Reference and Representation in Down's Syndrome

by

Lois Joy Kingsbury Moore

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Abstract

Previous research has highlighted a different pattern in the use of grammatical forms to successfully maintain coherent discourse by individuals with Down's syndrome. To maintain coherent discourse both linguistic and non-linguistic information must be integrated and maintained in a mental representation of current discourse. The ability of children with Down's syndrome to use such a mental representation has been assessed in this study.

The ability of adults with Down's syndrome to comprehend and produce a range of grammatical forms was initially assessed, using a grammaticality judgement task, an imitation task, and a spontaneous speech sample. Results indicated that the production and comprehension of pronouns was found moderately difficult. The successful use of a pronoun depends on the ability to use a mental representation to retain information about its antecedent in order to assist correct interpretation and avoid ambiguity.

A narrative task was used to investigate the use of referential forms by children with Down's syndrome and typically developing children. The effects of certain contextual features on the use of referential forms were investigated: the status of each character and the number of characters in the story; the method of presenting the story; and the position of a listener while the story was narrated.

When narrating a story typically developing children distinguished the status of characters in the stories by consistently using different referential forms for each. As age increased this strategy was used more successfully and flexibly. Children with Down's syndrome did not use referential forms in the same way as typically developing children. It is likely that this is a consequence of a difficulty in maintaining information about the whole story—where many sources of information must be accessed, integrated and maintained in a mental representation. At a local level within the story, children with Down's syndrome used referential strategies successfully, demonstrating an ability to integrate limited amounts of information about characters in a story. The inability to maintain information in a mental representation across longer periods of discourse indicates the importance of short term memory in language production.

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Publications

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External Contacts

Adult Day Centres

Albert Road, Plymouth

Newnham, Plympton

Schools

Baytree School, Weston-Super-Mare

Bidewell Brook School, Dartington

Burraton Primary School

Charfield Primary, Bristol

Coniston Infants, Bristol

Coniston Juniors, Bristol

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South Brook School, Exeter

White Lodge Nursery, Bideford

Signed .. YLMoore .... Date 20.06.97......

Chapter 1

General Developmental Issues

1.1 Introduction

The ability to initiate and maintain coherent communication has been investigated by many fields of research—from Artificial Intelligence to Zoology. The underlying reason for this fascination seems to be the desire to discover the means by which communication is achieved, and how the processes involved develop to produce an organised system for receiving, processing and returning information in an infinite number of contexts. The development of the language system is virtually complete by the age of five, enabling communication to occur. However, successful communication is also largely dependent upon world knowledge as well as an understanding of pragmatic rules—it is these aspects of the language system, in addition to an expanding vocabulary, which continue to be learned by the child. The development of mechanisms by which the integration of linguistic and pragmatic processes can occur is the main focus of the present discussion. Support is taken from models which suggest ways in which the process of language development occurs.

Although language development is typically well advanced by five, there are instances where the language system does not develop as would be expected, for example where one of the processes involved does not function adequately, preventing successful communication from occurring. In typically developing children communication is dependent on the successful functioning of a number of processes. Once the processes have been identified, the importance of their role becomes apparent when normal development is compared with the developmental process which results in communicative disorders. Individuals with such disorders provide examples of the consequences of certain processes not functioning adequately. The recognition of communication disorders is relatively simple, whereas the identification of the processes which are contributing to the disorder is more problematic. This is, in part, the reason for investigating the development of language in children with Down's syndrome in this thesis, where the focus is primarily concerned with identifying which processes are responsible for the language disorder exhibited by children with Down's syndrome.

1.1.1 Focus of Thesis

Language acquisition and development in children with Down's syndrome is an increasingly well researched issue. Until recently researchers have focused on outlining the general patterns of development in children with Down's syndrome, an approach made necessary by a lack of information. However, researchers are now beginning to suggest underlying causes for the apparent language difficulties exhibited by most children and adults with Down's syndrome. An overriding concern has been why children with Down's syndrome find many aspects of both the comprehension and production of language problematic.

