. So Traum and

Hinkelman's Discourse Unit corresponds to a top level contribution, in the terminology of Clark and Schaefer (1989). Some examples of grounding acts are; *Initiate* which is an initial utterance component of a discourse unit (traditionally considered sufficient to accomplish the core speech act being attempted) and *Acknowledge* which shows understanding of a previous utterance, this may be realised by both explicit or implicit means.

The core speech acts are traditional speech acts such as *Inform, Request, and Promise.* A core speech act attempt constitutes an initial presentation of a Discourse Unit, the core speech act is not fully realized until the Discourse Unit is grounded. This corresponds to the presentation and acceptance phases of contributions proposed in the contribution model of Clark and Schaefer (1989).

The following example illustrates the relationship between core speech acts, grounding acts and the dialogue itself. It represents one discourse unit:

Speaker 1 : Okay, the problem is we better ship a boxcar of oranges to Bath by 8am.

Grounding Act = Initiate. Core Speech Act = Inform, suggest.

Speaker 2 : Okay.

Grounding Act = Acknowledge. Core Speech Act = Accept.

This represents a discourse unit being grounded in two utterances. The grounding process is illustrated by the two grounding acts; **Initiate** and **Acknowledge.** The speech acts which are grounded are **Inform** and **Suggest.**

The highest level of acts are argumentation acts, which consist of multiple Discourse Units. These acts serve to, for example, summarize, convince, and clarify.

This approach therefore combines an account of grounding with a version of speech act theory. It gives an account of how speech acts may be grounded in conversation.

The Traum and Hinkelman system of dialogue analysis is very similar in several respects to the coding system which is used in this thesis. Both attempt to describe the grounding processes occurring in conversation while describing the function of the utterances employed in such processes.

The next section describes an AI model of conversation. It is included in this review since it served as an origin to the analysis system which is used in the thesis.

5. Power's AI Model of Conversation

Power's work on conversation has a different origin from the other work cited in this chapter. It is an AI model of how plans and actions are related to what is said in conversation. Power uses adjacency pair structures (Schegloff and Sacks,1973) in his model, where two robots talk to one another in order to cooperate in their activities in a simple world. The robots have a list of instructions about each adjacency pair, called a conversational procedure. They use these conversational procedures as tools in their cooperative activities. They can agree plans, exchange information, compare beliefs, and assess the results of their actions.

The robot's activities centre around moving in and out of a door which may be bolted or unbolted. They are given various beliefs about the state of the world, and various abilities to deal with it. For example, one robot may be 'blind' and unable to see whether the door is open or not, and may therefore have to ask the other robot a question regarding this, using the **ASK** procedure. The robots have knowledge about the use of such procedures, for example that the **ASK** procedure can be used to obtain unknown information, when there is evidence that the other robot has that information. These are akin to some of the preparatory and sincerity conditions which Searle (1969) proposes for the asking of questions.

Each robot has a set of planning procedures, relating to their goals, which is run individually. These planning procedures carry out actions to accomplish the robot's goals within their world, for example moving through the door. If a robot's goal cannot be accomplished by an action then conversational procedures enable the robots to cooperate. This is analogous to human conversation where individuals have plans and goals which often require co-operation with others and hence conversation. An example of a co-operative planning tree is shown in Figure 5.1.

[John in]
(both)

[Door open] [John move]
(both) (John)

[Mary push]
(Mary)

Power (1978)

Figure 5.1 Co-operative planning tree from Power (1978)

Goals are represented in square brackets, with responsibility labelled in round brackets (Mary and John are the names of the robots). The main goal in this example is for John to get in, and this is a joint responsibility. In order to accomplish this, three other sub-goals must be fulfilled: the door must be opened (joint responsibility); John must move (John's responsibility); Mary must push the door (Mary's responsibility). At points of joint responsibility conversational procedures will be called in order to select and agree on a plan.

Three important features of human conversation are modelled in this system. First is how conversation is used to accomplish nonlinguistic goals. Second is how sections of conversation may be embedded. In the model this is done by the use of a control stack which can put planning and conversational procedures 'on hold' in favour of other procedures which must be satisfied first. Third is how representations of knowledge can be constructed as joint efforts.

D. Conversational Game Analysis

The remained of this chapter describes the coding system which is used to analyse dialogues in this thesis. Conversational Game Analysis is a spoken discourse coding system which shares some features with all the above accounts, but combines these features in a more satisfactory way. It was developed by colleagues of the author with considerable input from the author (Kowtko, Isard and Doherty-Sneddon, 1991). The author was involved in the fine tuning of the analysis system and in its evaluation as a reliable tool for dialogue analysis. An important feature which the Conversational Games analysis provides, which the above accounts do not, is the recognition of the embedding of same-level structures in the grounding process.

1. Historical Background

The Game and move framework is based upon Power's (1979), Houghton's (1986), and Houghton and Isard's (1987) AI models of conversation. The aim of this earlier work was to develop a theory of how non-linguistic goals give rise to conversation. Power's model has already been discussed in the previous section, and the Houghton and Isard model is a development of that.

The model was again based on a scenario in which two 'robots' have programs for running conversational procedures which are used to achieve simple co-operative goals. These were called Conversational Games. Conversational Games consisted of exchange pairs where one participant opens an exchange and thus defines its type, and the other participant is expected to respond appropriately (i.e there is ‘conditional relevance’ between components of a pair of utterances).

The robots 'knew' that successful conversational Games would either result in the transfer of necessary information, or in their partner performing some non-linguistic act which would be of benefit to the task in hand. They had a repertoire of four conversational Games; **GET_DONE, FIND_OUT, MAKE_KNOWN,** and **GET_ATTENTION.** The robots knew the 'rules' of each of these Games, in that they knew what goals to use them for, what kind of response was expected in reply to the initiating move of a game, and how to use that response. The robots' conversational abilities were therefore integrally linked with their other capacities and planning procedures.

The present system of analysis was developed to see whether Games analysis could account for natural, spontaneous human-human conversational structures. The original system of analysis was developed by Jacqueline Kowtko (HCRC, Edinburgh), with the aim of studying the relationship between intonational patterns and conversational function.

The analysis has now been used for a wide variety of purposes. For example studying developmental changes in conversational structure, changes in communication strategy across different communication media, and how verbal and non-verbal channels of communication combine. These are described in the thesis.

The following section gives a brief introduction to the kinds of dialogues which the Conversational Games analysis was first developed from, and which are studied in the thesis.

The use of task-oriented dialogues is often optimal when studying conversation since it is easier to judge the intent behind utterances if one knows what the interlocutors are trying to achieve, and what their state of knowledge is at any given moment. The coding system was first applied to Map Task dialogues (Brown, Anderson, Yule, & Shillcock, 1983; Anderson, Bader, Bard, Boyle, Doherty, Garrod, Isard, Kowtko, McAllister, Miller, Sotillo, & Thompson, 1991).

The author also coded another type of task-oriented dialogue, Maze Game dialogues, using Conversational Games analysis. This task has a less well defined role structure than the map task and is a very different task. The two participants sit in separate rooms and communicate via earphones and microphones. They both have a computerized maze configuration in which there is a 'player' and a goal. The task is for them both to get their players to their goals. The pathways to the goals may become blocked, and when this happens a participant must enlist the help of their partner. He/she will have to guide their partner into a 'switch' node in order to change the barrier configuration. The primary information-giving role therefore alternates between the two participants. The Games analysis has also been found to be successful in describing these dialogues. The categories included in Conversational Games analysis account for around 98% of the utterances in Map and Maze dialogues. The distributions of different Game types varies between the different types of task due to the fact that they involve different communication strategies (see Kowtko et al 1991).

2. The Analysis

There are two functional levels of analysis within the coding system, which are related hierarchically. These are Moves and Games. Conversational Moves are grouped into dialogue units called Conversational Games (these are roughly equivalent to Sinclair and Coulthard's exchanges, or Traum and Hinkelman's Discourse Units). Conversational Games are defined by the goal they serve within the interaction, and represent the discourse units necessary to ground and accomplish the linguistic and non-linguistic goals of the interlocutors. There are six categories of Games which have been found necessary and sufficient to describe the dialogues studied: **INSTRUCT, CHECK, QUERY-W, QUERY-YN, ALIGN,** and **EXPLAIN.** An example is an **INSTRUCT** Game which serves the goal of having the instructee accomplish some task designated by the instructor. This Game in its simplest form may consist of only one Instruct Move followed by the action required, but frequently other conversational Games, such as questions, will be embedded within the **INSTRUCT** Game in order to accomplish grounding and ultimately the action required. In summary, Moves are organised into Games, and there is a facility for the embedding of Games within one another. This approach, in contrast to the Sinclair and Coulthard approach, views such embedding of structures, of the same level, as a natural reflection of a recursive planning structure for conversation with goals and subgoals (Kowtko et al, 1991).

Conversational Moves are similar to some of Sinclair and Coulthard's conversational acts, and Traum and Hinkelman's core speech acts. The conversational Move category assigned to an utterance (and there may be more than one move per utterance, or more than one utterance per move), represents the conversational function which that utterance is supposed to accomplish. There are twelve Move categories and these will be described shortly, they are: Instruct, Check, Query-w, Query-yn, Align, Explain, Clarify, Acknowledge, Reply-y, Reply-n, Reply-w, Ready.

Conversational Games analysis can also be applied to everyday conversation. The following short example is given to illustrate the relationship between Games and Moves.

Game 1 **INSTRUCT**

Mary: Could you shut the window?

Instruct move

Game 2 **CHECK (embedded)**

Sam: Just the nearest one?

Check move

Mary: Yes.

Reply-y move

End Game 2

Sam: Okay then. (Shuts the window).

Acknowledge move

End Game 1

This illustrates two simple structures of two types of Games. The main goal of the interaction is Mary's goal to get Sam to shut a window, she therefore uses an **INSTRUCT** Game to do so. Sam is not sure whether he can accomplish this task to Mary's satisfaction (given that there is more than one window present), and therefore checks a possible interpretation of her instruction by using a **CHECK** game. Please notice therefore that it is often necessary when accomplishing the goal of one game to embed other Games, with their own subordinate goals, within that Game. Once the **CHECK** Game is satisfied the **INSTRUCT** Game continues with the required action and Sam's acknowledgement of his agreement to carry out the action.

Houghton's (1986), set of four Games was expanded upon and new Games added in order to account for frequent patterns of exchange that did not fit the original four. There are six types of Games and twelve types of Move. Six of the Moves are classified as Game initiating Moves and give the Games their classification, for example an **INSTRUCT** Game is initiated by an Instruct Move, the Game itself consists of the Moves which are necessary to ground and satisfy the goal of the initiating contribution.

Game Types

INSTRUCT: Communicates a direct or indirect request for action or instruction.

CHECK: Checks self-understanding of a previous message or instruction from conversational partner, by requesting confirmation that your interpretation is correct.

QUERY-YN: Yes-No question. A request for affirmation or negation regarding new or unmentioned information about some part of the task (not checking an interpretation of a previous message).

QUERY-W: An open-answer, Wh-question. Requests more than affirmation or negation regarding new or unmentioned information about some part of the task (not checking an interpretation of a previous message).

EXPLAIN: Freely offered information regarding the task, not elicited by co-participant.

ALIGN: Confirms the co-participant's understanding of a message or accomplishment of some task. Checks attention, agreement, or readiness.

Any of these Games types may also be further coded as abandoned if the Game is abandoned by the interlocutor, for example ignoring a question either explicitly or implicity.

Response Moves

Clarify: Clarifies or rephrases what has previously been said, usually repeats given or mentioned information, elicited by the conversational partner.

Reply-y: Affirmative response to an elicitation by partner.

Reply-n: Negative response to an elicitation by partner.

Reply-w: An elicited reply to a question from the partner which carries more information than just an affirmation or negation of the question.

Acknowledge: Vocal acknowledgement of having heard and understood a previous utterance.

Ready: Indicates intention to begin a new game and focuses attention.

The following is an exert from a Map Task dialogue from the HCRC database (Anderson et al, 1991). In this example the beginning of a conversation is shown. The Instruction Giver is attempting to establish mutual knowledge about the first section of the map route before proceeding with her first instruction. Both participants have a 'start' and a 'caravan park' in the same locations. The Instruction Giver has an 'old mill' which is called a 'mill wheel' on the Instruction Follower's map. They discuss this briefly but assume the features to be the same.

The speech is shown in bold with the move coding directly beneath, and the Game codes above. The speech is labelled as an Instruction Giver or an Instruction Follower turn. If such a label is not present on a line of speech then that speech is a continuation of an existing conversational turn.

<u>Game 1 Query-yn</u>
Instruction Giver: **{Right Eileen, okay,} have you got a caravan park?**
Move: {ready} query-yn
Instruction Follower: **Uh huh,**
Move: reply-y

<u>Game 2 Explain (embedded)</u>
on the bottom left hand side.
Move: explain
Instruction Giver : **That's great.**
Move: acknowledge
End Game 2
End Game 1

<u>Game 3 Query-yn</u>
Have you got an old mill just

about 4 o'clock to that?
Move: query-yn

Instruction Follower: **Eh, I've got a mill wheel.**
Move: reply-w
Instruction Giver : **Yep, that's fine.**
Move: acknowledge

<u>Game 4 Align (embedded abandoned)</u>
Instruction Follower: **Is that okay?**
Move: align
End Game 4
End Game 3

The following is an extract from a maze game dialogue. The same transcription conventions apply. What is happening in this segment of dialogue is that participant B is stuck and is instructing participant A to go into a switch node. Player A tells B that he can do that and does so.

<u>Game 9 Explain</u>
Participant B : **I've got two gates blocking me.**
Move: explain
End Game 9

<u>Game 10 Instruct</u>
So You're going to have to move and help me.
Move: instruct

Participant A: **Right.**
Move: acknowledge

<u>Game 11 Explain (embedded)</u>
I can move into a switch now.
Move: explain

Participant B: **Right.**

Move: acknowledge

End Game 11
End Game 10
**Comment Participant 'A' moves his symbol.*

One way of explaining why Game structure is realised in conversation as it is, is to consider the dialogue progression as a series of conversational and pragmatic decisions. That is, one can predict from the state of play in the task, the subjects' current knowledge states, and from the 'just presented' Move type what the next Move is likely to be. The prediction of conversational structure can therefore be represented by a set of decision bound flow diagrams.

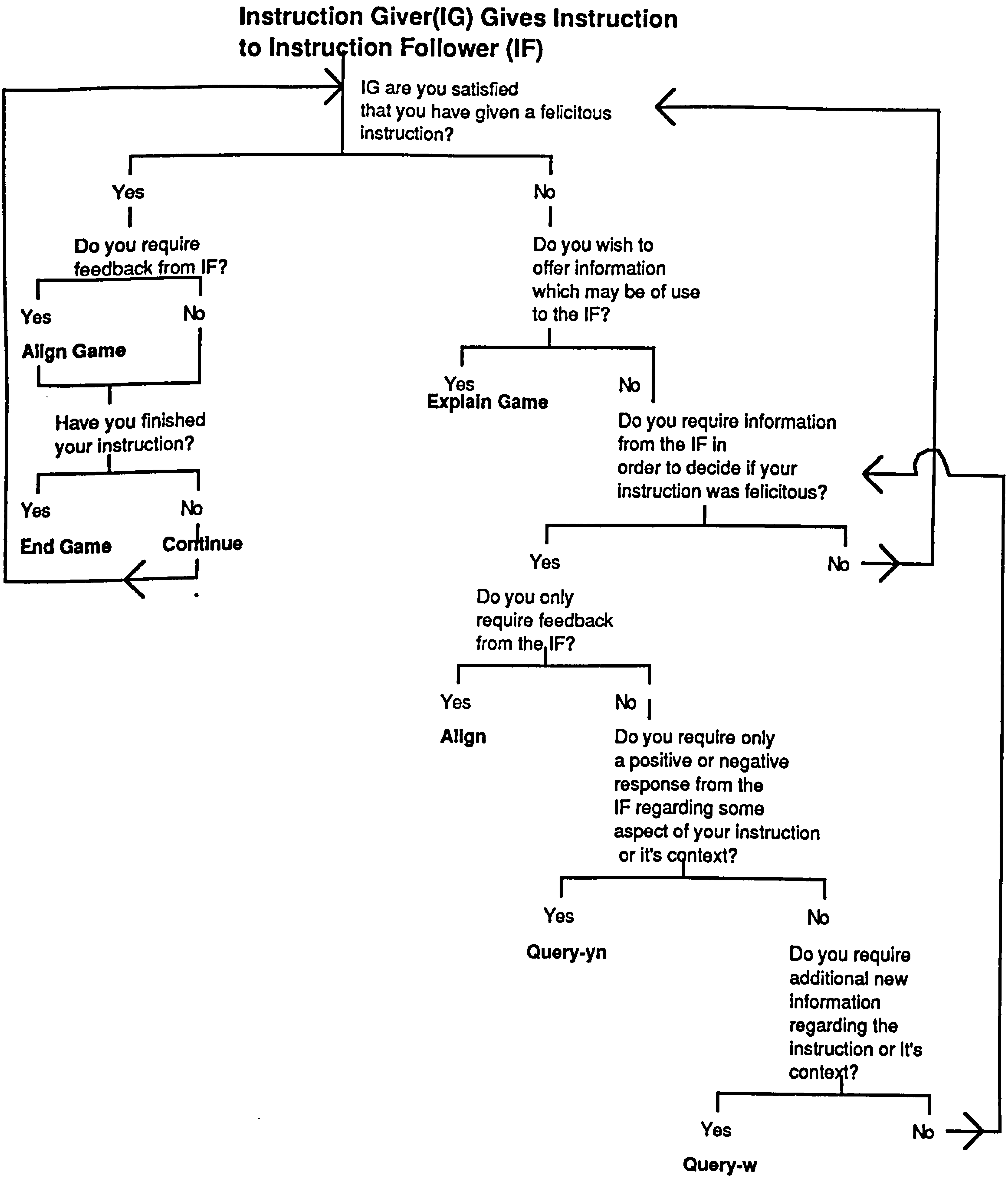


Figure 5.2 Flow diagram representing one set of possible conversational actions within a task oriented dialogue.

I have tried to represent this kind of model in Figure 5.2. The figure illustrates the sorts of conversational action which may occur while performing a task-oriented dialogue. The actions taken reflect the implicit and explicit self and discourse monitoring of the participant in question. This particular diagram shows various pathways which may be taken in a dialogue when an Instruction Giver (IG) gives an instruction. The decision branches can either loop back to a previous decision point or terminate. They may terminate with a response Move, or an initiating Move. If it is an initiating Move then this signifies the beginning of a new Game which must be completed. What will occur after the branch termination event can be predicted from the diagram relating to that particular Game or Move. A very simple course of event would be one where both participants' 'answers' to their first questions are yes. 'A' is therefore happy he has given a felicitous instruction, and 'B' is happy that she understands and is able to carry out the required action. The next Conversational Move is likely either to be an Align Move from 'A', an Acknowledge Move from 'B', or a continuation of the instruction from 'A'.

Such diagrams do not represent every eventuality within an interaction, but they do represent the sorts of planning procedures which may underlie some conversational processes.

In summary the Conversational Games analysis strives to show how grounding occurs in conversation through the use of speech acts.

It's main advance upon the other accounts discussed, is the way in which it regards speech acts as tools which are used in the grounding of conversational goals and subgoals. The speech acts themselves must be grounded, but so must the goals which the interlocutors are attempting to achieve.

E. Study 1: Assessment of the Analysis System

All of the dialogue coding systems described in this chapter share certain similarities. This is because they are all attempting to give functional accounts of the structure of task-oriented dialogues. None make the claim that they provide exhaustive repertoires of conversational functions. Conversational Games analysis is used in this thesis to provide one way of studying how conversational structure and functions are influenced by various external variables.

The approach taken in this thesis bridges the gap between 'conversational analysis' and the 'corpus based approach' in a couple of ways. First, although it uses a system of analysis based on the categorisation of utterances, this is done on the basis of taking many aspects of that utterance into account, including its very individual context. Secondly, in attempting to describe conversational structures it also strives to account for the relative frequency with which certain structures occur, not just that they occur, and what role they play in the communicative process.

1. Dialogue Coding

When coding an utterance several sources of information are used; the verbal content and syntax of the utterance, intonational and prosodic cues, position in the discourse, both discourse and situational context, and finally visual non-verbal cues (if necessary). Situational context is used here to describe the interlocutors' current state of knowledge, which can be ascertained by examing their progress in the task used to elicit the dialogues.

Moves are defined by the perceived intended function of their speaker. For example, instructions which are presented in question form are coded as instructions, unless it is judged that the speaker has the intention to elicit information rather than obtain a required action from their interlocutor. Coders worked primarily from audio tapes but if necessary the video recordings were also used if enough information was not available from the audio signal. Speakers' intentions were therefore judged on the basis of syntax, semantic and pragmatic information, and intonational cues. It was sometimes necessary to include reference to visual signals but this was fairly infrequent.

If the Conversational Games analysis is to be a useful tool for describing dialogue then it must encompass most of the possible utterance types in the dialogues to be studied. It must also show high inter-judge reliability. The purpose of the present section is to show that Conversational Games analysis meets both of these criteria.

An experiment was conducted to evaluate the interjudge reliability of labelling conversational Moves. Both Map and Maze dialogues were used.

2. Subjects

Four subjects took part in the experiment. They were all honours psychology undergraduates who participated as part of course projects. The subjects had no experience of coding dialogues or of the two types of task-oriented dialogue used in the experiment. The two expert coders had developed the system and had been using the Game Analysis for about eleven months prior to this experiment.

3. Materials

Five task-oriented dialogues were used; two Map Task dialogues and three Maze Game dialogues (HCRC database).

4. Procedure

Since the subjects had no knowledge of discourse analysis, they were given literature to read, including an explanation of the Game coding system. The subjects also had several tutorials on the Conversational Game analysis, and were supplied with written instructions on how to classify Conversational Moves for the Game structure analysis.

The subjects were each given copies of the dialogue transcripts with accompanying audio tapes. The dialogues chosen for this study were chosen at random from the Map and Maze dialogue corpora. To avoid confusion over Move boundaries, the expert coder segmented the map dialogues into Moves on the transcripts before the subjects coded. The Maze dialogues have much shorter turns, and subjects were left to decide on their own where to place the few within-turn boundaries in each Maze dialogue. Subjects were asked to assign Move boundaries to another, unmarked, Map Task dialogue so that it was possible to measure agreement between both move classification and decisions of boundary placement within the Map dialogues. Subjects were instructed to assign one label to each designated Move. No mention was made that some moves may have a dual function.

Although the subjects were coding the same dialogues they did so independently of one another. While they were coding, the subjects were given the opportunity to question the experimenter if they felt they did not understand anything about the coding system, although at no time were they told how any given move should be coded. The subjects spent several hours coding over a period of about four weeks, coming to the experimenter with any non-specific problems that they had, which usually concerned their understanding of the coding instructions they had been given.

Once they had completed this task, the subjects' coded dialogues were compared with those coded by the experimenter. These were compared and the results represented on confusion matrices. The measure of consistency used was the percentage of moves in a dialogue on which the subject and experimenter agreed on classification.

5. Results

5.1 Move Coding Agreement.

One of the subjects made changes to some of his classifications having seen the experimenter's coding and was therefore not included in the analysis.

The twelve types of Move account for 98% of the moves classified (Kowtko, Isard and Doherty-Sneddon, 1991). That is only 2%,(15 in 730), of utterances in this sample of Map and Maze Game dialogues could not be coded according to these twelve functions.

The percentage agreement on Moves (n=730) for the three remaining subjects for both tasks is shown in Table 5.1. The mean consistency score for the three subjects on all the dialogues was 78%. Some of the dialogues result in higher interjudge reliabilities than others. In particular the Map dialogues appear easier than the Maze dialogues. This may be due to the increased ease with which coders can judge speaker intent in the Map dialogues. This is due to the clearer structure of the task. In the Map Task a set, predetermined route (already known by the coder) is followed. The structure of the Maze task is much less certain, and progression through the task is determined during the task by the participants. Coders of Maze dialogues can therefore be far less sure of the mutual knowledge shared by the participants, and this may contribute to the increased difficulty by which speaker intent can be judged. Likewise the Maze 3 dialogue appears to have been easier than the Maze 2 dialogue. This may be due to differences between the clarity of intent exhibited by speakers in the different pairs. Such between-pair differences are likely always to have some effect on the reliability of a coding scheme such as Conversational Games analysis. The distribution of Instruction Giver Moves in the adult dialogues is reported in Table 6.6.