From various descriptive research findings (e.g. Fowler et al, 1980; Miller, 1988) it is clear that one area which proves an almost insurmountable linguistic obstacle to both children and adults with Down's syndrome is the acquisition of most aspects of grammar. Although both language comprehension and lexical ability is diminished in children with Down's syndrome, grammatical development occurs even more slowly and differently. These findings suggest that there is some ability to acquire vocabulary and some less abstract grammatical rules (e.g. word order) without which verbal communication would be virtually impossible for the child. However, the overwhelming difficulties experienced with the acquisition of grammatical rules are reflected in the expressive language of children with Down's syndrome. Indeed in order to maintain coherent discourse the use and understanding of grammatical elements is important. For example, the grammatical constraints imposed on the use of pronouns must be understood for anaphoric reference to occur successfully in discourse.

Grammar may be thought of as an abstract linguistic rule-system, the use of which can transform a finite lexicon into an infinite quantity of linguistic information which can be conveyed from one person to another. Both interlocutors in the discourse must be aware of the rule-system in order for successful communication to occur. Among other things grammatical rules depict relational information about the items in the discourse: they allow the interlocutors to construct a mental representation about the information being conveyed. Pragmatic information—such as the context of the utterance, other world knowledge, knowledge which is shared with the listener—is also necessary for both decoding of the grammatical input and the construction of a mental representation of the discourse.

The maintenance of coherent discourse depends upon the construction of a mental representation of the linguistic information conveyed in that discourse, this is achieved through pragmatics which facilitates the successful integration of lexical, syntactic, morphological, semantic, contextual and world knowledge. Pronominalisation has been reported to be one area of difficulty for children with Down's syndrome (Rondal, 1988). The construction and use of a mental representation can clearly be shown to be necessary for the use and understanding of pronouns: in the absence of a mental representation of the discourse the linguistic information conveyed by pronouns can be seen to be meaningless. A mental representation provides the necessary mechanism through which the meaning of pronouns may be decoded, since it allows for successful integration of pragmatic, semantic and syntactic information.

It is possible to hypothesise that an underlying cause of the difficulty in grammatical acquisition, and particularly difficulties of pronoun use, by children with Down's syndrome may be an inability to integrate necessary information: this may be reflected by an inability to construct a mental representation of the discourse. Processes which enable the construction of a mental representation may therefore be related to the difficulty exhibited by children with Down's syndrome in the understanding and use of grammar.

Determining what processes are involved in the successful use of pronouns, in association with the construction of a mental representation of discourse, is a hotly debated issue for typically developing children. Such an understanding is, however, necessary to enable a comparison to be made between normal development and that of children with Down's syndrome, whose development has been clearly shown to be different from normal development. The following sections will address the issues surrounding the normal acquisition and development of language from a perspective which assumes the importance of mental representations in the development and use of language.

Language is the medium by which much information is gained and communicated to others by each individual. Understanding the underlying processes which allow this to occur has been the focus of a number of theories which address the issue of maintaining coherent discourse. Although some of these theories recognise that mental representations must exist, the full importance of the role they perform in both the development and maintenance of successful functioning of the language system goes largely unacknowledged.

1.2 Language Acquisition and Development

Communication is an intricate integration of cognitive and linguistic processes. It is for this reason that we must consider development of both cognition and language. First, that of language acquisition and development, where the emphasis is on pragmatic rather than morphological and syntactic aspects of language. Second, aspects of cognitive development which are related to language development will be investigated—for example processing ability, coding and retrieval of information. It is an understanding of the mechanisms or processes which facilitate the interaction between language and cognition which will enable us to determine how communication can be maintained in a coherent manner.

1.2.1 Language: Innate or Learned?

There is much debate concerning the process by which language is acquired and develops: whether language is independent of or dependent upon other cognitive processes being an especially prominent issue. The innateness of language, coupled with issues regarding language-specific innate abilities, which presuppose a modular structure of processing have been the focus of one school of thought, influenced mainly by Chomsky (e.g. 1980). In contrast to this view is the claim that language development is a consequence of general cognitive ability (e.g. Piaget, 1970). Other theoretical approaches have amalgamated the above theories and regard cognitive development as necessary for language acquisition and partly as a scaffold for it, and also assume that the child possesses essential language-specific innate abilities which facilitate the acquisition of language (e.g. Cromer, 1991; Pinker, 1984). A modular approach which proposes that both specifically cognitive and specifically linguistic modules are necessary for language acquisition and development has also been supported (Karmiloff-Smith, 1992). The functioning of these cognitive and linguistic elements in tandem have been considered in relation to many elements of language development, for example grammatical development (Newport, 1988). The general communicative skills used to maintain cohesive discourse also support the notion of an intricate association between the linguistic and cognitive abilities of both adults and children. Relevance theory, which emphasises the importance of the construction of mental representations in discourse, suggests that successful communication is dependent upon the rule-based systems of both grammar and pragmatics (Sperber and Wilson, 1995).

Understanding of the mechanisms which are involved with processing of information is of fundamental importance when assessing comprehension and production of pragmatic and grammatical features of language. For these features to function normally, both non-linguistic and linguistic information must be integrated into the overall knowledge-base. Whether or not this integration occurs centrally or rather as a result of the interaction of separate specific modules has been the subject of debate for numerous theoreticians and researchers (e.g. Lenneberg, 1967; Fodor, 1983).

1.2.2 Universal Grammar

It has been argued (e.g. Chomsky, 1980) that the complexity of the language which the child eventually masters cannot be explained solely in terms of the linguistic environment to which the child is exposed. Instead it is suggested that the child is born with innate knowledge about the language system which aids the child in acquiring language. Chomsky (1985) termed this knowledge Universal Grammar.

The role of universal grammar (UG) is to limit the number of possibilities which the child will consider concerning the rules of the target language. Chomsky's model of UG can be defined in terms of a set of principles with associated parameters. Each parameter corresponds to one of the various subsystems of language, and has a finite number of settings. Various combinations of these settings will then yield all the possible core grammars of human languages; differential weighting attached to the various settings would mean that certain types of grammar would have a preferred status. UG guides language acquisition, since the use of the principles of grammar allows the child to form rules which can be tested, without the direct evidence from language input. Thus correct predictions about the grammaticality of an utterance can be made for sentences other than those to which the child may be exposed.

There are various segments into which language acquisition can be divided, each having its own rule system. For example, rules of morphology (word formation) enable the formation of new words. Rules of syntax specify the way in which words will be organised into phrases and sentences. The way in which the rules of universal grammar are implemented is dependent upon the language to which the child is exposed. The innate rule system is initially relatively flexible: parameter settings are selected, which determine exactly how the grammatical rules will be enforced.

1.2.3 The Semantic-Pragmatic Distinction

An argument central to the focus of this thesis is a distinction which Chomsky (1980) makes between two interacting components, first—semantics and pragmatics, and second—syntax, morphology and phonology. Both components are suggested to be modular and task-specific. The task of the first component is to interpret the linguistic meaning of an utterance (semantics) which then enables inferences to be made about the meaning of the utterance using non-linguistic processes, world knowledge and contextual information (pragmatics). The second component involves syntax and phonology and morphology, information relevant to this component is processed using an independent linguistic processing mechanism.

Therefore, when considering the interaction between linguistic and cognitive systems care must be taken to ensure that the distinction between linguistic and conceptual components is clear; linguistic theory invariably refers to linguistic semantics—that is, the manner in which meaning is conveyed through language, this is considered in complete isolation from any notion of conceptual semantics—which largely involves the representation of information and the associated knowledge-base.

It can therefore be seen that the distinction between semantics and pragmatics is an important but complex one. Carston (1988) recognised the importance of such a distinction and states that meaning derived from information which is conveyed either implicitly or explicitly cannot be explained wholly by semantic interpretation—which concentrates solely on the linguistic input, but rather it is necessary to involve pragmatic inference in order to explain the way in which meaning is ascertained from utterances. Stalnaker (1972) has defined pragmatics as "the study of linguistic acts and the context in which they are performed". This is a rather general statement which does not emphasise that what is critical in the process of pragmatic inference is how the context is used to determine meaning. This emphasises the importance of the need to be clear about the function of each process.