Dialogue:	Map 1	Map 2	Maze 1	Maze 2	Maze 3
Subject					
1	84	86	77	70	75
2	86	81	72	73	85
3	81	77	72	69	77

Table 5.1 Percentage Agreement Between Expert and Novice Coding

All instances of erroneous coding on the part of the novices (defined as mismatch with experimenter coding) were extracted and examined. These errors were classified in terms of which types of Moves the novices confused with which type of experimenter coding. For example an experimenter's **REPLY-Y** Move was confused by a novice as an **ACKNOWLEDGE** Move. Twenty different types of mismatch were found to occur; however, some were very infrequent overall: for example, expert **EXPLAIN** confused with novice **CHECK** accounted for only 1.17% of the errors. This was the case even though **EXPLAIN** Moves are frequently produced (on average 30 **EXPLAIN** Moves occur per dialogue). Only 1% of expert **EXPLAIN** Moves are misclassified by the novice in this way.

The mismatch which accounted for the greatest proportion of error was a Move coded by the experimenter as **REPLY-W** and by the novice as **EXPLAIN**. In such a case, the novice had overlooked the fact that the Move had been elicited by the other dialogue partner and was not a spontaneous information-giving move. This sort of mistake was one that could be easily rectified and recognised by the novice coders. It is caused by a lapse in attention to the coding rules rather than an inherent difficulty in understanding the concepts behind the coding categories. Some of the mismatch types were therefore classified as "retrainable". These accounted for about 54% of the error. These mismatches in coding were most likely due to the inexperience of the novice coders with the coding system and their misinterpretation of some of the coding instructions they were given. This view is supported by the self-reports of the novice coders after the exercise was finished and various mistakes were pointed out. Also it is clear, in the retrainable cases, that each mismatch could be associated with a specific misinterpretation of instructions.

Of the total error 54% was therefore classified as retrainable. It is predicted that, if these novices were given more detailed descriptions of the categories involved in these mismatch types, the overall consistency would rise from 78% to 89%. A more recent reliability study with different novices showed that with further training their mean reliability was 84%. Six out of the 10 categories of error previously defined as retrainable were still occurring, and errors of these sorts accounted for 61% of error at that time. Perhaps with further practice even more error would be eliminated. However these results do suggest that even mismatches in coding which can be described in terms of a specific misjudgement (and are therefore retrainable) may in fact always remain within the residual error of the coding scheme.

Of the remaining 46% error it is likely that some, as yet unidentified, proportion would be retrainable. The remaining would be due to individual random error, such as lapses in attention while coding. With such a system of coding, based upon subjective judgements of speaker intent, it is inevitable that there will sometimes be differing opinions as to what that intent was. As conversationalists we do sometimes misinterpret our conversational partners' intentions, causing misunderstandings which require to be repaired, it is therefore not surprising that as a coder one will also misread intention.

There is some error which may be inherent to the coding system: for example, confusion of **ACKNOWLEDGE** and **READY** Moves, which account for 15.5% of the total error. Such Moves are usually carried by single lexical items such as "right" or "okay" and are often difficult to classify. **READY** Moves signal the beginning of a new Game, while **ACKNOWLEDGE** Moves often signal the completion of a Game, and it is difficult to tell if these lexical items 'belong' with a new Game or the immediately preceding one. These Moves are less central to the Game analysis, however, and are thus of less concern than retrainable instances.

5.2 Move Boundary Agreement.

In order to check whether coders were consistent in their Move boundary placements, one Map Task dialogue was examined. The results appear in Table 5.2. In this dialogue disagreements between the subjects and expert were caused by the subjects both inserting more move boundaries and disagreeing with the expert's boundary placement. The mean agreement between novice and expert was 81%.

Subject	Percentage Agreement between Expert and Novice for Move Boundaries (Map 3)
1	88
2	80
3	75

Table 5.2 Percentage Agreement between Novice and Expert for Move Boundaries

The interjudge reliability could be spurious if novices use a very conservative strategy of, for example, coding a Move boundary after every word. This would produce many false positives. A signal detection analysis was therefore carried out. Data for 2 of the subjects is shown in Table 5.3 (the data from 1 subject was lost prior to this analysis). This shows that the Novices tended to put in more Move boundaries than the Expert but that this was not of a magnitude to have been the cause of the high interjudge reliabilities. The interjudge reliability is therefore not spuriously high.

Hits	False Positives
468	101
Misses	Correct Misses
41	25

Table 5.3 Signal Detection Analysis of Move Boundary Agreement Hit = Both Novice and Expert agree on Move boundary; False Positive = Novice codes a boundary where Expert does not; Miss = Novice misses a boundary which Expert codes; Correct Miss = Neither code a Move boundary (e.g. where a Move spans 2 of the speaker's turns no boundary should be coded between the turns).

5.3 Game Coding Agreement.

A dialogue from the Map Task Corpus was independently coded by

2 expert coders and inter-judge agreement of Games was measured. Reliability of this agreement was measured using Kappa, a coefficient of agreement for nominal scales described by Cohen (1960). It was found that $k = .7$, $p<.001$, therefore there was significantly more agreement between the 2 coders, across the 6 types of Games, than would be expected by chance. Indeed this level of agreement is high since kappa is a coefficient which ranges from -1 to 1, with a score of zero indicating no agreement. Seventy-five percent of times where 1 coder marked the beginning of a Game the second coder agreed both that a new Game had begun and on the type of Game. Many of the mismatches were cause by disagreement about where Games began and ended, for example one coder may initiate a new **INSTRUCT** Game while the other continues a previous Game for another turn before initiating the new **INSTRUCT** Game. When such diagreements are taken into account the interjudge agreement rose to 90%.

6. Conclusions

From the results of the interjudge reliability study, it can be concluded that even newly trained novice coders perform well on Move classification (78%). From an examination of the types of errors made by the novices, it was concluded that 10 of these types could be eliminated by clarifying instructions to the subjects, and allowing them more practise. The removal of this section of the error would raise the coding reliablity to 88%. As the novice becomes more 'expert' the amount of error will therefore decrease.

Some of the remaining error may arise from either weakness in the coding system itself, or difficulty in assessing a speaker's intent. Either way it is unlikely that a perfect reliability could ever be reached with such a coding system, especially since any coder will always be an overhearer of the interaction concerned and cannot be party to all the communicative signals passing between the interactants.

The high agreement on Move boundary placement (mean=88%) shows that the concept of the move is understood by the novice subjects. This result combined with the move classification performance suggests that entities like moves are psychologically useful. Even ethnomethodologists would have to admit that, given the relative ease with which this concept is acquired by people who had never consciously thought about conversational processes before, the Move concept has some psychological validity. The reasoning behind this is that, making conversational processes explicit through Conversational Games analysis is an easily acquired skill since, as conversationalists, we already have such knowledge implicit in our existing conversational skills. We already have implicit ideas about functional units within conversations which may be termed Conversational Moves. What we do when learning to code is simply learn to explicitly name these units.

A high inter-judge reliability was also found for the coding of Games between expert coders, both in terms of segmenting dialogue into Games and in the functional catergories given to Games.

In summary, 'Conversational Games analysis' is one of many systems of dialogue analysis. It shares certain characteristics with previous accounts, such as it's use of the concepts of speech acts, adjacency pairs and grounding processes. It is a valid and reliable method of describing the structure of conversation. It remains to be seen whether this level of granularity is a useful dialogue analysis tool. Conversational Games analysis is used in the analysis of Map Task dialogues in this thesis. It has also been applied to Maze Game dialogues (as mentioned) and to more naturalistic data in the form of conversations between sales-people and their customers. It is expected that the system of analysis will be a useful tool for many kinds of interactions. It is likely that the repertoire of Games discussed presently may have to be fine-tuned to other kinds of interactions with some Games being less prevalent and others being added. The following chapters show that the system can distinguish between dialogue occurring in different communicative contexts, and between interlocutors of different ages.

F. Chapter Conclusion

Many ways of describing the structure of conversation have been proposed. Disagreement about how to study the process of communication exits between conversational analysts who primarily study naturalistic data, and those taking an experimentally based approach. There is however considerable overlap in many of the approaches in terms of the kinds of issues which they address, and perhaps these overlaps reflect the nature of communicative phenomena.

The approach which is taken in this thesis is to view dialogue as structured both in terms of communicative functions, and how mutual understanding of contributions is established. While in this thesis it is used in the analysis of experimentally generated dialogues, it is an analysis system which generalises to more naturally occurring conversations. It has to date also been applied to 'real-life' conversations between sales-persons and their customers.

The Games analysis coding scheme is used to analyse dialogues in this thesis in order to investigate the pragmatic differences in the structure of dialogue in face-to-face and audio-only communication. It is also used to investigate the way in which dialogue structure changes as age increases. While the review of the referential literature in Chapter 3 suggests that young children's communicative abilities are rather limited, more naturalistic studies, such as that done by McTear (1985) and Dore (1977a), suggest that their abilities are far greater. McTear proposes that communicative competence and function precedes and fuels language development, and that even very young children (of around 4 years of age) have considerable communicative intent and ability. Likewise Oschs, Schieffelin, and

Platt (1979) and Scollon (1979) propose that even early 1 and 2 word utterances can carry functions which are later carried by full, syntactic sentences, and therefore communicative function precedes language form. There is also sufficient evidence in the sociolinguistic literature which shows that children are very aware of the felicity conditions associated with different illocutionary acts, and are able to use general inferential skills about functions of utterances (Garvey, 1975; Reeder, 1980). I therefore expect that children will use the communicative functions which adults use in their interactions, in other words they will exhibit the same range of Conversational Games. However, given the children's more limited language and other cognitive skills, their attempts with many Games will not be as successful as those of the adults.

While many referential studies have underestimated children's abilities due to the artificiality of the communication tasks used, naturalistic studies suggest that children's abilities go beyond this. However analysis of naturalistic data is fraught with difficulties (McTear, 1985). This thesis bridges the gap between these approaches by investigating spontaneous interaction in an experimental, corpus based approach.

Chapter 6: Conversational Games Analysis of Adult Dialogues

A. Introduction

I have shown in Chapter 5 that the Games analysis is a reliable discourse analysis system. I also speculate that the relative ease with which novice coders can achieve good levels of interjudge reliability, reflects the psychological validity of the system. The next step therefore is to put this analysis to use. The following is a report on the sorts of Game structures which adults use to accomplish the Map Task. In order to study, developmental changes in conversational structure and communication strategies, it is first necessary to establish a mature model of conversational skill.

The purpose of the present chapter is two-fold. First to describe the structure of adult Map Task conversations, and second to see how this structure changes in response to different communication modes. I shall compare situations where the interactants can see each other with those where they cannot.

Comparison between the face-to-face and audio-only conditions is of interest because of effects which different communication modes, (e.g. computer supported communication or teleconferencing) may have on the communicative process. It also has a bearing on the role of non-verbal factors in the communicative process. To date most research has been concerned with either linguistic or non-linguistic aspects of communication viewed in isolation. In this thesis a more holistic approach is taken in line with various other researchers, (Beattie,1980; Boyle, Anderson, and Newlands, 1992;) who see communication as involving the integration of both non-verbal and verbal processes.

Much of the literature on the effects of different communication media (see Chapter 2 for a brief review) has concentrated upon overall performance or basic interactional features such as interruption rate or the degree of over-lapping speech. For example Boyle et al (1994) report that communicative success on the map task does not alter when subjects perform the task in an audio-only condition compared with when they can see one another. However in order to attain the same level of success in the audio-only condition the subjects required more conversational turns, interrupted one another more frequently and used more back-channel responses, (see Williams, 1977, for a review of some related literature). The analysis presented in this thesis bridges the gaps between studies of communicative success (Krauss and Glucksberg,1969; Clark and Wilkes-Gibb, 1986), attempts to describe the structure of conversation (Sinclair and Coulthard,1975; Bellack et al,1966; Sutcliffe and Cooper,1990), and work done on the influence which non-verbal signals have on the communicative process.

B. Study 1: Conversational Games Analysis of Adult Dialogues

The purpose of the present study is to find what sort of structure adult Map Task dialogues have in terms of Conversational Games, and the way in which this structure is affected by changing the communicative context. The different communicative roles played by the Instruction Giver and the

Instruction Follower are also investigated.

Two general predictions are made. First it is expected that Games used to check on the grounding of information, such as **ALIGN** and **CHECK** will be used more in the audio-only context since visual signals, which may indicate how well the interaction is going, will not be available. These increases may account for some of the increase in dialogue length found by Boyle et al (1994). Second, it is expected that the different roles of Instruction Giver and Instruction Follower should be reflected in different frequencies of initiation of certain Games.

1. Subjects

Thirty-two dialogues from the HCRC database, produed by 16 different speakers were Game coded. The subjects were undergraduates of the University of Glasgow. Four subjects, which will be referred to as a quad, were used in any one session. Each quad consisted of two familiar pairs of subjects who where unfamiliar with either subject in the other pair. Each subject completed 2 Map Tasks with a familiar partner (once as Instruction Giver, once as Instruction Follower), and 2 Map Tasks with and unfamiliar partner (once as an Instruction Giver and once as an Instruction Follower).

2. Procedure

As mentioned previously, the Map Task is carried out between a pair of subjects who sit facing one another with a two-way eisel between them. Half (2 quads) of the subjects performed the procedure when they could see one another's faces and upper bodies (but not each other's maps). The other half performed the task in an audio-only condition, where a screen was placed between them. Refer to Figure 1 for examples of the Maps, with the instructions as in Chapter 4. The full set of Maps is presented in Appendix 2.

Analogue and digital audio recordings were made of all the interactions, with direct recording from head-set microphones to the tape recorders. Two video cameras were also set up, each placed to record one of the subjects.

These recordings were used together with audio-based transcripts of the dialogues and Map drawings to Game code the conversations. So each subject's knowledge state could be inferred from the position of their Map route together with what was known about shared and unshared Map features. This made it possible to accurately code the function of utterances.

3. Results

The data is reported in two forms. First the mean numbers of Games were analysed to see whether the turn- and word- length differences which Boyle et al (1994) report can be accounted for by different types of Games. The data is then normalised for length of dialogue by computing the number of Games per 100 turns and this was used to investigate the structure of the dialogues.

Preliminary analysis revealed no effect of familiarity on the use of Conversational Games. The data was therefore collapsed across this variable for all further analyses.

3.1 The Effect of Visibility Context on Game Structure

A by-dialogue analysis was used with the mean number of Games produced in each dialogue as the dependent variable. This data was entered into a 2-way ANOVA with 2 levels of Visibility Context (face-to-face or audio-only interactions) as a between-subjects factor and Game type (6 levels: **CHECK, INSTRUCT, ALIGN, QUERY-YN, EXPLAIN, QUERY-W)** a within-subjects factor.

Game Type	No. Games Per Dialogue
CHECK	16
INSTRUCT	14
ALIGN	13
QUERY-YN	11
EXPLAIN	10
QUERY-W	6

Table 6.1: Incidence of Game Types in Adult Dialogues

This revealed a significant main effect of Visibility Context $F(1,30) = 5.24$, $p<.05$ (mean number of Conversational Games produced per dialogue; visible context = 56, visible context = 84). The increase in the number of turns reported by Boyle et al is therefore also reflected in an increase in the number of Games.

There was also a significant main effect of Game type, $F(5,150) = 9.1$, $p<.0001$. The means are presented in Table 6.1. This reveals the fact that some Games are used more than others in the Map Task dialogues.

The most frequently initiated Conversational Game is **CHECK,** which checks the speaker's understanding of an utterance from his or her interlocutor. The second most frequent Game is **INSTRUCT** which is primarily used by the Instruction Giver to tell the Instruction Follower where to draw the route. So almost half of the Games used involve instructions and the checking that grounding of information has occurred.

Game Type	Face-to-Face	Audio-Only
CHECK	13.3	18.9
INSTRUCT	12.3	16.7
EXPLAIN	9.3	11.2
QUERY-YN	9.1	12
ALIGN	6.4	20.5
QUERY-W	5.4	6

Table 6.2: Mean Number of Games of Each Type in Face-to-Face and Audio-Only Interaction.

There was also a significant interaction between Game type and Visibility Context, $F(5,150) = 3.8$, $p<.01$. The means are shown in Table 6.2. It can be seen from the table that all the Game types, except **QUERY-W** Games, are more abundant in the audio-only context than the face-to-face context.

Simple effects analysis showed that there were two differences between the Visibility Contexts. First there was an almost significant increase in the number of **CHECK** Games initiated in the audio-only context F (1,106) = 3.25, p = .07. Second there was a significant increase in **ALIGN** Games when subjects couldn't see one another, F (1,106) = 20.33, p <.001.

The first prediction made is therefore supported; the increase in dialogue length found by Boyle et al (1994) is manifest in an increase in Conversational Games. Furthermore this increase is caused by an increase in the number of certain types of Games, **ALIGNs** and **CHECKs**, which may be of particular importance in the grounding process.

3.2 The Effect of Participant Role on Game Structure

The two interlocutors play very different roles in the Map Task scenario. The IG primarily has to instruct the IF, and the IF primarily has to act upon these instructions. However, the grounding of a message is seldom a one step process (see Clark and Wilkes-Gibbs, 1986). Therefore, in order to attain a good performance Conversational Games other than **INSTRUCTs** will be necessary in order to ground the instructions sufficiently. The second prediction made was that Games analysis could be used to describe the different roles played by the IG and IF in the Map Task dialogues. The effect of Role on initiating different kinds of Games over and above **INSTRUCTs** was therefore examined.

A 3-way ANOVA was carried out with Context (face-to-face/audio-only)) and Role (IG initiated Games/IF initiated Games), as between-subjects factors, and Game type (6 levels: **CHECK, INSTRUCT, ALIGN, QUERY-YN, EXPLAIN, QUERY-W**) as a within-subjects factor. The dependent variable was the number of Games of each type which each subject initiated per interaction.

The significant effects of Context and Game type hold as above. There was a significant effect of Role, F(1,60)=6.58,p<.05, (mean IG= 41 Games per dialogue, mean IF= 29 Games per dialogue). Instruction Givers therefore initiate significantly more Conversational Games than Instruction Followers.

In addition there was a significant interaction between Role and Game type, F (5,300) = 61.11, p<.0001. Some Games are used more by the IG, others more by the IF. These means are shown in Table 6.3. So the second prediction is supported since Games analysis does differentiate the two roles in terms of who initiates which Games.

Game Type	Instruction Giver	Instruction Follower
INSTRUCT	14.3	0.2
ALIGN	12.5	1.0
QUERY-YN	7.3	3.2
EXPLAIN	4.0	6.2
CHECK	1.8	14.3
QUERY-W	1.6	4.1

Table 6.3: Mean Number of Games of Each Type Initiated by Instruction Givers and Instruction Followers.

Simple effects analyses showed that the use of Games was significantly different between the Roles for **CHECK,** (F(1,300) = 77.7, p<.0001), **INSTRUCT,** (F (1,300) = 99.8, p<.0001), **QUERY-YN,** (F (1,300) = 8.54, p<.005), and **ALIGN** Games, (F (1,300) = 66.1, p<.0001). **INSTRUCT, QUERY-YN,** and **ALIGN** seem to be primarily IG Games, whereas **CHECK** is primarily an IF Game. It can also be seen from the table that the majority of IG Games are **INSTRUCTS** and **ALIGNS,** which are used to give instructions, and to elicit feedback from the IF as to his/her understanding of the instructions. However the majority of IF Games are **CHECK** Games used by the IF to check his/her understanding of messages.

As in the previous 2-way ANOVA there was a significant interaction between Visibility Context and Game type, F (5,300) = 3.63, p<.005.

Simple effects analysis showed that the difference between the two contexts was significant for **ALIGN** Games, (F (1,300) = 24.83, p<.001) with the number of these Games increasing more than three-fold, and for **CHECK** Games, (F (1,300) = 3.97, p<.05). The increase in **CHECK** Games in the audio-only context is therefore significant when broken down by speaker role.

Game Type	No. Games Face-to-Face	No. Game Audio-Only
INSTRUCT (IG)	12	16
ALIGN (IG)	6	19
CHECK (IF)	12	16

Table 6.4: Incidence of Games which are Significantly Influenced by Visibility Context.

Finally, there was a 3-way interaction between Task Role, Visbility Context, and Game type, F (5,300)= 4.29, p<.001. Post hoc t-tests revealed that the previously mentioned increase in **ALIGN** Games in the audio-only context only occurred for IGs (t(300)= 7.23, p<.05), and the corresponding increase in **CHECK** Games only for IFs, (t(300)= 2.33, p<.05). One further difference between the two contexts emerged from this interaction; a post hoc t-test showed that for IGs there was a significant increase in the number of **INSTRUCT** Games in the audio-only context compared with face-to-face interaction (t(300)= 2.43, p<.05). These means are shown in Table 6.4.

3.3 Conclusions

From the data it appears that adult Map Task dialogues consist mainly of **INSTRUCT, ALIGN,** and **CHECK** Games. Furthermore these are produced primarily by one or other of the player roles in the task, **INSTRUCTs** and **ALIGNs** from the IG, and **CHECKs** from the IF. The dialogues therefore centre around the instructions being given by the IG, who often tries to elicit feedback (by using **ALIGNs**) as to whether the IF is able to carry out these instructions, whereas the IF uses **CHECK** Games to ensure that these instructions are sufficiently grounded. The following extract illustrates these Games in use, and is taken from a dialogue produced in the face-to-face context.

Game 9 INSTRUCT

Instruction Giver: **Well what I suggest you do, ...**
Move: Instruct

Instruction Follower: **Right. Okay. >**
Move: Acknowledge

Instruction Giver: **Ehm, is like ... Right. There's a ... There's a line about quarter of the way down and it's ...The bottom of it ... it's from the start, right, and the bottom of it is in parallel with the ravine.**
Move: Instruct continue

Game 10 ALIGN (embedded)

Instruction Giver: **You know the word ...**
Move: Align

Instruction Follower: **Uh-huh.**
Move: Reply-y

Instruction Giver: **ravine**
Move: Align continue

Game 11 QUERY-YN (embedded)

Have you got that?
Move: Query-yn

Instruction Follower: **I've got ravine.**
Move: Reply-y

Instruction Giver: **Right.**
Move: Acknowledge

End Game 11
End Game 10

So. It's like ... /
Move: Instruct continue

Game 12 CHECK (embedded)

Instruction Follower: **So I start from start a /**
Move: Check

Instruction Giver: **Uh-huh. And it's like a curve.**
Move: Reply-y Clarify

End Game 12

This section of dialogue begins with an instruction from the IG which involves a description of the route with respect to a ravine. He embeds an **ALIGN** Game (Game10) within the **INSTRUCT** to ensure that the conversation is focused on the ravine before continuing with his instruction. He then also embeds a **QUERY-YN** Game (Game 11) to ensure that the IF actually has a ravine on her map, and it is therefore felicitous to use it as a reference point. The IG then proceeds with his instruction before the IF interrupts with a **CHECK** Game (Game12) to check her understanding of what the IG has been saying.

Conversational Games Analysis therefore differentiates between the different dialogue contributions which are made by the two participants in the Map Task, both in terms of conversational functions and in the number of contributions initiated by each speaker. The Instruction Givers **INSTRUCT**, **ALIGN** and ask **QUERY-YN** questions, and these account for around 60% of the Games in the dialogues. The Instructions Followers initiate 40% of the Games which are primarily **CHECKs**.

Conversational Games analysis also reflects differences between face-to-face and audio-only communication. The increase in dialogue length found by Boyle et al (1994) is at least partially accounted for by an increase in **INSTRUCT** and **ALIGN** Games by IGs and an increase in the number of **CHECK** Games initiated by IFs. When there are no visual cues available to them the IGs therefore employ more **INSTRUCT** Games to instruct their IFs around the map and they try to elicit feedback more often. This may result from the influence of visual information, such as eye gaze and gesturing, which are potential channels of communication in the face-to-face condition. The IFs check their own understanding of the IG's messages more. This increase in the number of **CHECK** Games reflects the increased number of messages which require checking.

The acoustic quality of the speech in the audio-only context was better than the face-to-face context (Anderson, Bard, Sotillo, Doherty-Sneddon, & Newlands, 1994), therefore the messages were less intelligible in the face-to-face context. It appears that the increased need to **CHECK** and **ALIGN** in the audio-only context reflects the loss of visual information rather than degradation of the messages produced.

Clark and Brennan (1990) suggest that non-verbal signals such as eye gaze, play a role in establishing mutual understanding, and that having information from the non-verbal channel makes the grounding process easier. In the audio-only context grounding can only be accomplished through the verbal channel, and one would expect that more verbal 'effort' would be required since non-verbal information is not available. This is reflected, in the present data, by the increased numbers of times IFs check their understanding, and IGs elicit feedback in the audio-only context.

It was therefore found that the increase in length of audio-only compared with face-to-face interaction, reported by Boyle et al (1994), is at least partially explained by an increase in **INSTRUCT**, **ALIGN**, and **CHECK** Games used in the audio-only dialogues. When visual information is not available it takes more instructions to complete the map task, interlocutors attempt to elicit feedback more, and listeners check their understanding of messages more often.

3.4 Normalized Conversational Games Data

Since the dialogues were of variable length the data was normalized by dividing the total number of Games of each type in each dialogue by the total number of turns in each dialogue. The dependent measure used was the number of Games of each type which occurred per 100 turns.

It was predicted that Dialogue Games would require more speech to reach completion in the audio-only context compared with the face-to-face. It was also predicted that there would be changes in the proportion of certain Games such as **ALIGNs** and **CHECKs** between the two contexts. It was expected that the frequency of these Games would increase in the audio-only condition because of the lack of visual information.

Using this proportional data three differences between the contexts were found. First, in the audio-only context it took more conversational turns to complete or ground Conversational Games. Second, **ALIGN** Games occured proportionally more often when subjects couldn't see one another. Finally, there was a significantly lower proportion of **EXPLAIN** Games in the audio-only context.

A 2-way ANOVA was used, with Visibility Context (face-to-face/ audio-only) and Game type (6 levels: **INSTRUCT, EXPLAIN, CHECK, QUERY-W, QUERY-YN, and ALIGN**) as the independent variables. The dependent variable was the frequency per 100 turns with which the different Games types were initiated.

There was a significant effect of Visibility Context $F(1,30) = 8.0$, $p<.01$, (mean frequency of Game initiation in the face-to-face context = 45.6 Games per 100 turns, in the audio-only context = 39.8 Games per 100 turns). Conversational Games in the audio-only context must therefore be longer on average than in the face-to-face context. A separate analysis showed that this was the case, with face-to-face Games taking up 2.24 turns, and audio-only Games 2.54 turns, $F(1,30) = 8.0$, $p<.01$.

Game Type	Frequency per 100 Turns
INSTRUCT	10.5
CHECK	9.5
EXPLAIN	6.5
QUERY-YN	6.4
ALIGN	6.1
QUERY-W	3.8

Table 6.5: Frequency per 100 Turns of Each Game Type.

A significant effect of Game type was found, $F(5,150) = 13.7$, $p<.0001$. Some Games therefore occur more frequently than others. The mean frequencies of Games are presented in Table 6.5.

The interaction between Visibility Context and Game type was almost significant, $F(5,150) = 1.92$, $p=.09$. Since predictions that the proportions of certain Games such as **CHECKs** and **ALIGNs** would change with the changing context, simple effects analyses were carried out. Two significant differences between the contexts were found: first, the frequency of **EXPLAIN** Games decreased in the audio-only context compared with the face-to-face context, $F (1,168 = 3.9$, $p<.05$ (mean face-to-face = 7.65 per 100 turns, mean audio-only = 5.19 per 100 turns); second, the frequency of **ALIGN** Games increased significantly in the audio-only context, $F (1,168) = 4.38$, $p<.05$ (mean face-to-face = 4.85 per 100 turns, mean audio-only = 7.46 per 100 turns).

Interlocutors are therefore less likely to offer information without elicitation in the audio-only context, and more likely to try and elicit feedback from their conversational partner. The composition of dialogue in the audio-only context differs from that of face-to-face dialogue in that attempts to elicit feedback are more predominant, and freely offered information is more rare.

3.5 Conclusions

The purpose of transforming the data to normalize for length of dialogue was to find whether or not there were frequency and therefore compositional differences between the face-to-face and audio-only dialogues, as well as the numerical differences already illuminated by the raw data analyses. It was hypothesized that the longer dialogues in the audio-only context were not just extended versions of the face-to-face dialogues, but would also have other fundamental differences.

Three compositional differences were found. First the Conversational Games which subjects used in the audio-only context were significantly longer than those in the visible context, therefore when visual information is not available it takes more conversational turns to accomplish the goals of Games. This suggests that information in the visual channel is important for the grounding process. Boyle et al (1994) have already shown that it takes more turns to attain the same performance in the audio-only condition, and now the Conversational Games analysis has shown that this is also reflected in the microstructure of the dialogue.

Along with this increase in length of Conversational Games there are two further qualitative differences between the different communicative contexts: an increase in the frequency with which **ALIGN** Games occur; and a decrease in the frequency of **EXPLAIN** Games. From the increase in **ALIGN** Games it appears that at least one function which the visual channel satisfies is to provide feedback regarding how well the interaction is going and whether grounding has been accomplished. This result supports the proposal that the visual channel carries communicative functions over and above being a turn-taking regulator, (Boyle et al, 1994; Clark and Brennan, 1990).

The decrease in the frequency of **EXPLAIN** Games may reflect fewer opportunities to offer information in a non-visual context This will be the case if non-verbal information is important for the setting up such opportunities. This finding may therefore be indicative that offering information is a less preferred conversational when interlocutors can't see one another. Rutter (1987) suggests that without the visual channel there are fewer social cues and therefore people are more reluctant to 'take the floor'. Therefore the non-verbal channel carries social cues, and when these are not available interlocutors hold back from offering information without elicitation.

4. Discussion of Study 1

Conversational Games provide one way of describing conversational structure and content. The analysis differentiates, both quantitatively and qualitatively, between dialogues produced in face-to-face versus audio-only contexts, and between the different roles played by participants in the Map Task.

The minimum Game structure required to perform the Map Task would be for the Instruction Giver to give instructions and for the follower to carry out those instructions. This would only result in an adequate performance if the instructions were unambiguous and fitted the Follower's model of the situation perfectly. However, it seems that to accomplish the task, the other Games, which give rise to the interactivity of the dialogues, are also necessary.

Instruction Givers and Followers use different types of Games when performing the task. Instruction Givers primarily use **INSTRUCTs**, **ALIGNs**, and **QUERY-YNs**, while Instruction Followers primarily use **CHECKs**, **EXPLAINs**, and **QUERY-Ws**. The Instruction Givers' use of instructions reflects the structure imposed upon the participants by the task. Their use of **ALIGNs** and **QUERY-YNs** reflects the need to communicate cooperatively, and therefore ensure that they give felicitous instructions that the Instruction Follower understands and complies with.

Around half of the Instruction Followers' Game contributions are **CHECKs**, and this reflects their need to make sure that they have understood the Instruction Givers' messages sufficiently. Instruction Followers also offer information which they consider relevant to the interaction and the task (i.e **EXPLAIN**), and they ask more open questions (**QUERY-W**).

As well as these qualitative differences between the two task roles, there is also a general quantitative difference in that Instruction Givers initiate around two thirds of the total Games in the dialogues, and the Instruction Followers the remaining third. This reflects the distribution of 'conversational work' between the two participants. Given that conversational turns alternate between speakers such a measure does not give an accurate representation of the differential between the roles. Similarily, Boyle et al (1994) found that Instruction Givers produced significantly longer turns than Instruction Followers, and concluded that this reflects their dominant role within the task.

A general difference between seeing versus not seeing your partner is in terms of Game length. In the audio-only context Games are significantly longer. When visual information is not available more verbal effort is required to accomplish the conversational goal associated with each

Conversational Game. From this it appears that the visual channel carries communicative information over and above being a mechansim for turn-taking (the different views of the role visual information plays in the communicative process are discussed in Chapter 2).

Further evidence comes from differences in Game usage between contexts. For Instruction Givers the number of **INSTRUCTs** and **ALIGNs** significantly increases in the audio-only condition. Therefore more **INSTRUCT** units are required to accomplish the task in this context, suggesting that the Instruction Givers package the instructions differently in the audio-only context. The increase in **ALIGNs** suggests that one type on information which the visual channel carries is feedback information from the listener. Without visual information explicit elicitation of feedback becomes increasingly necessary. This increase in **ALIGNs** is also a compositional difference between the interactions in the two contexts since the frequency of their occurrence per 100 turns increases when participants cannot see one another. Instruction Givers therefore use more Games in the audio-only context but also change their communicative style towards one more oriented to feedback elicitation. This may be symptomatic of a feeling of greater uncertainty in this context, because they cannot see their partners. This increase in 'interactivity' on the part of the Instruction Givers illustrates their attempts to communicate in a felicitous and co-operative way. If you are not sure that your interlocutor has understood what you have said to them you should seek feedback regarding this before continuing. I would like to propose that this feedback information is gained both via the verbal and visual channels, and is more likely to be obtained visually in face-to-face interaction.

The Instruction Followers increase the number of **CHECK** Games which they initiate in the audio-only context. This is likely to be due to the increased number of Games which there are to check, since the frequency of checking does not increase. Communicative style changes in this context, for the Instruction Followers, in that they decrease the frequency with which they freely offer information (**EXPLAIN** Games). It is suggested that this may be due to a reluctance to 'interrupt' the interaction since a lack of visual cues increases the level of formality within the dialogue (this is also reported by other authors, for example Rutter & Stephenson, 1977; Beattie & Barnard, 1979; Ellis & Beattie, 1986). This therefore supports the view that visual information performs social functions (Rutter, 1987).

In summary, it appears that visual information has an effect on the efficiency with which participants can communicate and ground necessary information. In particular it performs both feedback and social functions. Given the marked effects which the lack of the visual channel has on verbal communication it appears that visual information is an important and integral part of the communicative process. Visual signals are not just related to the verbal channel by juxtaposition, they clearly share communicative functions with the verbal channel.

The following section reports results from a further investigation of the feedback function in relation to gaze patterns. The methodology involved is novel in seeking a relationship between eye gaze and the dialogue function of the accompanying utterances.

C. Study 2: The Function of Gaze in Face-to-Face Interaction

1. Introduction

Two main views of the role of gaze in the communicative process are given in the literature. The first proposes that gaze functions primarily as part of the turn-taking mechanism, (e.g Sacks, Schegloff & Jefferson, 1974). The second approach proposes that gaze is associated with information transfer, thus gaze is treated as a channel of information through which mutual knowledge can be established (e.g Clark & Brennan, 1991). I would like to propose that gaze is multifunctional and serves both of these roles.

1.1 Gaze and Information Transfer

The interactions studied here were coded both verbally and non-verbally. This allows one to study what verbal functions (in terms of Conversational Games and moves) are associated with non-verbal acts such as gaze. If relationships between verbal functions and gaze exist, then this should indicate what functions gaze serves.

2. Do ALIGN Games and Gaze serve the same function?

I have suggested that in the face-to-face context gazing at one's partner will allow access to feedback information, for example a speaker can look up and see whether their partner has completed an instruction and is looking up waiting for the next. However in the audio-only context one must use a verbal alternative, the **ALIGN** Game, and stop and ask whether your partner has finished and is ready to continue. In the present section this is investigated in more detail. It is predicted that gaze and **ALIGN** Games occur in the same positions in the dialogues, and they are therefore likely to be fulfilling the same communicative function. The following investigates where **ALIGN** Games are found within the interactions. I will then report results from an analysis of gaze location with respect to the structure of the verbal channel.

ALIGN Games are primarily initiated by the IG (approximately 92% of **ALIGN**s are initiated by the IG). Feedback elicitation is therefore primarily an IG responsibility. If there is a relationship between **ALIGN** Games and eye gaze, within these interactions, then it will be for the IG rather than the IF. Because of this, only the relationship between IG Gaze and IG **ALIGN** Games is reported.

2.1 Where do ALIGN Games Occur?

A subsample of the interactions which had previously been Game coded were further investigated (8 face-to-face and 8 audio-only). The location of each **ALIGN** Game was found and this context was noted. It was found that **ALIGN**s occur associated (primarily by juxtaposition) with 5 of the Move types: **Instruct, Clarify, Reply-y, Reply-w,** and **Explain**. There are 13 Move types in total in Conversational Games analysis. Definitions of each of the presently relevant Move types are as follows:

Instruct: Communicates a direct or indirect request for action or instruction.

Explain: Freely offered information regarding the task, not elicited by co-participant.

Clarify: Clarifies or rephrases what has previously been said, usually repeats given or mentioned information, elicited by the conversational partner.

Reply-y: Affirmative response to an elicitation by partner.

Reply-w: An elicited reply to a question from the partner which carries more information than just an affirmation or negation of the question.

It is important to note here that we are discussing Moves and not Games. Each of the above Move types represent an utterance or part of an utterance which attempts to accomplish one of the above functions. Each is produced by a single speaker and this distinguishes them from Conversational Games which are joint endeavours between the two participants to accomplish a conversational goal (Conversational Games were the subject matter of the main body of the chapter showing the differences in dialogue structure between the conditions).

Ninety-one percent of the **ALIGN** Games which occurred in the sample of dialogues were investigated. The remaining 9% of **ALIGN** Games could not be coded for association. Each **ALIGN** was coded as associated with the Move type produced immediately prior by its speaker. Exceptions were made when it was judged that it served to **ALIGN** information which was used after the alignment. Examples follow:

1/

ALIGN associated with a previous **Clarify** Move;

--->

Instruction Giver: Vertical right. A vertical line... This is quite good...Vertical line, and stop just where the "r" is in forest.
Move: Clarify
Game 36 ALIGN Embedded
Do you know what I mean?
Move: Align
---->

2/

ALIGN associated in a 'forward' relationship with an **Instruct** Move.

---->

Game 120 ALIGN Embedded
Instruction Giver: You know that wee curve?
Move: Align
Instruction Follower: Uh huh
Move: Reply-y

Instruction Giver: There's a wee curve.
Move: Align continue
Follow that wee curve
Move: Instruct cont
--->

Speakers are therefore more likely to check that their partner has understood or accomplished some types of dialogue Move than others. Information giving Moves such as instructions and clarifications are frequently accompanied by such feedback elicitations. Eighty one percent of **ALIGN** Games are associated with these two types of dialogue Move.

Move Type	No. Moves per Dialogue (face-to-face)
Instruct	27
Clarify	14
Acknowledge	12
Query-yn	10
Reply-y	9
Explain	7
Align	6
Reply-n	3
Reply-w	3
Ready	3
Query-w	2
Check	2
Interjection	1

Table 6.6: Mean Number of Each Move Type Per Dialogue.

Instruct and **Clarify** Moves are the most frequently produced Move types by the IGs, see Table 6.6. The fact that **Instruct** and **Clarifies** account for most of the **ALIGN** Games could therefore be due to the fact that they are such frequently occurring Moves. In order to show that this was not the case chance levels of associations with these Moves were calculated and compared to the observed levels of association. The conditional probability of **ALIGN** Games co-occurring with **Instruct** and **Clarify** moves was worked out by multiplying the frequency of occurrence of these Move types by the frequency of occurrence of **ALIGN** Games (frequency was calculated by dividing the number of occurrences by the total number of Moves). The mean probability that an IG Move would be an **Instruct** or a **Clarify** was 0.48. The mean probability for the occurrence of an **ALIGN** Game is 0.11. The mean conditional probability of the co-occurrence of and **Instruct** or a **Clarify** with an **ALIGN** Game is therefore 0.05. This chance level of co-occurrence was compared with the actual level of co-occurrence.

A 2-way ANOVA was used, with Visibility Context (face-to-face / audio-only) and CHOB (chance / observed) the independent variables. The dependent variable was the probability of co-occurrence of either **Instruct** or **Clarify** Moves with **ALIGN** Games.

A significant effect of CHOB was found, $F(1,14) = 5.96$, $p<.05$, with the observed probability of co-occurrence being significantly higher (0.065) than the chance level (0.05). **Instruct** and **Clarify** Moves are therefore associated with **ALIGN** Games significantly more frequently than would be expected by chance.

There was also a significant effect of Visibility Context, $F(1,14) = 8.52$, $p<.05$. The probability of the co-occurrence of an **ALIGN** Game with one of the two Move types was significantly higher in the audio-only context (0.081) compared with the face-to-face interactions (0.035).

Visibility Context	Chance	Observed
Face-to-Face	.033	.036
Audio-Only	.066	.095

Table 6.7: Chance and Observed Probablities of ALIGN Games Occuring with Instruct or Clarify Moves, in Face-to-Face and Audio - Only Interaction

The interaction between Visibility Context and CHOB approached significance, $F(1,14) = 4.0$, $p=.065$. This was therefore investigated in more detail using simple effects analysis. The means are represented in Table 6.7. The effect of Visibility Context was only significant for the observed data, $F(1,14) = 11.94, p<.01$. Furthermore the significant difference between the chance and observed probabilities was only evident in the audio-only context, $F(1,14) = 9.86$, $p<.01$.

2.1.1 Summary

In audio-only interactions there is a significant relationship between **Instruct** and **Clarify** Moves and elicitation of feedback. Feedback elicitation occurs with these Move types significantly more than would be expected by chance when the non-verbal channel is not available. When non-verbal information is available no such relationship exists. This therefore further supports the claim that feedback elicitation is a dialogue function which can be carried both in the verbal and the non-verbal channel. In audio-only interactions significantly more verbal feedback elicitation occurs and this is linked reliably to certain Move types. The large increase in the occurrence of verbal elicitation of feedback in the audio-only context is therefore not due to a random increase in **ALIGNs**, but is due to strategic increases in the frequency of alignment of certain dialogue functions. What remains to be shown is whether signals in the non-verbal channel are linked to the same dialogue Moves in the face-to-face interactions. The following section reports analysis of one non-verbal signal, eye gaze.

2.2 Where Does Gaze Occur?

It is proposed that by gazing while delivering an **Instruct** or **Clarify** Move a speaker may judge whether his or her interlocutor understands or agrees with what is being said, and therefore in the face-to-face context an **ALIGN** Game will not be necessary. If gaze and **ALIGN** Games serve the same communicative function, to access interlocutor feedback, then it is expected that they will occur in the same dialogue locations. Here we investigate the occurrence of gaze on the two Move types, **Instruct** and **Clarify** which are highly associated with **ALIGN** Games. If visual signals, such as gaze, can be used as a non-verbal substitute for such Games, then we would predict that gaze should frequently occur in association with Instruct and Clarify Moves in face-to-face interactions since **ALIGN** Games occur with these Moves in the audio-only context.

If some or all of the speech which constituted a Move was accompanied by gaze then that move was said to be associated with gaze. The following is an IG turn (which functions as an **Instruct** Move) taken from the corpus. The underlined segments represent where the IG gazed during this turn:

IG: <u>Right,</u> go vertically down until you're underneath, eh, <u>diamond mine.</u> Then, eh, go right until you're between springbok and highest <u>viewpoint.</u>

Move Type	
Instruct	34
Clarify	19
Query-yn	17
Explain	8
Interjection	7
Reply-w	5
Align	5
Reply-y	4
Reply-n	3
Acknowledge	3
Query-w	2
Check	2

Table 6.8: Proportion of Instruction Giver Gaze which Accompanies Each Move Type.

The Conversational Moves most frequently associated with **ALIGNs** (**Instruct** and **Clarify**) in audio-only interactions, also appear to be frequent elicitors of Instruction Giver gaze in face-to-face dialogues. Table 6.8 presents the proportion of IG Gaze which accompanies each of the Move types. It appears that **Instruct** and **Clarify** Moves are strong elicitors of gaze, accounting for 53% of the total IG gaze. However, as mentioned previously, these are the most frequent Moves produced by the IGs. The abundance of gaze co-occurring with these Move types may therefore simply reflect their frequency. The chance probability of gaze co-occurring with these Move types was therefore calculated in the same way as the chance association of **ALIGN** Games was in the previous section (the probability of gaze occurring was multiplied by the probability that one of these Moves types would occur, thus giving the conditional probability of co-occurrence). This was then compared to the observed probabilities of co-occurrence of gaze with **Instruct** and **Clarify** Moves.

A 1-way ANOVA was used to compare the chance and observed probabilities of co-occurrence of gaze with **Instruct** or **Clarify** Moves. The independent variable was CHOB, as before (chance versus observed). The dependent variable was the probability of co-occurrence of gaze with **Instruct** or **Clarify** Moves.

The observed probability of the co-occurrence of gaze with either an **Instruct** or a **Clarify** Move was higher than would be expected by chance, $F(1,15)= 7.1$, $p<.05$ (observed= 0.21, chance= 0.18). Therefore these Move types are accompanied by more than chance levels of gaze even when allowing for the frequency with which they occur (the raw data for this analysis is shown in Appendix 3).

It appears that a considerable amount of IG gaze occurs in the dialogue locations which we would predict if it does indeed serve the same function as **ALIGN** Games do in the audio-only context. This does not account for all of the gaze since gaze is a multifunctional phenomenon. What matters for present purposes is that gaze occurs in the same locations as do **ALIGN** Games and can therefore potentially serve the same function.

3. Conclusions

Explicit verbal elicitation of feedback (in the form of **ALIGN** Games) occurs primarily with information giving Moves, and in particular **Instruct** and **Clarify** Moves. Instruction Giver gaze also occurs primarily with these Moves, 53% of IG gaze while speaking occurs with just these two Moves. This suggests that one function which gaze plays in the face-to-face interactions is to access feedback information concerning the comprehension and agreement of the speaker / gazer's interlocutor. When the speaker cannot see his or her partner then **ALIGN** Games are used instead.

D. Chapter Conclusion

Certain dialogue functions account for the increased length of audio-only conversations reported by Boyle et al (1994). Instruction Givers employ more **INSTRUCT** and **ALIGN** Games, and Instruction Followers must employ more **CHECK** Games. The most striking change in communicative style between face-to-face and audio-only interactions is the increased use of verbal feedback elicitation in audio-only conversations. This feedback elicitation is highly associated with **Instruct** and **Clarify** Moves in the audio-only context. In face-to-face dialogues these Moves accompany a substantial amount of the eye gaze which occurs. It is therefore concluded that a significant function which visual signals play in face-to-face interaction involves feedback information, and that this is accomplished verbally when visual signals are not available.

These results suggest that, at least at the level of communicative function, the processing of verbal and visual signals is highly related. Gaze is not a primitive way of accessing feedback information which is abandoned when verbal strategies are well-learned, as continuity theorists would claim, indeed gaze is the preferred option when it is available. Nor is the functioning of the verbal and visual channels independent as discontinuity theorists might claim. Rather, both channels of communication are closely linked and function interchangeably depending on situational constraints.

The next chapter investigates the dialogue structures which occur in the children's Map Task conversations when visual signals are or are not available. Results reported in Chapter 4 suggest that young children's use of visual information may differ from adults'. The pattern of dialogue changes between the two Visibility Contexts, and the relationship between gaze and utterance function is therefore investigated.

Chapter 7: Developmental Comparisons Using Conversational Games Analysis

A. Introduction

1. Summary of Results So Far

It has been shown, in this thesis, that performance on the Map Task improves with age. Also adults and 11 year olds can adjust their communication attempts to cope with an audio-only communicative context. In contrast, 6 year olds cannot. Furthermore, children use significantly fewer words in general, and more communicative gesturing. Non-verbal strategies are therefore a preferred option for children for the transfer of a significant amount of information. Previous literature suggests that non-verbal strategies are less demanding in terms of information processing (e.g Goldin-Meadow et al, 1992; Feyereisen & de Lannoy, 1991). The relative prevalence of non-verbal behaviour in the child interactions may therefore reflect that the Map Task is a relatively demanding task for the children, and they therefore rely more on less demanding communication strategies.