Semantics is the process by which linguistic forms are transformed into conceptual representations. Semantics can be seen as the meaning conveyed through the use of certain linguistic structures. Pragmatics allows for the interpretation of the linguistic input in a specific context. The underlying meaning of the utterance is inferred from the specific language used, the context in which the utterance occurred, and the associations which the utterances form; these features exist as part of the listener's and speaker's mental representation of the discourse. The extent to which each of these features is relevant to the overall discourse and utterances within that discourse will determine what is said, what is meant, and what is understood.

Relevance theory is one approach which seeks to explain the interaction of these features. It attempts to explain why and how mental representations are initially constructed, as well as how they are used and revised to understand utterances. Attempting to address issues surrounding the initial construction of mental representations sets relevance theory apart from other theories which attempt to explain the function of mental representations in language use and understanding (See section 1.4.4 for a discussion of relevance theory). Sperber and Wilson (1986) take the language processing system to be a specialised automatic decoding system. The pragmatic processing of utterances employs relatively unspecialised inferential processes and encyclopaedic knowledge which are involved in processing all incoming information, whether linguistic or perceptual.

Pragmatic information allows the listener to infer information from discourse. The speaker may not explicitly state a relationship between two pieces of information but it may be inferred by the listener on the basis of the context of the utterance as well as other world knowledge which has already been mentally represented by the listener. Relationships can be inferred using grammatical devices, but these usually indicate that the listener must use pragmatics to derive some conceptual information from the context (e.g. in the case of pronouns). The initial linguistic decoding can provide the general theme and direction of the utterance, while the pragmatic principles of relevance and informativeness provide the relationship between the items and the reason for the utterance. Pragmatic principles underlie and determine what is stated and what is understood. The following examples provide a useful illustration of the above points.

1. Here's a spoon, eat it.

2. That will set it off.

3. A: Fred has been to the doctor.

   B: Is he better?

Each example indicates the importance of pragmatics in discerning the relationship between the linguistic concepts explicitly stated by the speaker. In the first example the listener, after the initial linguistic decoding, must interpret the intended referent of the pronoun before the correct action can be taken. Unless the spoon is obviously constructed of edible material the listener is quite likely to infer that, although the semantic interpretation suggests that the spoon is the object to be consumed, the context would suggest that the spoon is the object which will assist in the consumption of the food in front of them. In the second example, although a pronoun is being used, the referent's interpretation by the listener is clear, and not dependent upon prior discourse. However, what is most important for this example is the context in which it is uttered, since the linguistic meaning decoded will be the same if uttered by a jeweller referring to a diamond, or by a bomb disposal expert referring to an explosive device, although it is clear that the pragmatic inference will be quite different. The third example highlights the importance of world knowledge, context and the interpretation of pronouns in even a simple discourse in order to infer the intended meaning. The clear statement by A has been linguistically interpreted by B who then responds apparently ambiguously. B has assumed shared knowledge between A and B about the context of the utterance, as well as world knowledge about the usual reasons for visiting a doctor.

Interestingly, Kempson (1988) has related the principles of UG to those of relevance theory. Kempson notes that relevance theory imposes a constraint on cognitive processes since they are all attempting to maximise relevance—"geared towards the least processing cost for suitable inferential reward". If the constraining features set out in the principles of UG were not present then the grammar would overgenerate with regard to what the speaker takes to be acceptable, and interpretation of utterances would demand enormous processing resources.

Sentences are only identified by listeners as potential sources of information if they have associated with them a logical form (i.e. a semantic representation) which can provide the basis for constructing a well-formed logical expression. Indeed it is possible to argue that syntactic rules of universal grammar are a direct consequence of, and thus dependent upon, the principle of relevance. The internalised constraint of maximisation of relevance while minimising processing costs, enables the speaker to construct a relevant and therefore grammatically correct sentence, and the listener to derive the most relevant proposition from the language used.