2. Predictions

Dore (1977a) suggests that sets of belief conditions operating in the domain of an illocutionary act will change qualitatively with age. It is therefore expected that the children will exhibit some differences between adults in terms of their use of Conversational Games. In particular it is expected that their conversations will be less interactive compared with adults. In other words, I predict that a higher proportion of the children's dialogues will be **INSTRUCTs** rather than attempts to ensure that instructions are grounded sufficiently, since this will be less cognitively demanding. It is also predicted that the 11 year olds will show some of the sorts of adjustments in Games usage which the adults show between the different communicative contexts, given their maintenance of their face-to-face performance level in the audio-only context. Six year olds are expected to show fewer signs of appropriate adjustment.

Similarily since the results of Chapter 4 show that the 11 year old pairs exhibit the same distribution of verbal effort between Instruction Givers and Instruction Followers as did the adults. It is expected that the speech produced by the 11 year olds will contain a similar distribution of Conversational Games. In contrast, 6 year olds distribute effort differently compared with older children and adults. It is therefore expected that the way in they structure their conversations in terms of Conversational Games will also differ.

The most striking change in conversational style between the Visibility Contexts for the adults was the increased number of times Instruction Givers attempted to elicit feedback from the Instruction Followers (**ALIGN** Games). It was shown that gaze and **ALIGN** Games occurred in the same dialogue locations in face-to-face and audio-only contexts respectively, and it is proposed that one function which gaze serves in face-to-face interaction is to obtain visual feedback information. When visual information is not available verbal elicitation of feedback occurs more frequently. The present chapter investigates these effects in the children's interactions. If the children's use of the visual channel is equivalent to that of the adults then the relationship between gaze and utterance function will also be the same. It is predicted that this will not be the case and that the use of visual signals is something which will develop over the age range investigated. It is predicted that as communicative competence increases the use of both verbal and non-verbal signals will become more refined.

In addition, children rely more on visual information and less on the verbal channel. In Chapter 6 I report that in the face-to-face context adults' Dialogue Games are significantly shorter than in the audio-only context, and concluded that this was due to the availability of visual information. It is therefore expected that the children's Dialogue Games will consist of fewer conversational turns because they will rely more on the non-verbal channel. Furthermore, if increasing length of Games reflects less use of the non-verbal channel one would expect the 11 year olds to show the increase in Game length in the audio-only context which the adults do, in order to compensate for the lack of visual information. In contrast, one would not expect a difference in Game length for the 6 year olds since they do not show evidence of coping with, and adjusting to the audio-only context.

B. Study 1: Conversational Structure of Child Dialogues in Face-to-Face and Audio-Only Interaction

1. Subjects

The dialogues of the twenty 6-year olds and twenty-two 11-year olds reported in Chapter 4 were Game coded.

2. Results

Game Type	Number per Dialogue
CHECK	13
INSTRUCT	11
EXPLAIN	9
ALIGN	8
QUERY-W	5
QUERY-YN	4

Table 7.1: Mean Number of Games: Interactivity of the Child Dialogues

A 4-way ANOVA was performed with Age as a between-subjects factor (2 levels; 11 year olds and 6 year olds), Task Role (2 levels; IG initiated Games and IF initiated Games), Game type (6 levels; the 6 Game types), and Visibility Context (2 levels; face-to-face, and audio-only) as within-subjects variables. The dependent variable was the number of Games of each type within each interaction.

The distribution of Conversational Games did not differ between the two age groups. There was a significant effect of Game type, $F(5,190)= 3.59$, $p<.01$. The means are presented in Table 7.1.

In the child dialogues the most common Game is **CHECK** followed by **INSTRUCT**. This is the same rank ordering found for the adult interactions. However the child results then diverge from the adults': the adults use nearly twice as many **ALIGN** Games per interaction compared with the children (13 versus 8), and more than twice as many **QUERY-YN** Games (11 versus 4). So it seems that the children attempt to elicit feedback verbally less than the adults, and use fewer specific yes/no questions. All the other Games are comparable with the adults. The children therefore use the same repertoire of Games as the adults, but use notably fewer **QUERY-YN** and **ALIGN** Games. The means are presented in Table 7.2.

Age	6 Years	11 Years	Adult
QUERY-YN	3.2	4.1	10.6
ALIGN	5.7	11.5	13.4

Table 7.2: Comparison of Incidence of Games in Child and Adult Dialogues

Two 1-way ANOVAs were carried out on the mean number of Games of these sorts which each pair initiated. The independent variable in both cases was Age (6 year and 11 year olds, & adults), and the dependent variable was the number of **QUERY-YN** Games or **ALIGN** Games initiated. Adults on average initiated significantly more **QUERY-YN** Games than either group of children ($F(2,34) = 8.53$, $p < .001$). The difference for **ALIGN** Games was not significant although there was a trend for the 11 year olds and adults to employ more **ALIGN** Games (mean 6 year olds = 5.7 Games, mean 11 year olds = 11.5, mean adults = 13.4). This data was split by Visibility Context, and 2 separate 1-way ANOVAs were carried out, one for the face-to-face data and the other for the audio-only data. The independent variable was Age (3 levels: 6 year olds, 11 year olds & adults). The effect of age now approached significance for the audio-only data, $F(2,34) = 2.49$, $p = .09$. A planned comparison t-test revealed that the 6 year olds used significantly fewer **ALIGN** Games compared with the adults, in the audio-only context, $t(34)=$

2.0, p<.05 (mean 6 year olds = 5.8 per dialogue, mean for adults = 20.5 per dialogue).

2.1 The Effect of Participant Role on Conversational Structure

There was no significant effect of Role nor an interaction between Role and Age. There was a trend towards an interaction which did not reach significance, therefore the mean number of Games initiated by the participants are presented in Table 7.3.

Age	IG	IF
6 years	23	29
11 years	30	19

Table 7.3: Mean Number of Games Initiated by Instruction Givers and Instruction Followers in the Child Dialogues.

These means are shown to contrast with the adults pattern of Game initiation (Table 6.3). The adult IGs were found to initiate on average 41 Games per dialogue, while the IFs initiated 29 Games. It was proposed that this reflects the more dominant role the IG plays in the Map Task. From Table 7.3 it can be seen that the 11 year olds share this pattern with the adults, although the difference between the two roles is not significant for this age group. In contrast the 6 year olds show a trend in the opposite direction. This again illustrates that the 6 year olds do not conform to the role dominance structure of the Map Task, which both the 11 year olds and adults do. This is likely to be another symtom of the relatively poor contributions offered by the 6 year olds IGs. Because of this their IFs have to compensate by contributing more in their attempts to establish understanding. When IGs are relatively competent communicators, Map Task dialogues are predominantly contributions from IGs. When IGs are not as effective in their task (as with the younger children), more responsibility lies with IFs.

Game Type	Instruction Giver	Instruction Follower
INSTRUCT	10.7	0.3
EXPLAIN	2.6	6.2
CHECK	1.3	12.0
QUERY-W	1.7	3.7
QUERY-YN	2.5	1.1
ALIGN	7.8	0.7

Table 7.4: Mean Number of Initiations of Each Game Type by Instruction Givers and Instruction Followers in the Child Dialogues.

There was a significant interaction between Role and Game type, $F(5,190) = 16.63$, $p<.0001$. See Table 7.4 for means. Simple effects analyses showed that for **INSTRUCTs**, $F(1,158) = 21.0$, $p<.0001$, **ALIGNs**, $F(1,158) = 9.9$, $p<.001$, and **CHECKs**, $F(1,158) = 23.2$, $p<.0001$, there was a significant differential distribution between IGs and IFs.

Dialogue Games analysis therefore differentiates between the participant Roles of the Map Task for children. In fact the differentiation is of the same pattern exhibited by the adult IGs and IFs. The only dissimilarity between the patterns found for the children and for the adults was that the adult IGs used significantly more **QUERY-YN** Games compared with their IFs, while for the children this difference is not significant, although it is in the same direction. The child IGs and IFs carry out the same dialogue functions that the adult IGs and IFs do.

2.2 The Effect of Visibility Context on Conversational Structure

There were no further significant main effects or interactions, however the 4-way interaction between Age, Role, Game type, and Visibility Context was investigated using planned comparison t-tests to see whether the same sorts of adjustments to communicative media, which were exhibited by the adults, were also shown by the two groups of children.

The 11 year olds pattern of Conversational Games did not alter between the different communicative media. In contrast, when the data is broken down by task role 2 differences between face-to-face and audio-only communication emerge for the 6 year olds. The Instruction Givers produce significantly more **INSTRUCT** Games ($t(190) = 2.43$, $p<.05$), and the Instruction Followers produce significantly more **CHECK** Games ($t(190) = 3.33$, $p<.05$ in the audio-only context. The means for the 6 year olds are presented in Table 7.5.

Game	Face-to-Face	Audio-Only
INSTRUCT (IG)	9.4	12.9
CHECK (IF)	13.3	18.1

Table 7.5: Mean Number of INSTRUCT and CHECK Games in Face-to-Face and Audio-Only Interaction.

The 6 year olds therefore appear to adapt to the change in context in a way similar to adults. However the most marked change across the different contexts for the adults was the increase in **ALIGN** Games. This is not found for the 6 year olds. The increase in **INSTRUCT** Games reflects that more instructions are required to complete the task in the audio-only context, suggesting that for both 6 year olds and adults the task is more difficult when subjects cannot see one another. However, the 6 year olds do not accompany the **INSTRUCT** increase with an increase in feedback elicitation as the adults do. The 6 year olds' dialogues reflect the greater task demands in the audio-only context, but do not reflect the kind of communication strategy adjustment which is exhibited by the adults. The 6 year old IGs therefore do not felicitously attempt to elicit verbal feedback from their IFs when they can no longer make use of visual feedback. The increase in **CHECKs** may, as in the adult dialogues, simply reflect the increased number of messages which IFs have to check in the audio-only context. Alternatively it may be that the task is more demanding for IGs, so when audio-only interaction makes things even more difficult 6 year olds concentrate even more on simply giving information and do not go to the effort of eliciting feedback and ensuring that their IFs have understood. The following example is from a 6 year old pair's audio-only Map Task dialogue. The example illustrates the general difficulty the young IG had tailoring their messages to their listeners' needs. The appear to be exacerbated in the audio-only context. Notice that the IG gives instructions regarding several features of the Map without ever checking that her IF has these features and/or that she has accomplished each part of the instruction. Also note the way in which the responsibility for IF understanding rests very much with the IF, with the IG taking little if any notice of whether it is accomplished or not.

Game 1 INSTRUCT
Instruction Giver: Start at the bottom. Go past the shop and you go past the van and then you go past the castle/
Move: Instruct

Instruction Follower: I'm way past the shop.
Move: Acknowledge
Game 2 Query-w embedded
Right, now where do I go?
Move: Ready Query-w

Instruction Giver: And then you go to the van, and then you go to the woods, and then you go to the caravan, and then you go to the, and then you go to the house.
Move: Clarify Instruct Continue

Instruction Follower: Right, I went throught the wood.
Move: Acknowledge
Game 3 Query-w embedded
Where do I go now?

Instruction Giver: Uhm, you just go up and then round the castle.
Move: Clarify
Game 4 CHECK embedded abandoned
Instruction Follower: Up where? Passed the/
Move: Check
End Game 4
End Game 1

Game 5 INSTRUCT
Instruction Giver: And then you just go right up, and then go round. And then you stop at the castle, and then you go to the grass. And then you go to the house, and then you go to the pillar box.
Move: Instruct

Game 6 Query-w embedded
Instruction Follower: Where is the house?
Move: Query-w

2.3 Feedback Elicitation in the Child Dialogues

ALIGN Games represent a speaker's attempt to elicit feedback from their interlocutor. In Chapter 6 it was shown that adults use such Games in the same dialogue locations in audio-only conversations, where gaze is found in face-to-face conversations. An interesting pattern which emerges from the child data is that while the 6 year old IGs initiate around 6 **ALIGN** Games per dialogue in both the face-to-face and audio-only context, the 11 year old IGs initiated around twice as many **ALIGNs** in both communicative contexts (12 in the face-to-face and 11 in the audio-only). This may explain, in part, why the 11 year olds maintain their face-to-face performance level without making the sorts of Games adjustments which the adults make. Level of alignment is very likely to be correlated with the number of communicative breakdowns which are resolved. Initiating an **ALIGN** Game provides the opportunity for a conversational partner to indicate a problem they have. The following extract from an adult dialogue illustrates this point. In this example the Instruction Follower is experiencing some trouble with an instruction, and the Instruction Giver elicits feedback twice in order to make sure that the trouble has been resolved.

Instruction Giver: So skirt it and co-come back so that you are directly above the right hand wheel of the safari truck.
Move: Instruct continue

Instruction Follower: O.K
Move: Acknowledge

Game 34 CHECK
Right above where that wee 'T' sort of handlebar type thing is?
Move: Check

Instruction Giver: Yeah, yeah that one, yeah
Move: Reply-y

Instruction Follower: Of the safari truck? Right O.K
Move: Check continue Acknowledge

Game 35 ALIGN
Instruction Giver: Right, you've got it, uh huh. O.K?
Move: Align

Instruction Follower:O.K I know where I'm going
Move: Acknowledge
End Game 35
End Game34

Game 36 ALIGN
Instruction Giver: O.K?
Move: Align

Instruction Follower: O.K
Move: Reply-y
End Game 36

The 11 year olds Alignment level is elevated in the face-to-face context compared with the adults (number of **ALIGNs** initiated by the adults in the face-to-face context is around 6, and in the audio-only is 19), and in the audio-only context this level of alignment is simply maintained. This suggests that the 11 year olds primarily rely on a verbal strategy of alignment regardless of whether or not they have access to visual signals, and therefore their performance is not affected by removing the visual channel. Their frequent use of alignment is not the only factor which maintains their performance but is symptomatic of their more skilled use of the verbal channel. Unfortunately the Games analysis does not capture these finer grained discourse features. In contrast, the 6 year olds rely on a visual alignment strategy (if indeed they seek feedback information at all) whether or not visual information is available, and therefore this contributes to their decreased performance in the audio-only context. Again this illustrates their lack of ability to change strategy from visual to verbal. In contrast, the adults use the visual channel for alignment when it is available but change to a verbal strategy when the nonverbal one is not appropriate. I suggest that this reflects the more mature, adaptive communicative competence of the adults who optimise the information available to them in order to successfully communicate.

2.4 Normalized Conversational Games Data

The data was normalized in the same way as the adults' data in Chapter 6. The total number of Games in each dialogue was divided by the total number of turns in that dialogue. The dependent variable used was the number of Games of each type per 100 turns.

A 3-way mixed design ANOVA was used, with 1 between-subjects factor, Age (6 year olds and 11 year olds) and 2 within-subjects factors; Visibility Context (face-to-face and audio-only), and Game Type (6 Game types).

Game Type	6 years	11 years
INSTRUCT	23.5	21.3
CHECK	12.6	10.2
EXPLAIN	11.5	10.1
QUERY-YN	3.2	5.4
QUERY-W	7.1	5
ALIGN	7.0	10.9

Table 7.6: Frequency per 100 Turns of Each Game Type In Child Dialogues

There was a significant effect of Game type, $F(5,90) = 8.32$, $p<.0001$. See Table 7.6 for the mean frequencies per 100 turns.

For both 6 year olds and 11 year olds the frequency with which **INSTRUCT** Games occur is almost twice the frequency with which the next most frequent Game, **CHECK**, occurs. This contrasts with the difference in frequency with which **INSTRUCTs** (10.5 per 100 turns) compared with **CHECKs** (9.5 per 100 turns) occur in adult dialogues. In other words, the frequency of **INSTRUCT** Games is predominant in the child dialogues but not in the adult. A 1-way ANOVA was carried out to compare the frequency of **INSTRUCTs** in each age group. The independent variable was Age (6 years, 11 years & adult). The effect of Age was almost significant, $F(2,32) = 2.73$, $p = .08$, (mean frequency of **INSTRUCT** per 100 turns for 6 year olds = 25.5, for 11 year olds = 19.9, & for adults = 10.6). A post-hoc t-test revealed that the difference between the 6 year olds' and adults' frequencies was significant. Approximately 50% of all Dialogue Games produced by both groups of children are **INSTRUCT** Games, while only 30% of adult Games are **INSTRUCTs**. This supports the prediction that a higher proportion of the child dialogues, compared with adults, would be devoted to **INSTRUCTs** rather that Games used to ground these instructions. The level of interactivity is less in the child dialogues as predicted. Although the children exhibit a full repertoire of Conversational Games and therefore possess these conversational skills, these are accustomed (Whitehurst & Sonnenschein, 1981) or require too much processing capacity to be implemented (Case, 1974; Ammon, 1981).

There was no change in the frequency of occurrence of any of the Game types between the different media for either group of children. Neither group make communicative alterations in the kinds of dialogue functions which they use when the media changes. This contrasts with the adults who increase the frequency with which they **ALIGN**, and decrease the frequency with which they freely offer information (**EXPLAIN**).

2.5 Length of Dialogue Games

There was no significant context effect nor an interaction between context and age in terms of the frequency with which Games in general were initiated. However, one of the predictions made was that the children would have shorter Conversational Games in terms of dialogue turns, since they rely more on visual information. Similarily it was predicted that in the audio-only context the 11 year olds would increase their Conversational Game length in response to the change in Visibility Context.

Age	Face-to-Face	Audio-Only
6 years	1.56	1.54
11 years	1.45	1.61

Table 7.7 Mean Game Length (in turns) in Face-to-Face and Audio-Only Interaction.

An additional 2-way ANOVA was therefore carried out, with Age (6 years, & 11 years), and Visibility Context (face-to-face & audio-only), the independent variables. The dependent variable was the mean length of Dialogue Games (in terms of the number of turns) in each interaction. There were no significant effects, however given the above predictions, the interaction between Age and Context was investigated. The means are presented in Table 7.7.

The mean Game length in the face-to-face context for adults was 2.24 turn, and in the audio-only 2.54 turns. By comparing Table 7.8 with Table 6.7, it can be seen that both groups of children do indeed invest fewer conversational turns to ground each Dialogue Game in both the face-to-face and the audio-only contexts compared with the adults. The data was collapsed across Visibility Context and a 1-way ANOVA was carried out, with Age a between-subjects factor (3 levels: 6 years, 11 years, adult). There was a significant effect of Age, $F(2,34) = 10.1$, $p < .001$, showing that Conversational Games in adult dialogues are significantly longer than Conversational Games produced in the child dialogues.

The 11 year olds increase the length of their Dialogue Games in the audio-only context as predicted (this was almost significant $F(1,18) = 3.74$, $p = .06$), whereas the 6 year olds show no such increase. The 11 year olds show at least a partial adjustment in terms of their verbal investment in response to communicative media change.

3. Conclusions

An important finding from the results is that the children, even the 6 year olds, exhibit the same repertoire of Conversational Games as do the adults. They do not use them with the same frequencies: there are notably fewer specific questions (**QUERY-YN**) and feedback elicitation attempts (**ALIGNs**) in the child dialogues. They also invest fewer conversational turns per Game.

The children do not alter their communicative strategies in the same way as adults, and their use of their conversational skills is not as effective.

However they do use Games such as **CHECKS**, which are attempts to disambiguate messages and ground information. Such a finding is contrary to many studies in the referential literature which propose that children as young as 6 years do not notice or attempt to deal with ambiguities. In fact the 6 year olds from the present study exhibit an even higher frequency of **CHECK** Games than the adults. It appears that these attempts are just not as effective as those of the adults. The following extracts illustrate differences between 6 year old's and adult's **CHECK** Games.

Extract from Adult Dialogue:

Game 46 IG INSTRUCT
Instruction Giver: Right, drop down till you're level with the top of the leaves of the banana tree... d- you're coming straight down/
Move: Ready Instruct

Instruction Follower: Right.
Move: Acknowledge

Instruction Giver: and the banana tree is on your left.
Move: Instruct continue

Instruction Follower:O.K.
Move: Acknowledge

Game 47 CHECK embedded
So I'm going straight down?
Move: Check

Instruction Giver: <Straight... straight down until the... to/
Move: Clarify

Instruction Follower: Due South directly?

Move: Check continue

Instruction Giver: due South, until you come level with the top leaves of the banana tree.
Move: Clarify

Game 48 ALIGN embedded
O.K?>
Move: Align

Instruction Follower: O.K.
Move: Reply-y

End Game 48

End Game 47

Extract from 6 year old pair:

Game 2 INSTRUCT
Instruction Giver: Well, that cross. From that cross/
Move: Instruct

Instruction Follower: Yes.
Move: Reply-y continue

End Game 1

Instruction Giver: go round go round a wee bit.
Move: Instruct continue

Game 3 CHECK embedded
Instruction Follower: Round?
Move: Check

Instruction Giver: Yeah.
Move: Reply-y

End Game 3

Go two lines
Move: Instruct continue

Game 4 ALIGN embedded
Have you gone two lines and that's all?
Move: Align

Game 5 CHECK embedded
Instruction Follower: Like this .Right this is the circle, like that/
Move: Check

Instruction Giver: No you go,
Move: Reply-n Clarify

Instruction Follower:you go straight
Move: Check continue

Instruction Giver: No you up a bendy way.You go... you go st st
Move: Reply-n Clarify continue

Instruction Follower:[nonverbal gestural move]
Move: Check continue

Instruction Giver: [nonverbal gestural move]
Move: Clarify continue

Game 6 CHECK embedded
Instruction Follower: Like that?
Move: Check

Instruction Giver: Yeah, but "o".
Move: Reply-y Clarify

These examples illustrate that the adult messages are often verbally richer than the 6 year olds'. The 6 year olds make use of conversational structures, such as CHECK Games, but they do not have the verbal skills to make these structures effective. In the 6 year old's example many Moves were completely nonverbal, highlighting the difficulty these children had verbalising the necessary information. Even this gestural information was not accurately encoded by the sender, or decoded by the receiver. The point to be made here is that attempts are made and therefore these important conversational tools are in operation at some level.

This may reflect the distinction between transactional and interactional coherence (Brown & Yule,1983; Garrod & Doherty, 1994)). Transactional communication refers to the accurate transfer of information, while interactional communication is primarily concerned with the maintenance of social relationships. It may be that the use of conversational tools such as various types of Conversational Games are learnt at an interactional level early on. The effective use of such tools for transactional purposes may develop later as general communicative competence increases. Much of the referential literature has been concerned with children's transactional abilities, and by focusing upon this, has missed their extensive interactional abilities.

In contrast, sociolinguistic studies have found that children are aware of and use appropriately the felicity conditions of speech acts (Garvey, 1975; Reeder, 1980; McTear, 1985). The present data supports this view and shows that children from the age of 6 years have a good understanding of the kinds of communicative functions which are useful while doing the Map Task.

However the child Instruction Givers initiate proportionally more **INSTRUCT** Games than adults. They are therefore more likely to give instructions without attempting to ground the information contained in these instructions. This may be because of a lack of awareness of the necessary grounding criteria or because of a lack of skill with such procedures. It is proposed that children may not implement conversational skills appropriately because task demands are already high, and that certain conversational procedures require more processing capacity than is available.

There are three main responses made by the adults to the media change which can, at least partially, be explained in terms of pragmatic responses to an audio-only communication context; the increase in the number of Games used to package instructions, increased verbal feedback elicitation, and the increased use of **CHECKs** which probe understanding of messages. None of these changes are found for the 11 year olds who do not therefore appear to adjust their verbal communication strategy in response to media changes, although they show a trend towards increasing the mean length of their Conversational Games in the audio-only context, as the adults do.

The 6 year old IGs, in contrast to the 11 year olds, do make a Games adjustment between contexts. They significantly increase the number of **INSTRUCTs** which they perform in the audio-only context. However they do this without increasing the number of **ALIGN** Games they produce, and this therefore results in a trend towards a proportional increase in **INSTRUCTs** (50% -> 57%). This means that 6 year old IGs become even less interactive, than they were in the face-to-face context, in the audio-only context. While the adults require more verbal grounding processes when they lack visual communication, the 6 year old IGs decrease their verbal grounding attempts. Their contributions are based even more upon instructing the IFs, with about 3/5 of their contributions being **INSTRUCTs**, nearly double the proportion allocated by the adult IGs.

The adult IGs make, what appear to be, sensible media adjustments, and their communication style becomes more oriented to verbally eliciting feedback. The 11 year olds make no adjustment, but maintain their face-to-face performance level, partly because they are highly oriented to verbal feedback elicitation. In contrast, the 6 year old IGs decrease their attempts to ensure that instructions are grounded sufficiently when they cannot see their partners, and their communication becomes more oriented towards giving instructions. I propose that this is symptomatic of the difficulty 6 year olds have with the Map Task, especially in the audio-only context.

The 6 year old IFs look very much like the adult IFs both in terms of the mean number of Games of each type that they produce, and in the way they adjust their Game strategy in response to the media change. As in the adult data, about half of the 6 year old IFs contributions are **CHECK** Games. They also significantly increase the number of **CHECK** Games which they perform in the audio-only context. However this adjustment may occur for different reasons for the adults and the 6 year olds. The adult IGs maintain a certain level of interactivity (elevated compared with both child groups) in both contexts, and illustrate a sensitivity for the need to increase explicit verbal grounding processes in an audio-only context. It is likely therefore that their contributions will be as helpful to the establishment of mutual knowledge in the audio-only condition as they were in the face-to-face condition.

In contrast, the 6 year old IGs decrease their level of interactivity in the audio-only context making the grounding of information less likely. Their partners may have to do more interactive 'work' therefore in response to not only an increase in **INSTRUCTs**, but also more poorly presented **INSTRUCTs**. For the adults there is a significant negative correlation between deviation score and the number of **CHECK** Games initiated in a dialogue (Rho(14) = .047, ,>05). More **CHECKs** are therefore associated with improved performance. There was no such correlation for the 6 year olds. Given the lack of correlation between the number of **CHECKs** produced, and performance for the 6 year olds, it appears that they do not effectively use **CHECKs**. Although the young Instruction Followers attempt to help establish mutual knowledge and perhaps compensate for the poorer contributions offered by the Instruction Givers, they are not successful in doing this.

The level of interactivity and the use of Games found in the 11 year old interactions partly predicts the sort of level of performance which the 11 year olds attain. In the face-to-face context the 6 year olds are comparable in their Games usage to the 11 year olds and attain the same level of performance. The 6 year olds illustrate, in the audio-only context, that if the interactivity is reduced even further then performance also suffers further.

3.1 Reasons for Changes in Conversational Structure

I shall now discuss some possible explanations for the media changes which occur in the interactions. Each age group will be dealt with in turn.

Reasons why the adults alter their verbal communication strategy in response to an audio-only communicative context have already been discussed. These centre around the idea that visual signals are an important part of the communicative process. It appears that without them adults need to use more instructional units to perfom the task, they elicit feedback more often, and check their understanding of messages more often. In Chapter 6 it was shown that one function which gaze serves is to provide the Instruction Giver with feedback information. When the visual channel is not available the Instruction Giver must elicit this information verbally.

For 11 year olds it appears that the visual channel is not used in the same way as adults use it: blocking the visual channel has no effect on either their performance or their verbal communication strategy both in terms of the amount of speech produced and in terms of the pattern of Conversational Games. Their high frequency of **ALIGN** Games in face-to-face interaction also suggests that they treat access to visual information in a different way to adults. They appear to rely more on verbal elicitation of feedback from their Instruction Followers, and therefore removing the visual channel does not effect their task performance or verbal strategy.

The 6 year olds, in contrast, appear to be quite dependent upon the visual channel. When this is removed their verbal strategy changes for the worse, becoming less interactive and less efficient. One reason for this is that they rely very much upon visual signals such as gestures, eye gaze, facial expression, and lip configuration. When these are absent the task may become more difficult and the task demands too great. Such visual signals are assumed by continuity theorists to be less complex than verbal expressions (for example Weiner et al, 1980). They are therefore likely to be more prevalent in younger children's communication. Likewise Shatz (1977) suggests that 'less well-learned' information handling techniques will occupy more information processing capacity than 'well-learned' processes. If this is the case, and the 6 year olds' Conversational Games are indeed 'less well-learned' processing tools then there may not be enough processing space available to accomplish interactivity. This will of course be most evident for the IGs who are primarily responsible for the information transfer within this task, and this is perhaps one reason why they default to their poorer patterns of contributions in the audio-only context. Such effects will be compounded in the audio-only context. The present results therefore offer some support for a continuity approach.

However, as Shatz (1983) points out communicative understanding is still very immature even once language has emerged. This is illustrated by the present data. Even a 6 years of age children still lack communicative adaptability and an ability to adapt their use of non-verbal signals. It therefore appears that language and non-verbal signals become increasingly coupled (Shatz, 1983) with development. This is reflected in the way in which 11 year olds adapt to audio-only interaction in a way which appears to be outwith the abilities of the 6 year olds.

While the 11 year olds would be expected to have and indeed appear to have far greater linguistic skills compared with the 6 year olds, their gesturing frequency is as great as that of the 6 year olds in face-to-face interaction. Their gestures have therefore not been simply replaced by linguistic expressions (Feyereisen & de Lannoy, 1991).

These results suggest that both verbal and non-verbal aspects of the communicative process develop significantly between the ages of 6 years and adulthood. The 11 year olds overuse verbal elicitation of feedback in face-to-face interaction, while the 6 year olds do not increase this verbal strategy appropriately in the audio-only context. This reflects the significant change in communication skills found by Anderson et al (1991) between 7 and 10 year olds and that reported by Lloyd (1992).

In summary, both groups of children exhibit an ability to produce the same repertoire of Conversational Games as the adults. This supports Dore's (1977a) conclusion that even preschoolers' conversations are remarkably 'rational' and well organised. Therefore on the surface their interactions are well-formed. However their use of Conversational Games is less effective. They do not seem to operate according to the same principles in terms of strategic changes in communicative style in response to media changes. The appropriate use of available communicative strategies in different situations and contexts is another level of pragmatic knowledge. For example the 6 year olds know how to elicit feedback from their listeners (**ALIGN** Games) and do so with a comparative frequency as adults in face-to-face interaction. However in audio-only interaction the 6 year olds do not increase their use of this communicative function which suggests that they lack the pragmatic knowledge to do so.

It is possible that a task with lesser demands on processing capacity may result in greater adaptability for the younger children. Therefore if they were more practised at the task or the verbal expressions required were less demanding it is possible that the absence of visual signals would have a lesser effect. The interplay of communicative adaptability and task demands is indeed a very valid area for future research.

C. Study 2: The Function of Gaze in Face-to-Face Child Interactions

1. Introduction

In Chapter 6 it was shown that in adult dialogues Instruction Giver gaze (in face-to-face interaction) and **ALIGN** Games (in audio-only interaction) are highly associated with **Instruct** and **Clarify** Moves. From this it was concluded that some Instruction Giver gaze performs the same function in face-to-face interaction that **ALIGN** Games perform when no visual information is available. The present chapter has shown evidence which leads to the conclusion that visual information is not used in the same way by children as it is by adults. If this is true then we expect that the kinds of dialogue function with which gaze will be associated will be different. As a comparison with the adult data in Chapter 6, Instruction Giver gaze in the children's conversations is now investigated.

The high frequency of **ALIGN** Games in face-to-face interaction for 11 year olds suggests that they do not use gaze to obtain feedback as frequently as adults since they prefer the verbal option. It is therefore predicted that there will be less of an association between Instruction Giver Gaze and **Instruct** and **Clarify** moves. Likewise I predict that there will be less of a definite association between gaze and verbal function for 6 year olds since I expect that refined use of the visual channel develops with increasing communicative competence.

2. Materials

The 6-year olds' and 11-year olds' Conversations which had previously been gaze and Game coded were further analysed.

3. Results

The amount of gaze which co-occurred with each Move type in the face-to-face dialogues was measured, and the percentage of the total amount of Instruction Giver gaze associated with each Move type was then measured. The means are presented in Table 7.8.

Move Type	6 Years	11 Years
Instruct	14	39
Explain	15	12
Query-yn	10	5
Query-w	6	5
Align	11	9
Check	19	6
Reply-y	4	4
Reply-w	2	2
Reply-n	0	1
Clarify	10	7
Acknowledge	5	6
Ready	2	1
Interjection	2	2

Table 7.8: Proportion of Instruction Giver Gaze Which Accompanies Each Move Type in Child Dialogues.

Given the differing lengths of the Moves it seemed inappropriate to make claims as to the exact location of the gaze within the Moves (for example at the beginning, middle, or the end). No claims are therefore made here regarding gaze location within Moves, only that gaze occurred at some point within a Move. Gaze is likely to serve many functions within these interactions and the functions which the analysis of gaze location in terms of Conversational Move can only represent some of these. It would be more crucial to examine the location of gaze within conversational turns if, for example, turn-taking mechanisms were being investigated. It appears from the large amount of gaze on Instruct and Clarify Moves within adult interactions that this gaze is accessing feedback information. The large amount of gaze occurring on Query-yn Move most likely represents a different function of gaze, perhaps as a turn-yielding signal.

These figures are compared to those in Table 6.8 for the adults. Such comparisons show that like the adults, the Move accounting for the largest proportion of Instruction Giver gaze is Instruct (34% for adults and 39% for 11 year olds). In contrast the Move most associated with gaze for the 6 year olds is **Check**, with **Instruct** accounting for only 14% of the total Instruction Giver gaze. An additional major difference between the 6 year olds and the older subjects was the relatively large amount of gaze associated with **Check** moves (19% for 6 year olds, 7% for 11 year olds, & 2% for adults). This shows that the 6 year old Instruction Givers were more likely to look at their Instruction Followers while the Instruction Followers checked their understanding of messages. This is not the case for the older Instruction Givers who attended to the task materials while Instruction Followers checked their understanding. A 2-way ANOVA was carried out on this data, with Age (6 years & 11 years), and Move Type (the 13 move types) the independent variables. The dependent variable was the percentage of Instruction Giver gaze associated with each Move type. A significant effect of Move was found, $F(12,204) = 8.9$, $p<..0001$, and a significant interaction between Age and Move Type, $F(12,204) = 3.2$, $p<.001$. Simple effects analyses were carried out and significant differences between the ages were found for **Instruct** ($F(1,204) = 31.9$, $p<.001$), and **Check** ($F(1,204) = 7.3$, $p<.01$) Moves. Therefore significantly more Instruction Giver gaze in 11 year olds' interactions is associated with **Instruct** Moves than for 6 year olds, and significantly more of the 6 year old Instruction Givers' gaze is associated with **Check** Moves compared with 11 year olds.

Finally, in contrast to adults, **Clarify** Moves claim relatively little gaze for either group of children. While adults monitor their conversational partners' responses to clarification attempts, children do not.

It therefore appears that the distribution of gaze according to dialogue function is not the same in child interactions as it is in adult. The distribution for older children is more similar to adults than the younger children since a high proportion of gaze is associated with **Instruct** Moves in the 11 year olds' and adults' dialogues. The gaze of 6 year olds is more evenly distributed across a greater number of types of dialogue moves suggesting that the way in which 6 year olds use gaze differs from that of older interlocutors. In addition the 6 year old Instruction Givers show a high frequency of gaze during their Instruction Followers' **Check** Moves, which the older children an adults do not. The older subjects attend to the task materials in order to assess the **Check** message, while the 6 year olds monitor their partners. This may reflect difficulties they have understanding such messages.

In order to take into account the differing frequencies of the Move types, conditional probabilities of the co-occurrence of gaze with the Move types were calculated, as in Chapter 6. In Chapter 6 it was shown that there was significantly more gaze associated with **Instruct** and **Clarify** Moves than would be expected by chance. This was investigated for the children. A 2-way ANOVA was used, with Age a between-subjects factor (6 years & 11 years), and CHOB (chance versus observed frequency of co-occurrence of gaze plus the Move type) a within-subjects factor. No effects were found, and it must be concluded that gaze is not associated with **Instruct** and **Clarify** Moves any more than expected by chance for either age group. It is concluded that gaze is not used by the children in the same way as it is for adults. The finding that there was no difference between observed and expected co-occurrence of gaze with **Instruct** and **Clarify** Moves, for the 11 year olds, is surprising given the result which showed that 11 year olds gaze more on **Instruct** Moves than the younger children. This could be due to the low occurrence of gaze on **Clarify** Moves cancelling the **Instruct** Move effect. The difference between chance frequency of co-occurrence of **Instruct** Moves with gaze, and the observed frequency, was therefore tested independently for the 11 year olds' data. A 1-way ANOVA was carried out. The within-subjects variable was CHOB (observed versus chance co-occurence of gaze frequency). The effect of CHOB was almost significant. $F(1,9)= 4.7,=.058$ (mean chance frequency = .15; mean observed frequency = .8).

4. Conclusions

It therefore appears that there are no strong associations between the probability of gaze and the function of the utterances it accompanies in the child interactions, although there is a trend for gaze to be associated with **Instruct** Moves in the 11 year olds' dialogues. The finding that gaze is used differently by adults and children supports previous findings showing that certain functions which gaze serve develop with age (for example Abramovitch & Daly, 1978; Baron-Cohen & Cross, 1992).

D. Chapter Conclusion

Much literature on the development of communication skills presumes that non-verbal communication is an aspect of the communicative process which is mastered early in development. In Chapter 4 it was shown that 4 and 6 year olds depended to a greater extent upon visual information, and that 6 year olds communicate as effectively as 11 year olds when such information is available. This could be taken as evidence to support the above presumption. The results of the present chapter suggest that the functions which visual information serves differ according to the age of the interlocutors. Non-verbal skills therefore also continue to develop at least past 11 years. This supports the Jancovic et al (1975) findings which showed functional changes in the use of both gaze and gesture.

Evidence for this is two-fold. First, the major structural change seen in the adult dialogues in the audio-only context, of increasing verbal elicitation of feedback, is not found in the child dialogues. This could either be due to the children not using gaze for a feedback function in face-to-face interaction, or because they don't have the necessary skills or meta-skills to implement a verbal strategy. The first alternative is most likely for the 11 year olds since they show a high frequency of **ALIGN** Games in their face-to-face conversations. The second is most likely for the younger children since their use of **ALIGN** Games is relatively infrequent in face-to-face interaction and does not increase in the audio-only context. McTear (1985) suggests that although non-verbal strategies are less complex to process than verbal strategies, their use does not necessarily signal communicative immaturity. In certain contexts non-verbal strategies are more appropriate and effective than verbal. The 11 year olds use verbal alignment more frequently than adults in face-to-face interaction, which in this context is less appropriate than using visual signals and gaze to gain this information, as the adults do.

Second, it appears that very young children do not use gaze discriminatively, in other words gaze is distributed across a wide variety of Move types, however the older children are beginning to use more adult-like patterns, in that a larger proportion of their gaze is associated with Instruct Moves. Adult gaze is significantly associated with certain dialogue functions, while this is not the case for the children.

We readily accept that young children have linguistic limitations, it seems that we must also recognise that they have limitations in their ability to use and to understand non-verbal signals. The successful development of non-verbal skills is an essential element of both our communicative and social lives, and is something which should not be trivialised in the shadow of language skills. Our understanding of the developmental progression of, for example eye gaze, is essential to increase our understanding of normal communicative development. Likewise such work has implications for work with populations with communicative problems, for example dysfunctional gaze patterns are used in the diagnosis of autism. The present results show that normal 11 year olds still do not use eye gaze in the way which adults do.

Children's language skills are indeed limited and developing, but so too are their non-verbal skills. The integration of both these aspects of communication is an essential milestone in successful communicative development.

Chapter 8: Thesis Conclusions

A. Introduction

The aim of this thesis was to investigate the development of conversational skills. Two aspects of conversational skill were examined. The first was the way in which conversations are structured in child and adult interactions. This was done using a novel system of dialogue analysis, called Conversational Games analysis. The motivations behind this were to see whether children have the pragmatic and conversational knowledge to use the kinds of structures which adults use, and second to provide a description of the verbal channel which could be used for further analyses of the interactions.

The second aspect of conversational skill which was examined concerns the role of visual non-verbal signals in the communication process. In order to do this three approaches were used: developmental studies; studies manipulating visual context; and analysis of the interchangeability of verbal and non-verbal communication strategies. Each of these approaches are now discussed.

1. Developmental of Verbal and Non-verbal Skills

Looking at development of verbal and non-verbal conversational skills gives insight into the relationship between them. Some authors propose that the same processing mechanisms underly both sets of skills, and that non-verbal communication strategies are the foundations upon which linguistic abilities develop (e.g McNeill, 1975; Bruner, 1983). The view that non-verbal behaviour is a primitive precursor to language has perhaps helped to consolidate the opinion, pervasive in the literature, that non-verbal behaviour is somehow more natural and requires less learning than language. Support for this comes from the cultural universality of, and early non-intentional use of certain non-verbal signals (Ekman, 1971; Camras, 1977; Argyle, 1990). Likewise the assumption that facial cues, such as facial expression and eye gaze, have basic innate communicative qualities is supported by the fact that infants are predisposed and sensitive to the qualities of human faces (Spitz & Wolf; Fantz, 1961).

However although there is evidence that some non-verbal signals are innate, such as spontaneous facial expression, a large component of non-verbal behaviour is subject to learning processes, and is therefore determined by our age, culture, and communicative competence. Just as we must learn the syntax, sematics, and pragmatics of language, likewise we must learn how to use non-verbal signals in our communication. The resulting use of non-verbal signals may differ considerably from early uses. It is therefore important to track the development of the functions which are served by non-verbal signals. I wished to investigate whether children's use of the non-verbal channel was the same as adult use, or whether the way in which visual signals are used in task-oriented interaction, is subject to learning and increased communicative competence.

Shatz (1983) suggests that communication development involves the development of many subsystems (for example syntactic knowledge, knowledge of speech acts) and the integration or 'coupling' of these subsystems. It was therefore expected that children's abilities with both verbal and non-verbal conversational skills would improve with age, and that these abilities would become increasingly linked.

B. Development of Conversational Structure

I found that communicative performance improved with age, with 11 year olds performing better than 6 year olds and adults performing the best of all. In terms of verbal conversational skills, Conversational Games analysis showed certain differences between the age groups in terms of conversational structure. From the referential literature it would be expected that dialogue structures would be more limited and less elaborate in children's interactions (given, for example, their deficient ambiguity detection, comparison processes and comprehension monitoring). For example, Cosgrove and Patterson (1977) found that younger children were less likely to ask for clarification compared with older children. In other words it is expected that children will have more limited repertoires of Conversational Games. On the other hand the sociolinguistic literature suggests that children's abilities are far greater (for example, McTear, 1985; Becker, 1982; Reeder, 1980). The present results show that there is a tendency for the child interactions to contain relatively fewer structures which served to ground messages. In particular children use fewer verbal elicitations of feedback (**ALIGN**s) and fewer specific questions (**QUERY-YN**s). The children's interactions are therefore more oriented toward instructions (50% of contributions are **INSTRUCT**s in child dialogue while only 30% are **INSTRUCT**s in adult conversations). On the whole however, children exhibit the same repertoire of Conversational Games as the adults. For example children ask various types of questions, however the questions do not always elicit the required information. In contrast to the Cosgrove and Patterson (1977) findings, the 6 year olds request clarification (**CHECK** Games) as frequently as the adults. However Cosgrove and Patterson conclude from their post-training sessions that, from 6 years onwards, the lack of question asking is a performance rather than an ability deficit. This suggests that question asking is an accustomed rather than a novel skill from 6 years onwards (terminology used by Whitehurst and Sonnenschein, 1981). The communicative situation which Cosgrove and Patterson used may not have provided the necessary 'releasing components' (Ammon, 1981) for question asking skills. The reason why the 6 year olds request clarification so relatively frequently, in the present study, may therefore be because question asking is a salient communicative strategy for such young children in the communicative situation used.

The greatest difference in verbal skills relates to how communicatively effective these Games are. The children's Conversational Games were significantly shorter in terms of conversational turns compared with adults, and this may be symptomatic of their decreased effectiveness.

The children also fail to show a discriminating use of **ALIGN** Games between face-to-face and audio-only interaction in the way that adults do. While adults attempt to elicit feedback reliably on only certain Move types, this was not the case in the children's interactions. This illustrates their lack of pragmatic knowledge regarding feedback elicitation in conversation.

The verbal analyses show that the young children function more on an interactional level than a transactional level (Brown & Yule, 1983). On the surface their communication is like that of the adults in that they use the same communicative functions. The interactions are however not successful enough to reach a transactional level of functioning.

C. Development of Non-verbal Communication Strategies

Both verbal and non-verbal phenomena are important aspects of the communicative process, regardless of linguistic competence. Non-verbal signals may be easier to process both at encoding and decoding (Feyereisen & deLannoy, 1991). This does not mean that young children are skilled users of non-verbal signals. Indeed many adults are not skilled users. It may be easier to transmit certain kinds of information non-verbally, for example shape, via gesture. However recognizing that monitoring a communicative partner's facial expression, for feedback, while sending them a message, is a cooperative and effective communication strategy. This may only develop as a result of higher level communicative competence. The ability to choose the most appropriate strategy in different contexts will also increase with increasing communicative competence.

Aspects of the non-verbal channel which are investigated here are communicative gestures and eye gaze. Both non-verbal and verbal skills develop together for many years after the advent of language, perhaps into adulthood (e.g Weiner et al, 1980; Jancovic et al, 1975). Functions which non-verbal signals play will change with age and with growing competence in both channels. So it is expected that the use of gesture and gaze should change with age, and that the differences between face-to-face and audio-only communication should also change with.

The present results show that the use of both gesture and gaze change with age. Children use deliberate communicative gesturing relatively frequently while adults almost never do in the Map Task situation. So children transmit a substantial amount of information via gesture. This suggests that they find encoding certain information in gesture easier than they do encoding it verbally, but that adults prefer to use verbal expression. This result compliments the findings of Merrison et al (1993) who showed that Aphasics unable to express information verbally used gesture instead. Gesture is therefore easier to use either because it requires less processing capacity or because it is a better learned communication strategy (Feyereisen and deLannoy ,1991). Church and Goldin-Meadow (1986) offer further support for this view. They found that concepts which children were on the verge of understanding could be expressed in gesture before they could be expressed in words. The 11 year olds, in the present study, had sufficient verbal skills to encode the information (gestured in face-to-face interaction) verbally in the audio-only context. This is one explanation why they maintain their face-to-face performance level in the audio-only context.

Pechman and Deutsch (1982) found that 4 year olds point inappropriately during referential communication. They interpreted this as showing a lack of pragmatic knowledge about when it was or was not appropriate to use certain communication strategies. This misuse of gesture was also found in the 6 year olds' interactions. The frequency with which they use communicative gestures does not change in the audio-only context even though it is no longer an appropriate strategy. In contrast, this kind of pragmatic knowledge has been grasped by the 11 year old children, since they do not use communicative gestures in the audio-only context but do so in face-to-face interaction.

Eye gaze can be both a visual cue and a means of accessing visual cues. If a subject looks at his/her partner they gain visual information, however they also transmit information to their partner by the very fact of gazing. The frequency with which individuals gaze may therefore reflect how dependent their communication is upon visual signals. If adults are less dependent upon visual signals than children then we would expect them to gaze less frequently at one another. The present gaze analysis results support this, showing that adults gaze less frequently than either group of children. In terms of both gesturing and gazing, adults use the visual channel less than children do. The question still remains as to whether this difference is simply quantitative or whether there are qualitative differences in the functions of visual signals in child and adult interactions.

In order to answer this question a more detailed analysis of the gazing behaviour in the different age groups was carried out. The analysis investigated the interchangeability of verbal and visual signals. It is proposed that certain communicative functions may be carried by both verbal and non-verbal means. So limited availability of one of these channels will bring the other into play. For example, in audio-only communication verbal expression must be relied upon. However, if audio information is limited, for example in noisy conditions, then visual signals become more prevalent. This would suggest a close relationship between the verbal and non-verbal channels in terms of communicative functioning, despite their technical independence.

Each gaze from the Instruction Giver was associated by it's location in the dialogue to a Conversational Move. In other words the verbal communicative functions which gaze accompanied were investigated. Adult Instruction

Givers are found to gaze primarily when their utterances accomplish either **Instruct** or **Clarify** Moves. These are also primarily the dialogue locations where Instruction Givers verbally elicit feedback in the audio-only context. So one function which gaze serves in the adult face-to-face interactions is to gain feedback information from the Instruction Follower. It is particularily important for the Instruction Giver when he/she is giving an instruction or clarifying information for the Instruction Follower. This feedback function is one of the four proposed by Allen (1981).