1.2.4 Support for Universal Grammar

The system of grammar is largely in place by between three and five years old, this rapid time scale for development has been used by proponents of Universal Grammar as support for a highly structured learning mechanism. Support for the innateness of language acquisition can be derived from a number of sources. For example, there is evidence of an orderly progression of stages where the child passes through distinct phases of development during the acquisition of a grammatical system. Evidence which supports a critical period has also been used in defence of the innateness of language acquisition. The critical period is an age, possibly corresponding to the onset of puberty, beyond which the child is restricted in their ability to learn language. The demonstration of a critical period for language acquisition provides important evidence for the claim that native language learning operates successfully due to a set of internal constraints, at least some of which are only present early in life. However, there is also evidence against the claim of a critical period for language learning. For example, Rondal (1988) has indicated that adults with Down's syndrome continue to acquire language beyond the age of thirty. Changes that occur between childhood and adulthood in language learning seem to affect all aspects of grammar acquisition, including access to universal grammar, the ability to set parameters, and the ability to master the language-specific details of the grammar. It has been suggested that the child brings to the first language task two types of information. First, an innate set of constraints on what human languages are like, which rules out certain kinds of structures or grammars as possible in any human language. Second, a set of procedures for using linguistic input to determine the particular features of the target language among the range of possible forms human languages take. The older learner has both a diminished or weakened set of universal constraints on human languages in general, and a weakened or flawed set of procedures for analysing the particular features of the target language (Newport, 1988).

Those supporting the innateness of language acquisition would argue that development is, to a certain extent, independent of external information. Evidence for this claim comes from groups of children with disabilities. For example, deaf children can be observed to babble, regardless of the fact that they are unaware of the sounds around them or the sounds they are making. Babbling has been proposed as a precursor (but not necessarily a prerequisite) to spoken language, and a possible indication of an innate predisposition to acquire and use language. However, the fact that deaf children do refrain from making further progress in the usual stages of language acquisition emphasises that the external stimulus does play a crucial role. The sections below discuss further evidence which supports innate language ability, that of prelinguistic precursors and external influences on language acquisition such as negative and positive evidence, and the learnability of language.

1.2.5 Prelinguistic Precursors

In the quest for an understanding of the underlying mechanisms for language development, researchers have attempted to identify abilities which may be prerequisites and precursors to language development. It is argued that by determining the abilities and processes which are necessary for language to develop some insight may be gained into whether the processes needed are purely linguistic or cognitive, or whether interaction between the two might occur. The interaction of the processes necessary for the successful functioning of a formal rule-governed language system can be explained within the framework of a mental representation. Mental representations provide the mechanism by which the linguistic and cognitive processes can be integrated and the information temporarily stored and revised. Establishing a connection between non-linguistic processes and their association with language development is useful for those researchers who are attempting to identify possible causes of language impairment.

Many researchers have sought to demonstrate that infant gestural systems and other motor activity serve as the prelinguistic foundation upon which verbal language forms are directly mapped (e.g. Bruner, 1975; Lock, 1978; Volterra, 1981). Bates et al (1983) note that children of approximately 13 months produce manual gestures with common objects in their hand and suggest that the use of these gestures is like the child's early use of referential words. Because of the similarities between these symbolic manual gestures and words, Bates et al, while focusing on the use not the form of the linguistic system, conclude that they derive from common underlying cognitive capacities, rather than language-specific knowledge. Thus the gestures are not prelinguistic, rather they are regarded as gestural equivalents of names.

The view that language represents an elaboration of gestural communication has also been developed in regard to the relationship between pointing behaviour and deictic terms. Clark (1978) proposed that the child's verbal deictic words emerge directly out of early pointing gestures in a natural and continuous progression. Early non-communicative pointing is said to represent the child's emerging ability to recognise and distinguish self from external distant objects. It can be seen that there is some evidence for the essential continuity of language and other linguistic forms. This view suggests that the transition from prelinguistic communication to linguistic competence should be relatively smooth with no abrupt discontinuity in the use of these differing forms.

The alternative view is that if a language is a distinct formal system reflecting a particular mental capacity, not wholly built up from early communicative competence, the transition from prelinguistic to linguistic expression may be discontinuous, marked by evidence of the reorganisation of knowledge regarding the function and use of linguistic forms once they become part of a formal grammatical system.