The same analysis was carried out on the child data. No significant association between gaze and verbal Conversational Move was found, although there was an almost significant association between gaze and **Instruct** Moves for the 11 year olds. Thus 6 year old's Instruction Giver gaze is not associated with any particular Move type, whereas eleven year old's Instruction Giver gaze is associated with **Instruct** Moves, but not with **Clarify** Moves. Likewise, this reflects the lesser association between **ALIGN** Games and particular Move types in the children's conversations, compared with the adult dialogues.

The gaze patterns of the younger children do not therefore resemble the adults, while for the older children the pattern is much more like that for adults. These results suggest that the functions which gaze serves in adult and child interactions are indeed different, and that with increasing age the use of gaze becomes more finely tuned and 'coupled' (Shatz, 1983) with the verbal channel.

D. Adjustments to Different Communicative Media

The third way in which the relationship between verbal and non-verbal communication was investigated was by comparing the communicative outcome and process of interactions in face-to-face and audio-only contexts. Up until this point the conclusions of this thesis suggest that visual signals do not form a large part of the communicative effort of adults. Previous work in this field does however illustrate that, while adults are very adaptive communicators who can overcome the loss of the visual channel in terms of communicative outcome, losing visual information affects the process of communication (Anderson et al, 1994; Ellis & Beattie, 1986; Beattie & Barnard, 1979; Chapanis et al, 1972). Likewise, the present results show that adult gaze patterns are structured and that gaze serves a definite function in adult interactions.

The effect of audio-only communication on the communicative was therefore investigated by comparing dialogue structure in face-to-face and audio-only interaction.

Anderson et al (1994) report that adults take significantly more words and turns to complete the Map Task in audio-only interaction than in face-to-face. The present results show that there is also a trend towards this for 6 and 11 year olds, and for the 4 year olds doing the Glucksberg task. In contrast to the adults, the increased amount of verbal material does not help maintain the performance of the two younger age groups. One explanation for this is that the extra speech does not add further information and therefore does not replace the information lost from the visual channel. Alternatively, it may be that message processing, for the young listeners, is easier when visual signals, such as gesture, gaze, and lip configuration, are available.

Conversational Games analysis was carried out on corpora of child and adult Map Task dialogues, which occurred in both face-to-face and audio-only conditions. The conversational structures were compared across the contexts in the different age groups.

There are three changes in dialogue structure which occur when the visual channel is not available for adults. Adult Instruction Givers increase the number of instructions they give, and in response the Instruction Followers check the increased number of messages which there are. However the most striking change in the adult dialogues in the audio-only context is the increase in both the absolute number, and frequency, with which Instruction Givers verbally elicit feedback (**ALIGN** Games) from their Instruction Followers. This adds further support to the conclusion that a substantial function which gaze serves in adult interaction is the obtaining of feedback information. In face-to-face interaction feedback is gained by looking at the Instruction Follower. When gazing is not possible the Instruction Givers resort to asking the Instruction Followers. Visual signals are therefore not simply primitive precursors to linguistic abilities and redundant accompaniments of language. Adults use gaze and visual signals systematically, and in preference to verbal expression, to obtain feedback in face-to-face interaction.

The next question addressed was whether children structure their conversations differently in face-to-face and audio-only interaction. In contrast with the adults, the 11 year olds' conversational structure does not differ between the face-to-face and the audio-only contexts. They frequently use a verbal strategy for gaining feedback in face-to-face interaction and therefore do not have to raise this level of alignment in the audio-only context.

The 6 year old IGs increase the number of **INSTRUCT** Games which they employ in the audio-only context, and in response their IFs increase the number of **CHECK** Games to allow for the increased number of messages which have to be checked. However the 6 year olds increase the number of instructions without increasing the frequency with which they elicit feedback in the audio-only context, and given that they can no longer see one another, this means that Instruction Followers have far less opportunity to inform Instruction Givers of communication problems.

This result is in agreement with previous research which shows that children of around 6 years have less pragmatic competence as supportive interlocutors than older children and adults (Lloyd, 1992; Dittman, 1972). Six year olds do not increase alignment when visual cues are unavailable, and do not appear to use gaze to systematically obtain feedback information. This supports findings of Peterson et al (1972). They found that, even by the age of 7 years, children gave no response to facial expression feedback (for example looking puzzled). Seven year olds are therefore either not sensitive to, or at least do not recognize the importance of such expressions when interacting. It is therefore not surprising that 6 year olds do not look for these facial expressions.

The results therefore show that even at 11 years of age children still have not acquired certain non-verbal communicative skills. Eleven year olds do not use visual signals to the same extent as adults in order to elicit feedback in face-to-face interaction, and instead prefer to use a verbal strategy. McTear (1985) suggests that verbal communicative strategies do not necessarily show communicative maturity, he argues that communicative competence is indexed by the use of appropriate strategies in a given context. The most efficient and appropriate way of getting feedback from a listener in face-to-face interaction is to look at them. Instead the 11 year olds use a verbal strategy to elicit feedback. The dip in performance at this age may be related to the move into formal operations (Piaget, 1926), as the children begin to organise and collate their communicative and other abilities.

E. Conclusions

This thesis has shown the importance of both verbal and non-verbal information in communication. It also illustrates that both of these develop over childhood into adulthood and are integrally linked to each other as a part of communicative competence.

Like Goldin-Meadow et al (1992) the present results show that there is information transmitted visually by young children which is not transmitted verbally. This has important implications for professionals whose job it is to assess children in various ways. In addition, the thesis has shown that the way in which visual signals are understood by children differs from that of adults.

It is therefore important for adults who assess children to be aware of the information which may be transmitted in a non-verbal format. Equally important is for the adult communicator to use visual signals, such as eye gaze, as they would normally do in face-to-face interaction, since children appear to be best adapted to such a communication style. Failing to do this may result in inhibition of the child's communication.

It has yet to be shown that young children have the ability to alter their communication strategies in response to different communicative media and styles in the way which many adults can. In his book on how to interview suspected child abuse victims, Jones (1992) advises the interviewer that "direct gaze fixation is often too intrusive for children" (Jones, 1992, p38), and that techniques should be employed which avoid this. The present results suggest that this may not help to elicit information from young children, since they seem to be especially dependent upon the social and information cues in visual signals. Otteson and Otteson (1980) propose that eye gaze itself may play a very important role in children's abilities to process information. They found that children's recall of stories was better when an adult reader gazed at them while telling the story compared with when gaze did not occur.

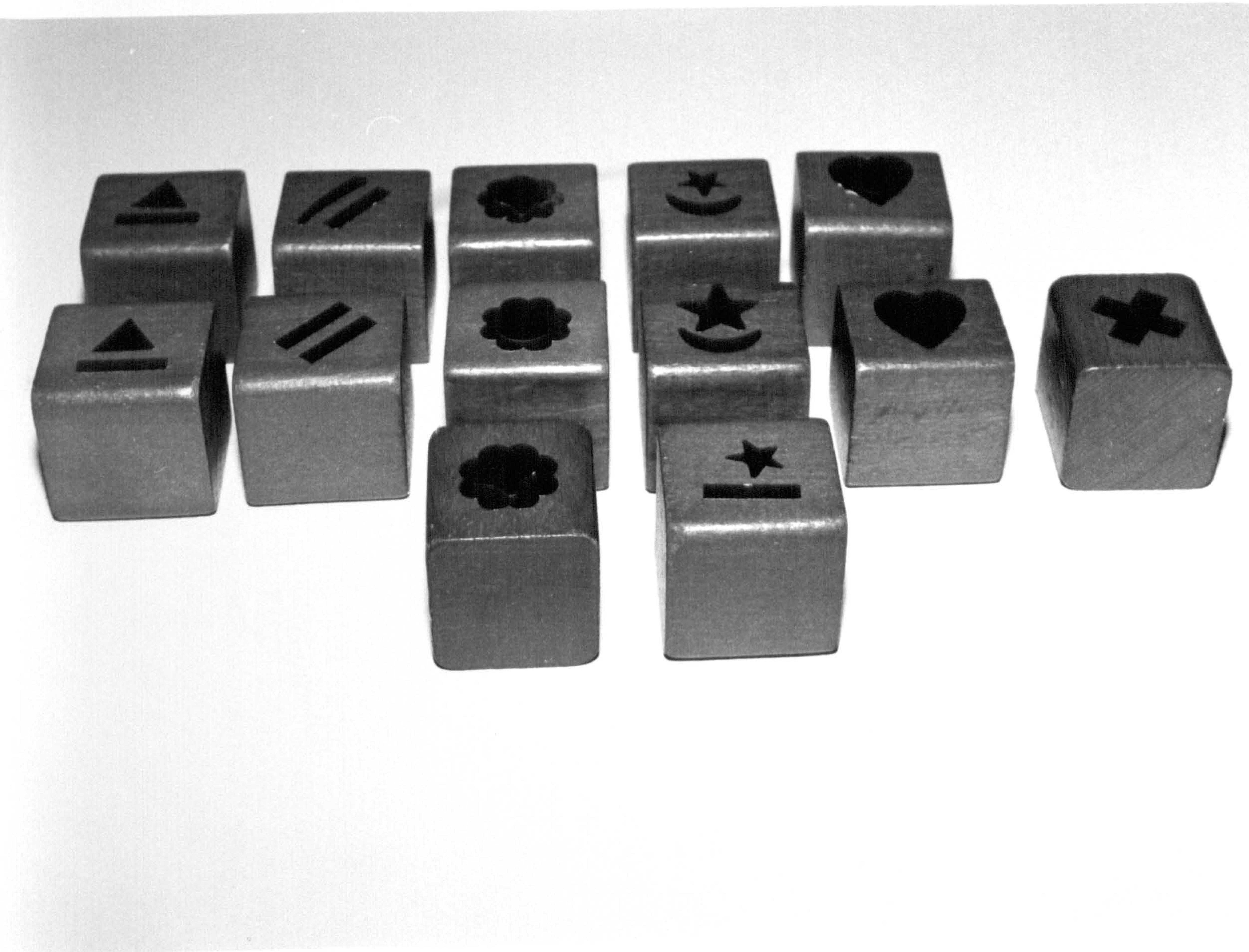
These findings also have implications for the use of video mediated interviewing in court. Video links are now implemented in several courts in Britain to be used in cases where children are involved as witnesses (Davies & Noon, 1991; Murray, 1995). The reason for using such links is to decrease the emotional trauma which many children experience when giving evidence. There is however evidence that video mediated communication is not equivalent to face-to-face interaction for adults, and indeed may be more similar to audio-only communication (Cohen, 1982; O'Connaill, Whittaker, & Wilbur, 1993; O'Malley & Langton, 1994; Sellen, forthcoming; Doherty-Sneddon, Anderson, O'Malley, Langton, Garrod, & Bruce, submitted). The present results show that visual signals are very important in the communication of young children. The question which must be answered is whether the visual signals provided by video links are an appropriate substitute.

Murray (1995) evaluated the video link in Scottish courts and compared cases using this technology with those using open court testimony. She found that children using the link were less likely to cry during cross-examination or to report feeling fear while testifying. However, Murray also found that many of the children described the set-up as strange, some finding it scary, and some strongly disliked it. One child even requested that she complete her testimony in open court. Link users also tended to give less detailed evidence (this pattern of results mirrors the findings of Study 3 (Chapter 4), where significantly more conversational turns had to be used to elicit the same amount of information in the audio-only context). These results suggest that while there are emotional benefits for the child using this technology, it may bring with it certain communication problems. Understanding the roles which visual signals play in children's communication and to what degree the video link serves these functions is central to overcoming these.

In summary, visual signals play an important role in children's communication in two ways. First, children express information non-verbally which they find difficult to express verbally and this must be attended to. Second, young listeners may find it easier to process visual information, and verbal information which is accompanied by visual cues. Young children communicate best in face-to-face interaction and do not cope well with a lack of visual signals. Both of these aspects of visual communication should be noted when communicating with, assessing and interviewing young children.

Appendices

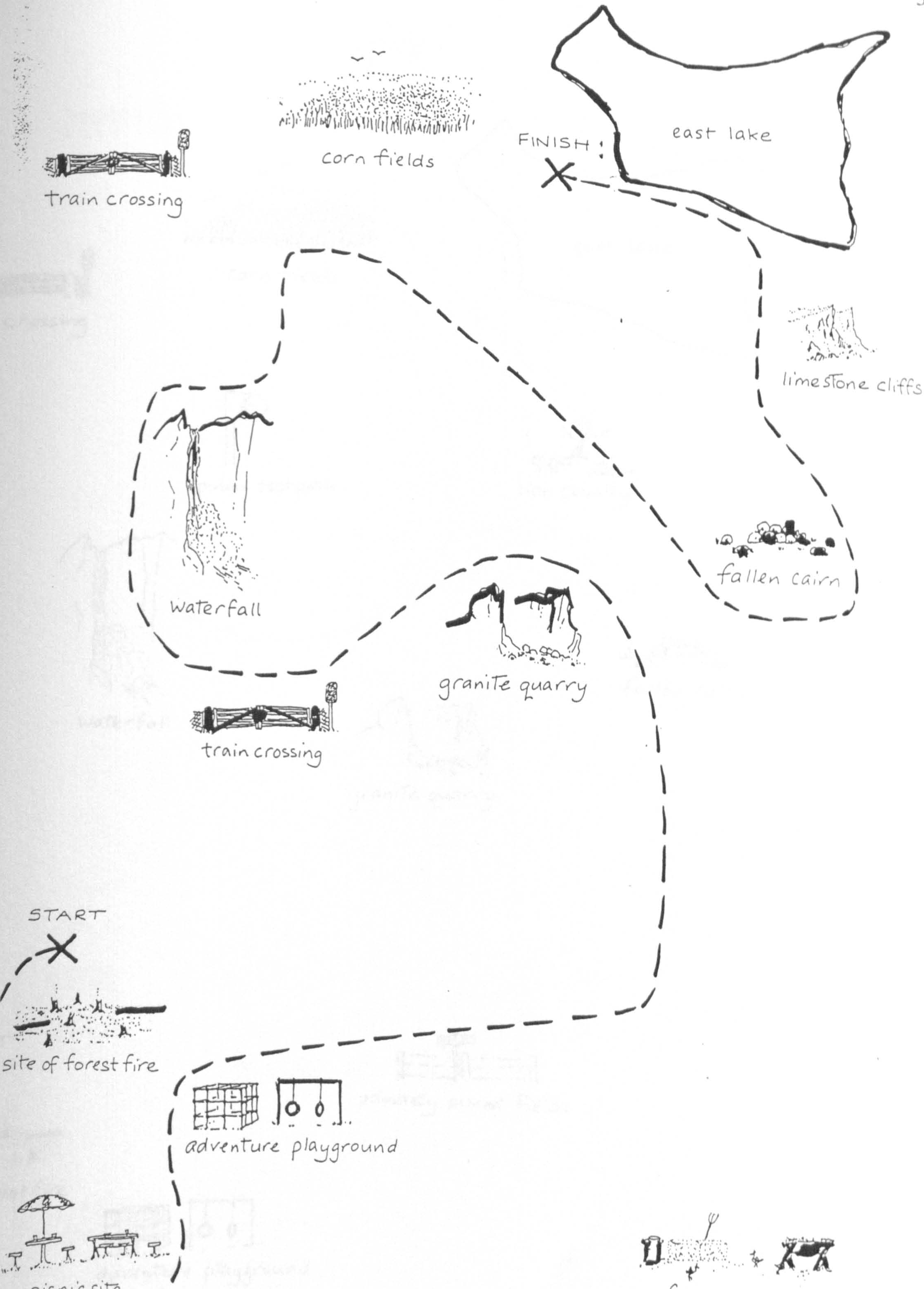
Appendix 1: A set of blocks used in Study 3 (Chapter 4). The set shown is a complete Instruction Follower set. The Instruction Giver, or target referents, are those in the top line of blocks.