Support for this explanation of language development has been provided by Pettito (1987) who has examined the relationship between prelinguistic gestures and the acquisition and use of pronouns in signed language. Sign languages exhibit formal linguistic organisation at the same levels found in spoken languages. One would expect that if the acquisition and use of pronouns depends on cognitive prerequisites, including prelinguistic referential gesturing, then the progression from such an action to the linguistic form would be smooth and effortless. Pettito has shown that for deaf children who were developing normally linguistically and cognitively, pointing gestures were not used initially (between six and eight months). By ten–twelve months deaf children were shown to use pointing gestures to communicate with others about objects, places and people. However, surprisingly, Pettito notes that during the period between twelve and eighteen months deaf children stop pointing to people—either themselves or others. However, they continue to point to objects and places, indicating that the general communicative usefulness of pointing is still understood by deaf children at this age. Pronouns were produced at the age of 21–22 months by the deaf children in Pettito's study, initially in a relatively unstable fashion—producing reversal errors for personal pronouns. There was also a general tendency to use full referential forms where possible, since the attempt to use personal pronouns produced errors. Similar errors are noted in the development of pronoun use in typically developing children (e.g. Schiff-Meyers, 1983). By the age of 27 months the errors were corrected and the use of pronouns was error-free. Pettito notes that this U-shaped pattern of development with regard to the use of pronouns corresponds with that observed in typically developing children. The cause of production errors in the case of signed pronouns is particularly intriguing since the meaning of the pointing gesture is transparent. The transparency of the meaning is one reason for Bates et al (1983) supporting the notion that pointing is a direct prerequisite of the linguistic use of pronouns. However, this evidence clearly shows that there is a dissociation between the early deictic pointing gestures used and the later use of pronouns in a linguistic form, and clearly provides evidence which disconfirms the predictions of some models. As the deaf child's sign language develops, there is a preoccupation with the linguistic referencing rule-system associated with the pointing form used for "you" and "me" and the child ignores the fact that the physical action of pointing conveys the same information. The error of using the opposite form from the appropriate one, as seen in typically developing children, is genuinely linguistic since the child ascribes linguistic rules to something which could, if prelinguistic gesturing was still in action, be referenced by simply pointing. So pointing, used in prelinguistic communication, is ignored in favour of a process which draws upon a structured, rule-governed system. The idea that gestures can function as linguistic symbols is so powerful that it overrides the transparent deictic pointing gesture. This suggests that the deaf child's knowledge undergoes a basic reorganisation, somewhat similar to the process which is seen in typically developing children who adopt various linguistic referencing strategies (Karmiloff-Smith, 1992—see section 1.3.4 for further details).

Aspects of grammatical structure and its acquisition involve language-specific rather than general cognitive knowledge which the child brings to the language acquisition process. The mechanism used for the assimilation of linguistic and pragmatic information can be seen to occur within the framework of a mental representation. The importance of mental representations becomes clear for most processing tasks, since they act as intermediaries between other necessary processing mechanisms. For example, in the case of processes necessary to use pronouns in discourse, linguistic perceptual and decoding processes as well as short and long term memory are necessary. Short term memory allows the temporary storage of incoming information—whether linguistic or non-linguistic, and long term memory allows the storage of encoded information which can then later be accessed. How the meaning encoded by all of these separate processes can be integrated can only be explained through the use of mental representations. The meaning attributed by syntactic and semantic processes to the linguistic signal which has been initially accessed from short term memory is represented. Pragmatic processes access other extra-linguistic information which has been stored in long term memory such as the context of the utterance, the shared knowledge of the speaker and listener, and world knowledge. The resulting pragmatic information is also represented and integrated into the same mental representation. A judgement can then be made about the likely meaning of the utterance and what relevance it has to the ongoing discourse. It becomes clear, therefore, that while the acquisition and development of linguistic skills is necessary, as well as that of non-linguistic cognitive skills, the ability to integrate the two sources of information, using a mental representation, is equally important.

1.2.6 Positive and Negative Evidence

The typically developing child is exposed to a vast array of linguistic information in an equally disparate set of contexts. The way in which the child makes judgements about the grammaticality of the language which is heard is dependent upon external linguistic information which the child gains through communicative experience. Research has tried to determine what information children use to learn language, and how much learning is controlled by an innately driven rule-system. Linguistic input which the child receives can be divided into positive and negative evidence for the correct version of the grammatical rules which the child should be acquiring.