Appendix 2: Map Tasks

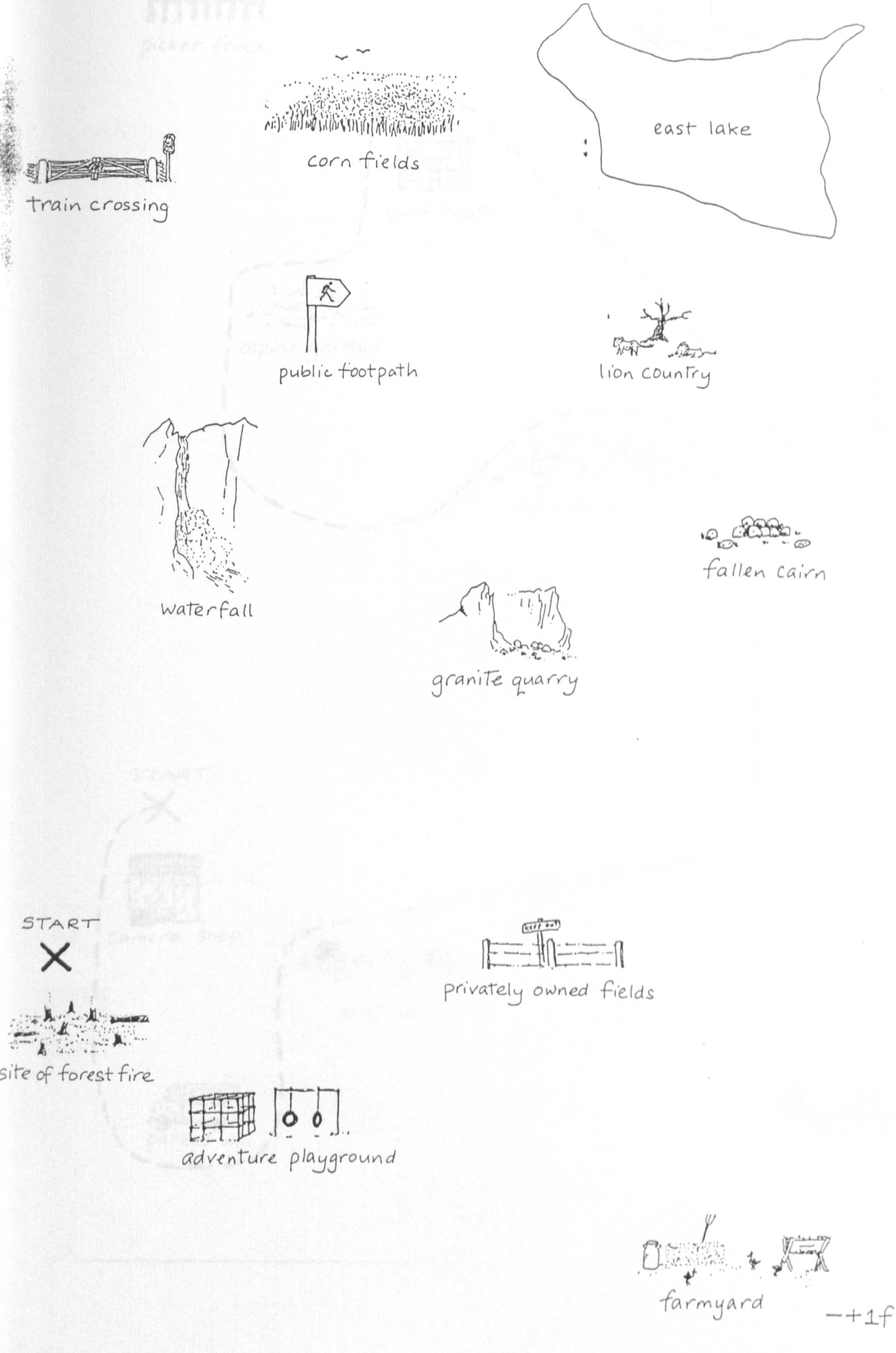
BEST COPY AVAILABLE

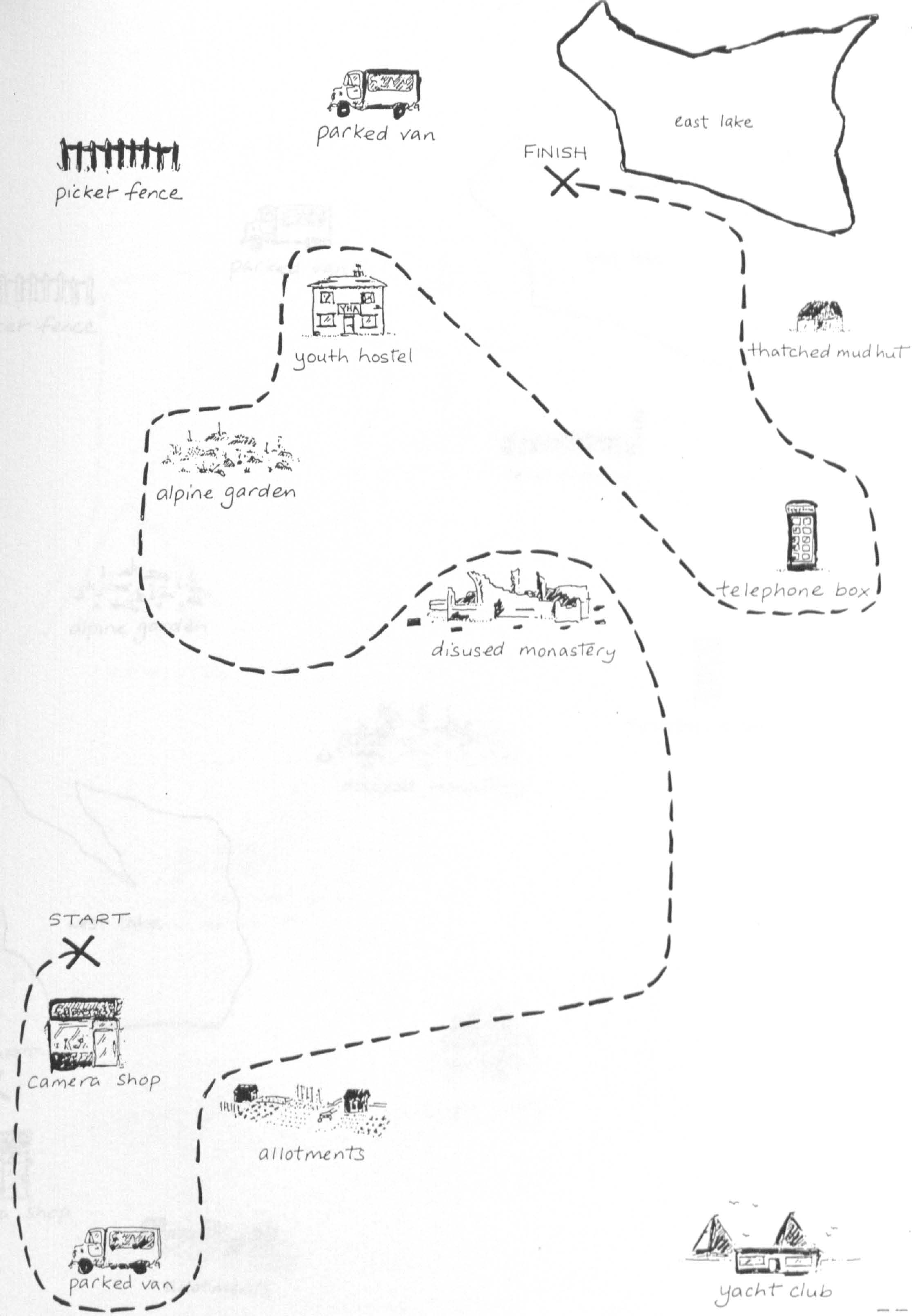
Variable print quality



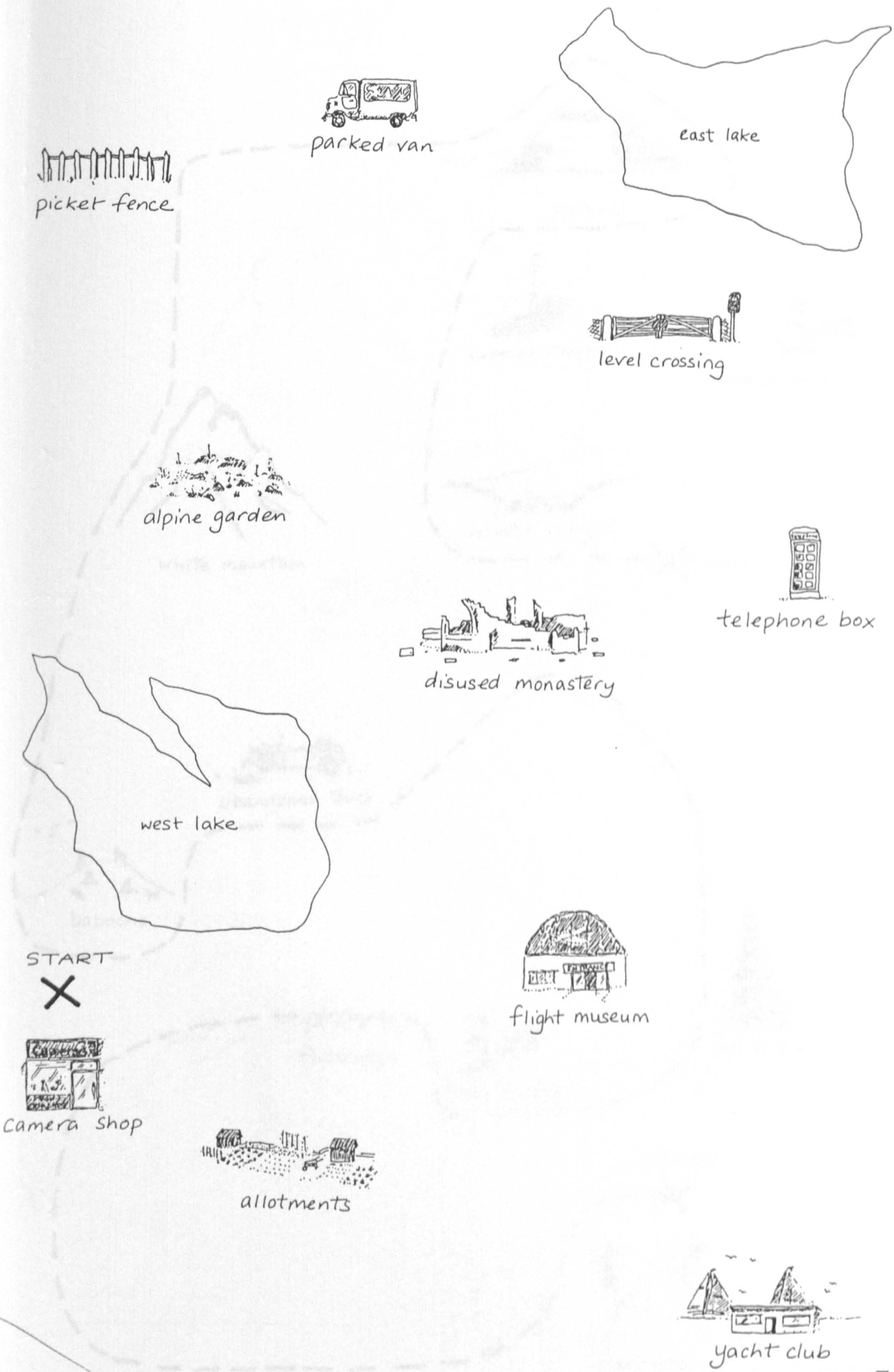
-+1g

N4Q3C5-t1AU

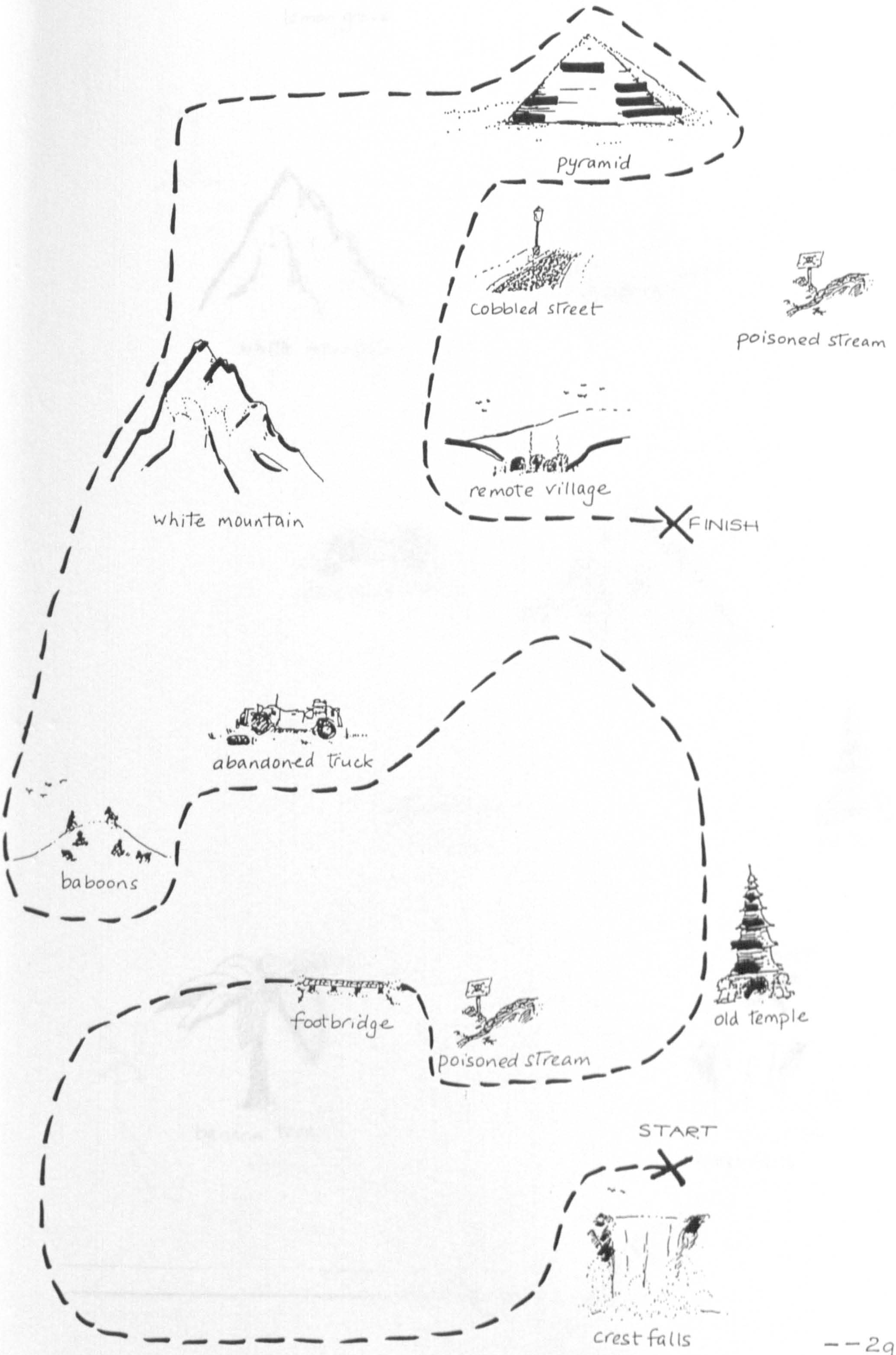

corn fields
east lake
train crossing
public footpath
lion country
waterfall
fallen cairn
granite quarry
START
privately owned fields
site of forest fire
adventure playground
farmyard
—+1f

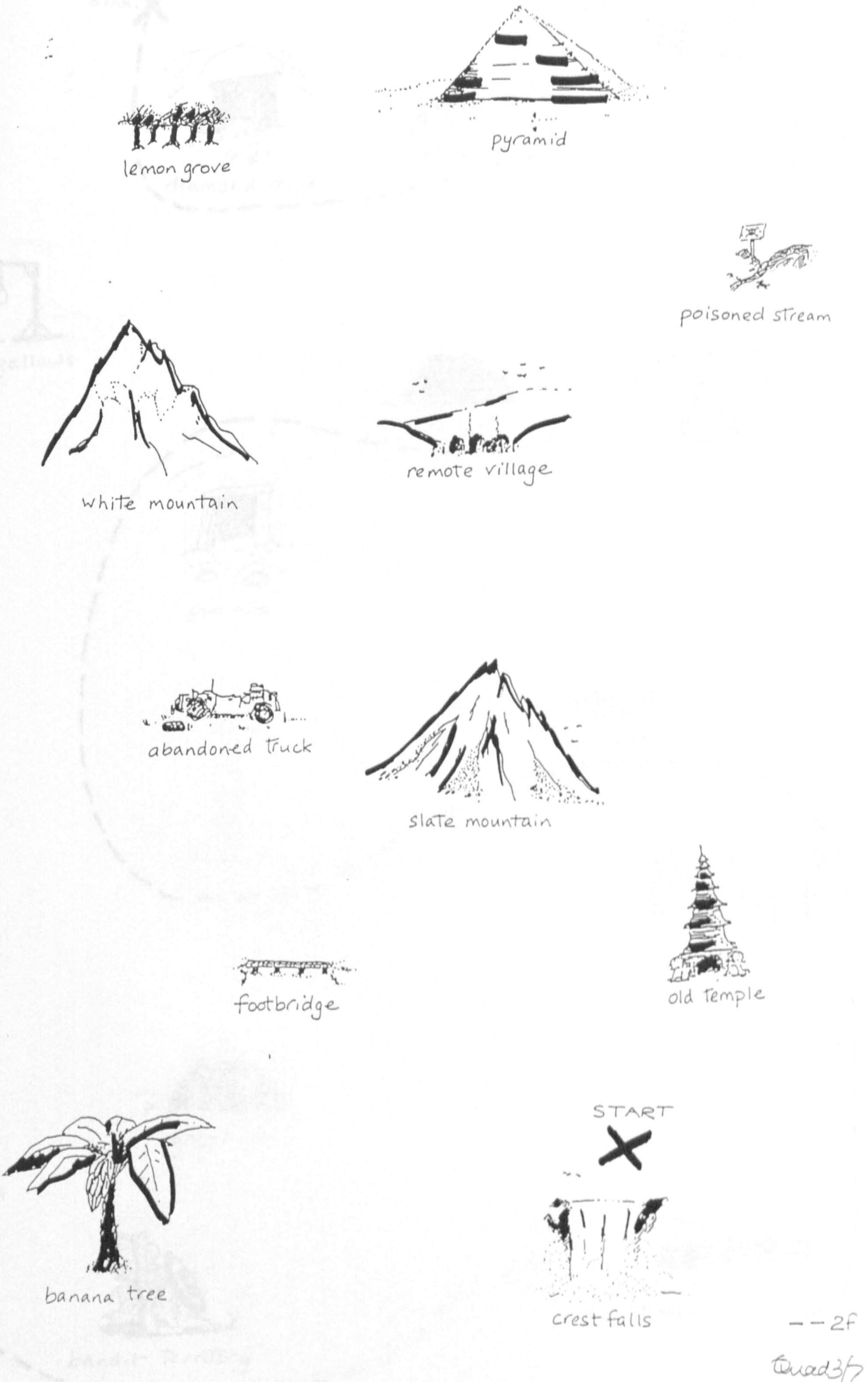

parked van
picket fence
east lake
FINISH
youth hostel
YHA
thatched mud hut
alpine garden
telephone box
disused monastery
START
Camera shop
allotments
parked van
yacht club

--1g
Quad 4/8

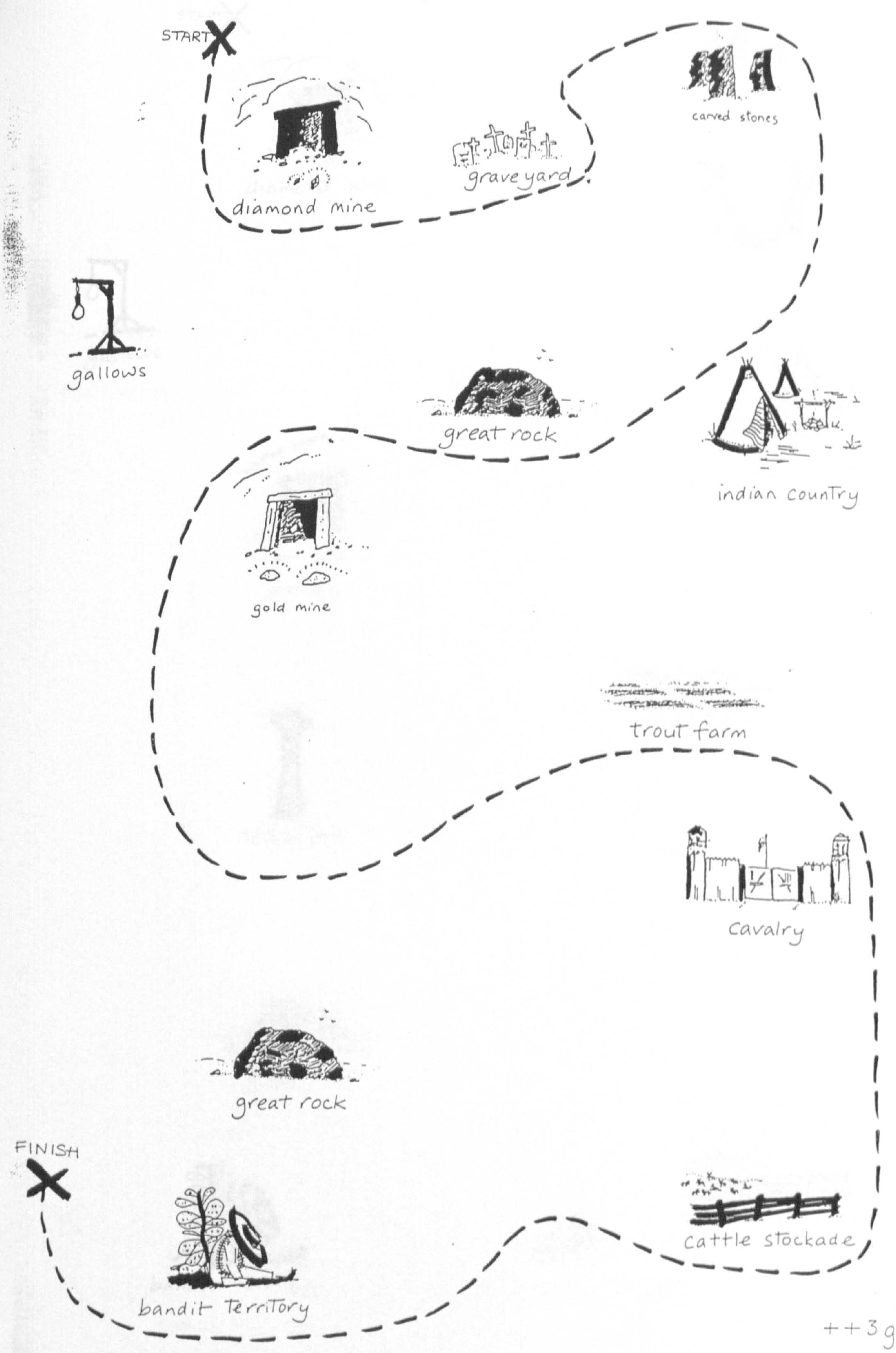

parked van
east lake
picket fence
level crossing
alpine garden
telephone box
disused monastery
west lake
START
X
flight museum
camera shop
allotments
yacht club

--1f

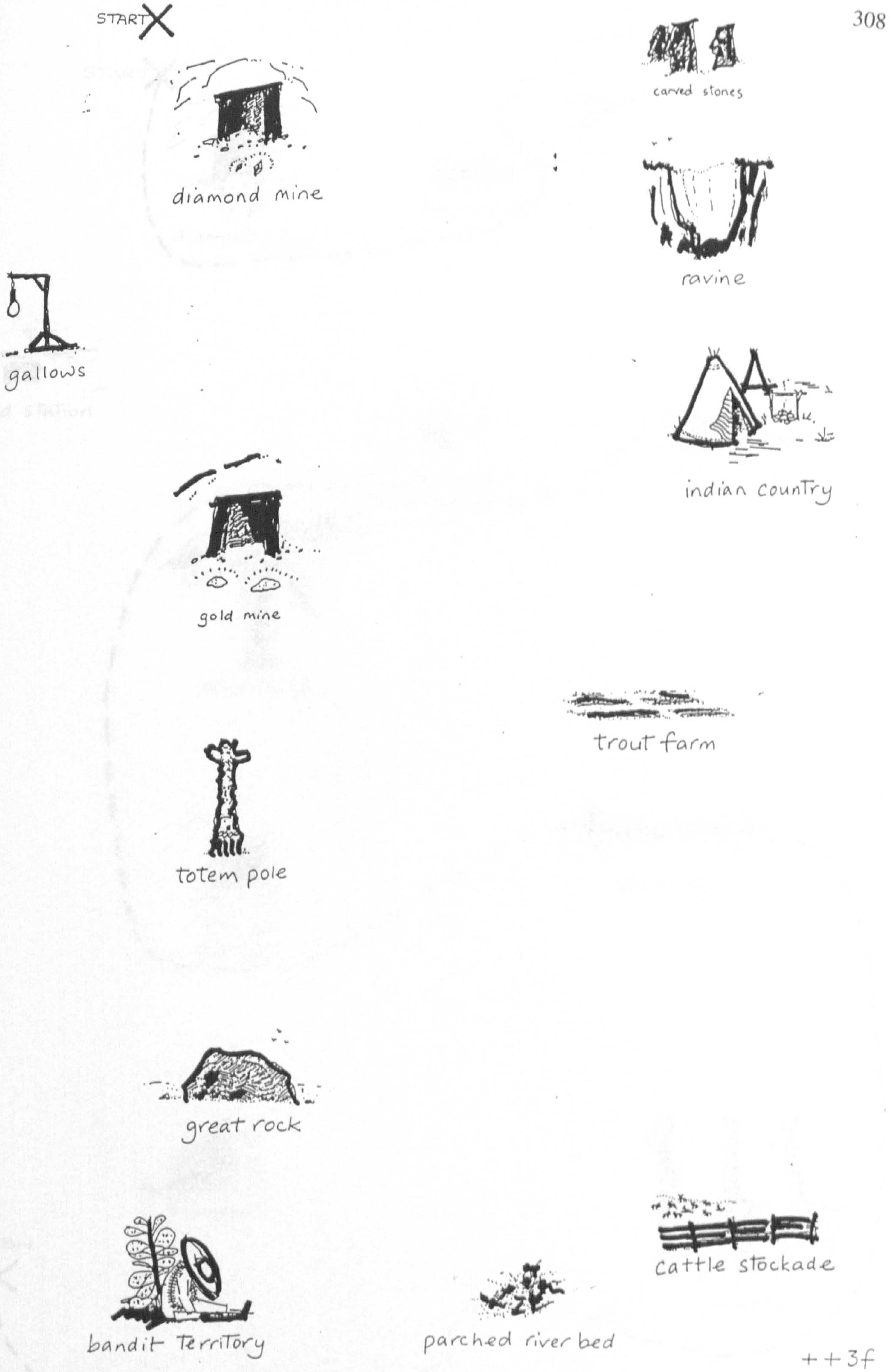

pyramid
cobbled street
poisoned stream
remote village
FINISH
white mountain
abandoned truck
baboons
footbridge
poisoned stream
old temple
START
crest falls



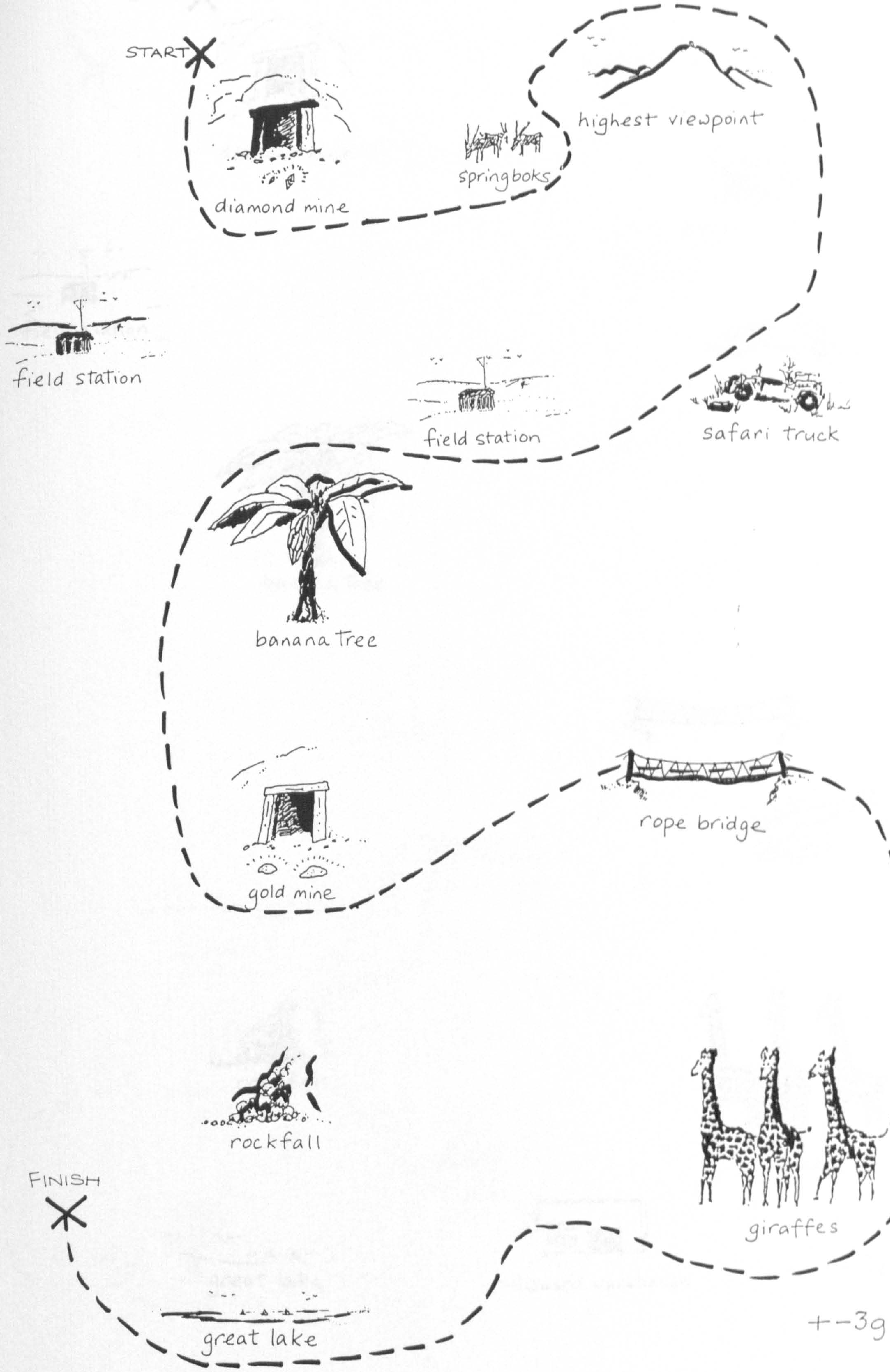
pyramid
lemon grove
poisoned stream
white mountain
remote village
abandoned truck
slate mountain
old temple
footbridge
START
banana tree
crest falls
– – 2f
Quad3/7