The positive evidence indicates that the forms exist in the target language. From this language input the child must independently determine specific information about the structure and meaning of the utterance. They may use contextual information to aid this process. The child is only exposed to a limited sample of the possible grammatical sentences in the language: for this reason the influence of positive evidence is limited.

Negative evidence is information given about the grammaticality of a sentence produced by the child, that is, feedback informing the child that certain strings have been ungrammatical. There is some debate about the amount of negative evidence which is given to children, but the majority view tends to agree with the fact that there is very little given. Parents do not reliably or frequently correct ungrammatical sentences, and on occasions in which such feedback does occur, children fail to take advantage of it (Pinker, 1989). Both positive and negative evidence has been considered to be insufficient for the acquisition of grammar: this has been used to support the view that the child's acquisition of grammatical language is guided by an innate knowledge of principles of grammar.

However, studies have shown that negative evidence, as well as additional information about linguistic devices can aid the acquisition of certain grammatical rules. For example, Snow (1986) and Penner (1987) indicate the importance of expansions and clarification by parents. Newport, Gleitman and Gleitman (1977) showed that such information facilitates the acquisition of a variety of syntactic constructions such as tag questions, future tense, passives, and relative clauses. Corrective language input has been shown to help eliminate incorrect grammatical rules (Farrar, 1992). Saxton (1992) also supports this view and has shown that negative evidence occurs much more frequently than previously assumed. However, the important conclusion which is reached is that the extent of exposure to negative evidence does not necessarily aid the child if that child is unable to make use of that information. Such a conclusion supports the claim that the application and success of either positive or negative evidence can only be explained in terms of a mental representation. A mental representation encapsulates both the language used by the child, the context of the discourse and the previous (positive evidence) or subsequent (negative evidence) language used by the adult. If the child cannot represent and integrate such information, the information cannot be used to aid grammatical development.

1.2.7 Language Learnability

Using aspects of the learnability paradigm, support has been gained for the presence of innate structural principles which guide language acquisition. Information processing theories divide the cognitive system into components and explore the way in which these components transform and manipulate information. They also emphasise the representations used to store information. Learnability theory is used to prove theorems about whether or not language is learnable given certain assumptions about the input, the learning mechanisms the child possesses, and the structure of the adult language system.

Pinker (1989) places a number of requirements on learnability. First, the rule system governing a particular stage of development must have been constructed by an acquisition mechanism that began with no knowledge of the child's native language. Second the system must have arrived at its current state on the basis of the input it has received in the interim. Third, each intermediate rule system must be the result of specified acquisition mechanisms operating on the preceding rule system. Fourth, the end result of acquisition must be a grammar adequate to represent adult abilities.

If it is assumed that children are equipped with the universal linguistic categories of noun and verb, as well as able to induce the phrase-structure rules for the specific language, then after having learned which words fit into which category and the individual meaning of those words, these words can be used to construct a semantic interpretation of the sentence. Semantic interpretations can then be used to guide inferences about the syntactic structure of the sentence. Thus it can be seen that children can infer the syntactic structure of a sentence from a meaning which is independently determined, by deducing the semantic concepts which universal categories encode. It clearly follows that this paradigm operates under the assumption of the existence of mental representations of the various stages of the learning process. The function of a mental representation is to allow the information being processed to be assimilated to form an organised structure, from which deductions about incoming information can then be made.

1.2.8 Representing Grammar

The process of acquiring and developing language has been shown in the previous sections to be largely innately driven, the ability to represent incoming linguistic information has been shown to greatly enhance language development. The functioning of mental representations in the acquisition and development of grammatical rules can clearly be seen to be necessary. Grammatical information is ultimately encoded in the mental representation of the discourse in terms of the general meaning which it conveys rather than the specific linguistic elements of which it is made up. However, some initial representation of the linguistic elements must take place in order for the meaning of the utterance to be extracted from the linguistic input. Therefore, the role which is assigned to each element of the language input of the child will affect subsequent perception, storage and retrieval of those and similar items. The message which is usually remembered by the listener may not involve a direct representation of the linguistic input, but rather an amalgamation of information which has been constructed within their mental representation of the discourse and context. This resulting representation has been influenced by assumptions about the relevance of the utterance. It is likely that the message which is encoded within the mental representation has been enhanced pragmatically rather than merely representing the often limited or incomplete linguistic information which has been provided by the speaker (Carston, 1988).