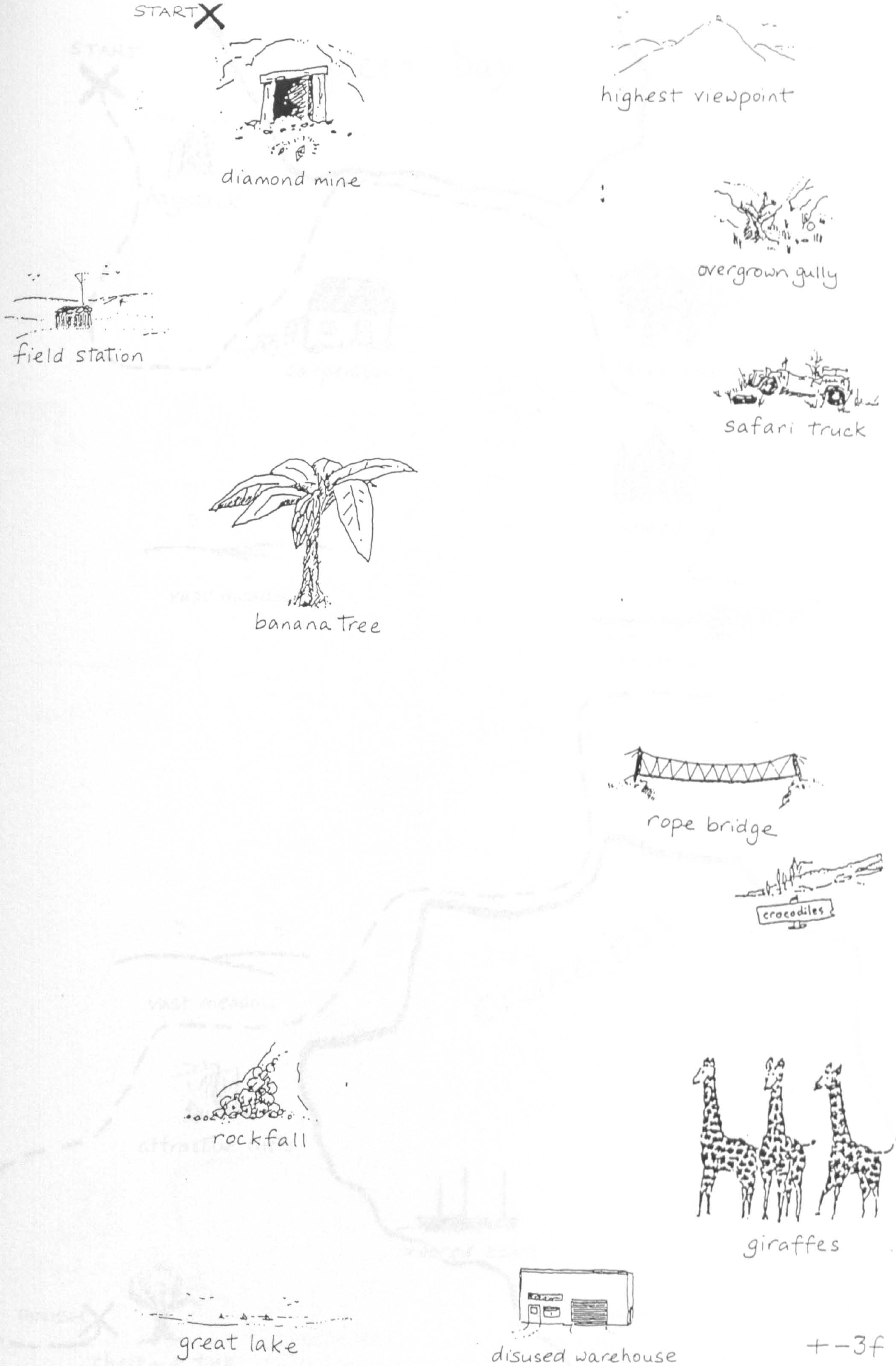

START
diamond mine
grave yard
carved stones
gallows
great rock
indian country
gold mine
trout farm
cavalry
great rock
FINISH
bandit territory
cattle stockade

++3g


START
diamond mine
carved stones
ravine
gallows
indian country
gold mine
trout farm
totem pole
great rock
cattle stockade
bandit territory
parched river bed

++3f

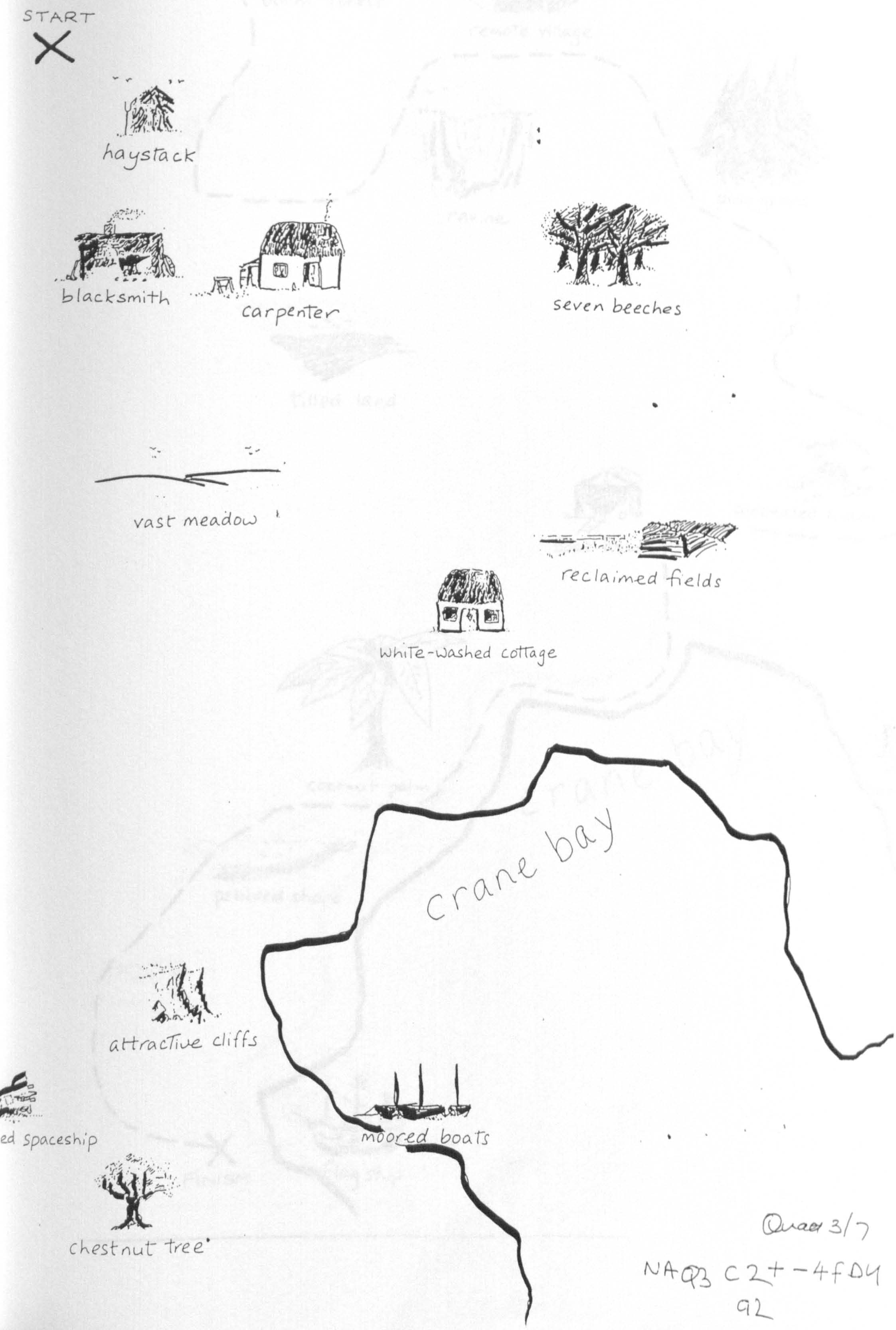

START
diamond mine
springboks
highest viewpoint
field station
field station
safari truck
banana tree
rope bridge
gold mine
rockfall
giraffes
FINISH
great lake
+--3g

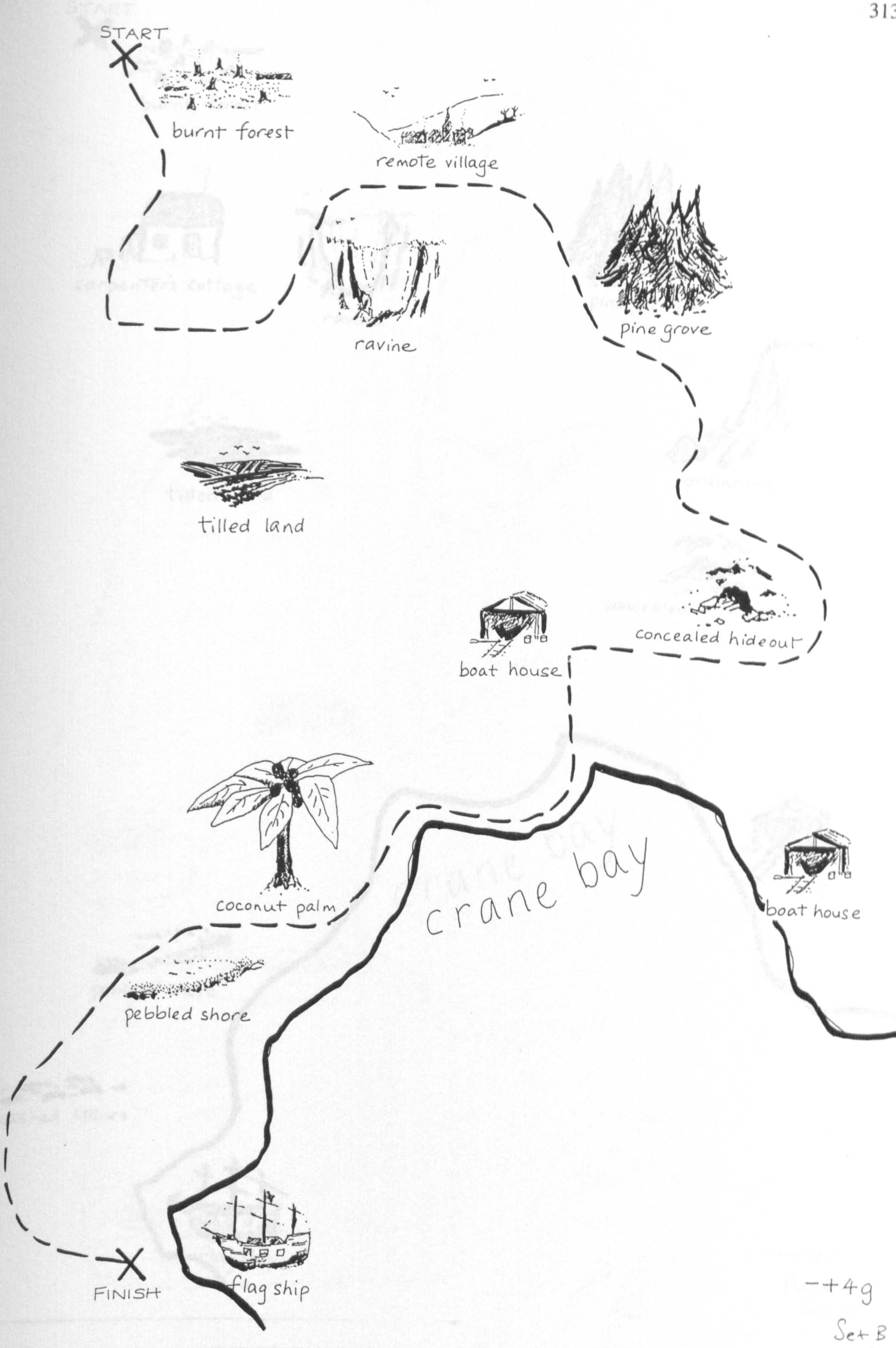


START
diamond mine
highest viewpoint
overgrown gully
field station
safari truck
banana tree
rope bridge
crocodiles
rockfall
giraffes
great lake
disused warehouse
+−3f


START
green bay
haystack
carpenter
seven beeches
chapel
vast meadow
reclaimed fields
crane bay
vast meadow
attractive cliffs
moored boats
FINISH
chestnut tree

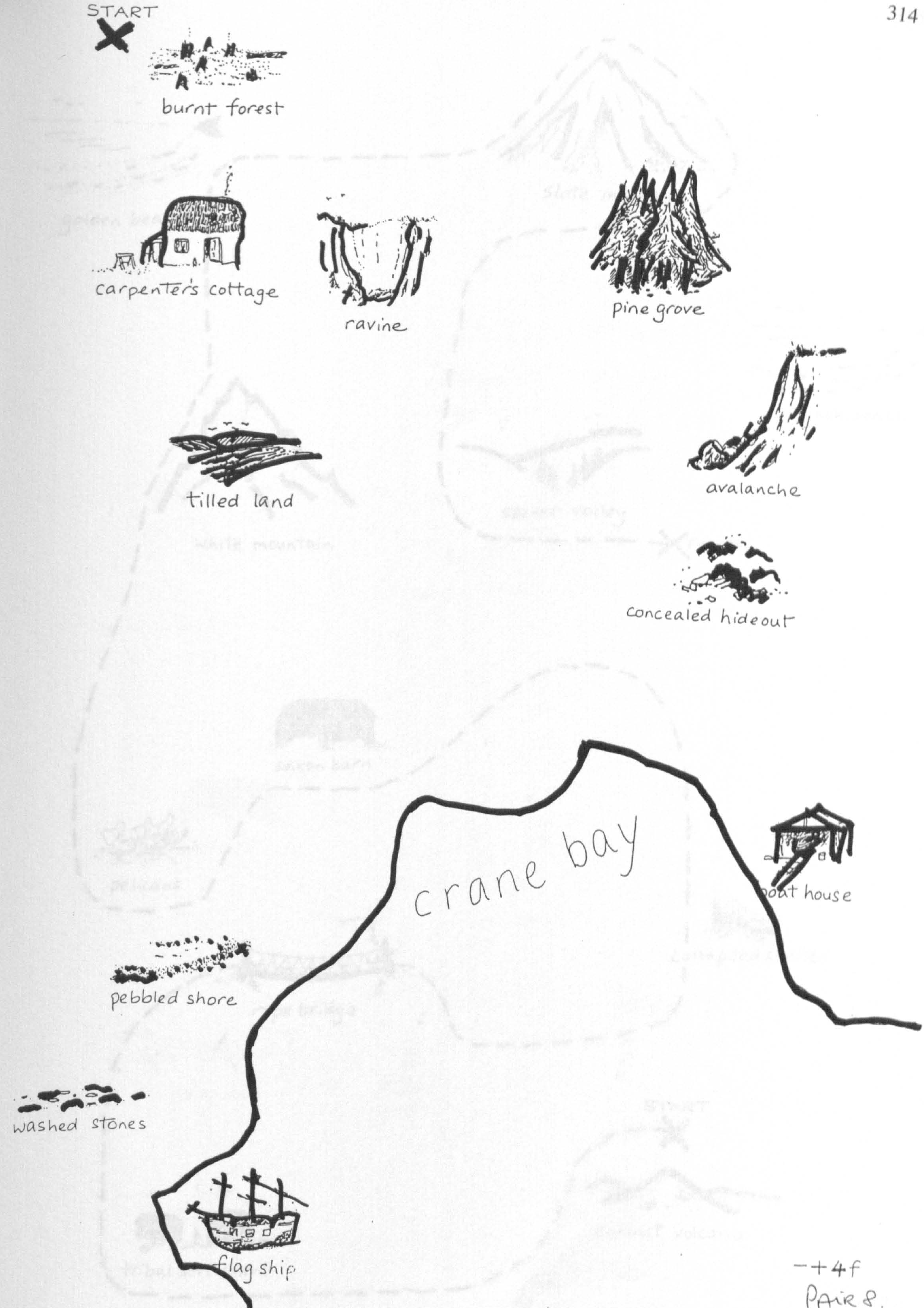
+ –49


START
haystack
blacksmith
carpenter
seven beeches
vast meadow
reclaimed fields
white-washed cottage
Crane bay
attractive cliffs
moored boats
chestnut tree

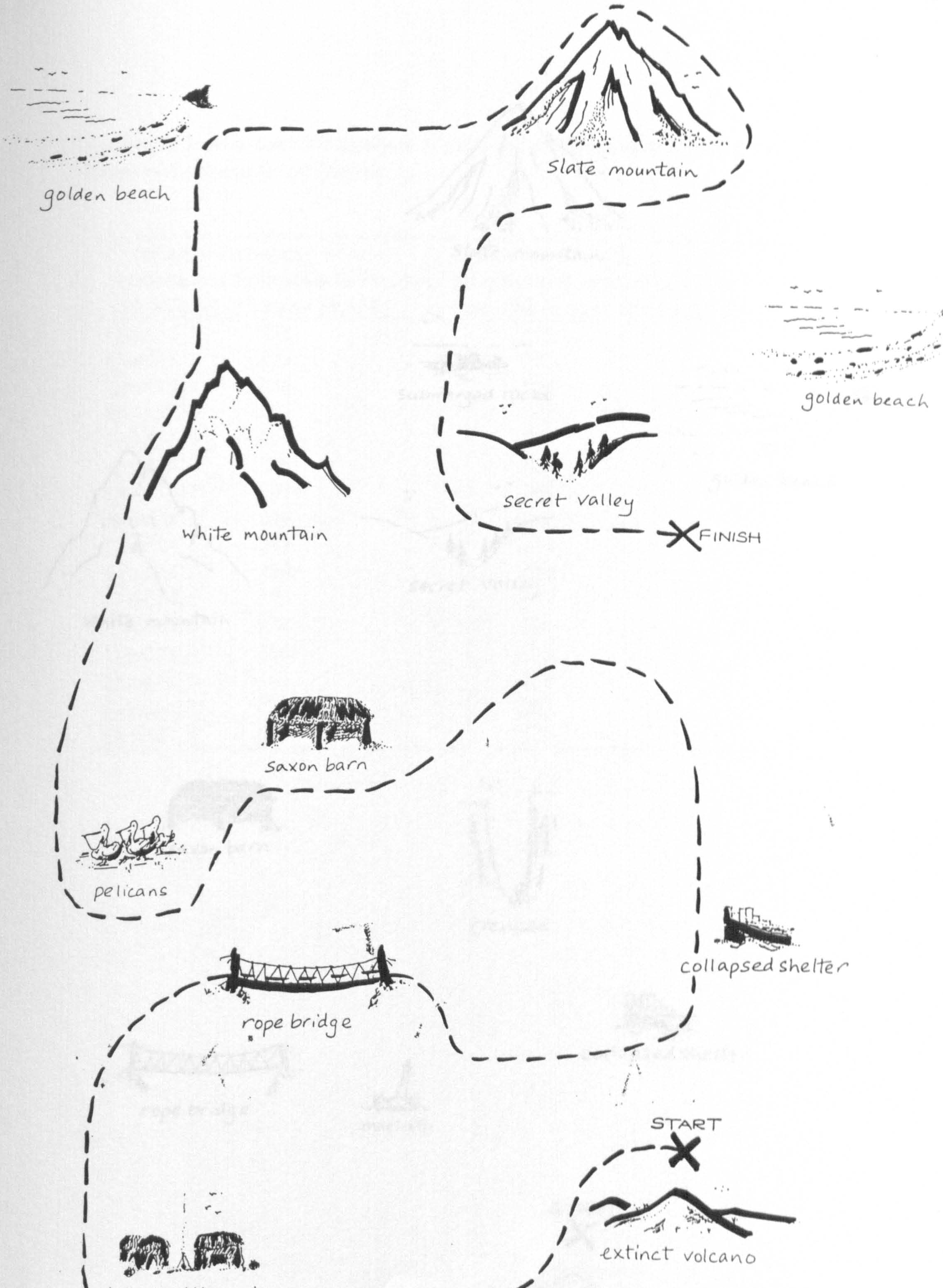

START
burnt forest
remote village
ravine
pine grove
tilled land
boat house
concealed hideout
coconut palm
crane bay
boat house
pebbled shore
flag ship
FINISH

-+4g

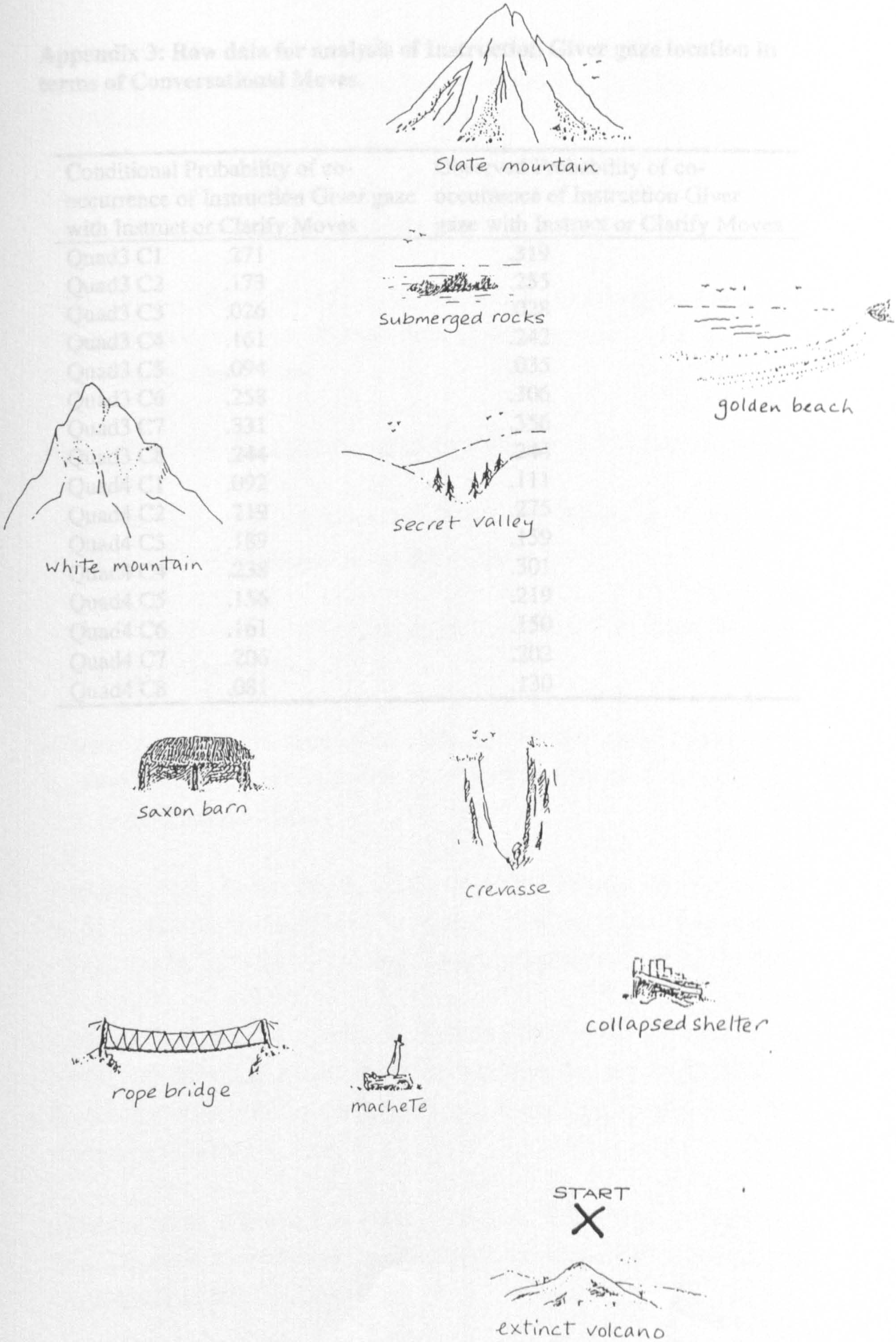
Set B



−+4f
Pair 8.
Set B


golden beach
Slate mountain
golden beach
white mountain
secret valley
FINISH
saxon barn
pelicans
collapsed shelter
rope bridge
START
extinct volcano
tribal settlement

++2g


Slate mountain
submerged rocks
golden beach
white mountain
secret valley
saxon barn
crevasse
collapsed shelter
rope bridge
machete
START
extinct volcano

++2f

Appendix 3: Raw data for analysis of Instruction Giver gaze location in terms of Conversational Moves.

Conditional Probability of co-occurrence of Instruction Giver gaze with Instruct or Clarify Moves		Observed Probability of co-occurrence of Instruction Giver gaze with Instruct or Clarify Moves
Quad3 C1	.271	.319
Quad3 C2	.173	.255
Quad3 C3	.026	.028
Quad3 C4	.161	.242
Quad3 C5	.094	.035
Quad3 C6	.258	.306
Quad3 C7	.331	.356
Quad3 C8	.244	.244
Quad4 C1	.092	.111
Quad4 C2	.219	.275
Quad4 C3	.189	.159
Quad4 C4	.238	.301
Quad4 C5	.156	.219
Quad4 C6	.161	.150
Quad4 C7	.206	.202
Quad4 C8	.081	.130

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