The importance of mental representations in the initial stages of sentence processing has also been supported by claims that some kinds of linguistic information are delayed in application during sentence processing (Clifton and Frazier, 1986). This may be because some information is more readily accessible for processing, perhaps because of the way information is structured in the mental representation of the discourse. Linguistic information can be successfully encoded (at minimal processing costs) so that the overall meaning of the discourse can be stored within a mental representation. If this usual procedure fails to elicit a likely meaning, a more detailed (costly) processing procedure must be implemented. Therefore, the salient features of the incoming linguistic information are made available to the mental representation of the discourse in order to make judgements about its grammaticality, the overall meaning of the utterance, and the implication of that meaning on the revision of the mental representation of the discourse.

Failure to include many of the elements required by adult grammar is one frequent linguistic error which young children who are in the process of acquiring grammatical rules are shown to commit (Gerkin, 1991). Indeed, similar difficulties are observed in the language produced by older people with Down's syndrome. Certain sentential elements may be omitted because the immature grammar either does not represent these elements at all or treats them as optional. Alternatively, children may have limits on the complexity of the utterances that they can plan and produce, and therefore they are forced to omit elements that they, nevertheless, may know are obligatory. Therefore, it can be seen that the ability to represent the grammatical elements of the incoming linguistic information is necessary in order to glean the meaning of the utterance which will influence the overall representation of the discourse. The presence of cognitive overload may also indicate an immaturity or inability to represent linguistic information efficiently within a mental representation.

1.3 Cognitive Influences on Language Development

Cognitive development has been suggested to occur from an interaction between innate potential cognitive ability and environmental factors (e.g. Piaget, 1970). New cognitive structures are formed through modification and integration of existing ones, thus developmental growth depends on internal processes in interaction with the environment. This aspect of development can also be explained and supported through the notion of a mental representation, where processing of incoming information is done within the specific mental representation of the event, which in turn can draw on previously encoded experience, as well as modifying the representation of the experience according to new information obtained. Because mental representations are not module-specific they allow easy interaction of information from various domains, for example that of cognition and language.

According to the "interaction-based" models (e.g. Piaget, 1970) language development is a result of general cognitive capacities. Language is built up from preestablished forms of knowledge through the child's interactions with caretakers, objects and events in the environment. McCune-Nicolich (1981) has provided evidence to support this notion from examining the development of object permanence and its relation to representational language, and concluded that the child must attain a particular stage of object-concept development before the use of particular kinds of representational language can occur. It can also be seen that this connection can be made by the child through the use of a mental representation, where object concept may occur as the result of developing the ability to abstractly represent the object internally, while allowing the linguistic expression to be assigned to the mental representation. This explanation does not therefore assume that the acquisition of the linguistic expression is dependent upon prior cognitive acquisition of the concept but that adequate processing abilities are necessary to relate the two.

Similarly, Tomasello and Farrar (1984) concluded that the semantic content of the child's early words should be related to specific developments in cognitive ability; namely that absent-relational words do not appear until stage six of object permanence when the child has an understanding of invisible-object transformations. Gopnik and Meltzoff (1986) also found a relation between success at certain cognitive tasks and the use of particular words relevant to those tasks, but they question the direction of the association. Bates et al (1979) in answer to this question proposed a homology model which considered "local homologies" or "skill-specific" parallels. Therefore, in relation to language and cognition, her model would claim that a developing underlying capacity could manifest itself either in cognitive tasks or in language, and that either of these could emerge first in observed development. The supposition that language depends on the formation of prior concepts does not explain the ability to encode those concepts in language. It is also clear that some linguistic information is not dependent on prior conceptual knowledge. Gopnik and Melzoff (1984) have provided evidence that concepts and language develop together, in which language is seen as a contributing factor rather than as a simple consequence of cognitive development, which is closely related to the theory proposed by Vygotsky (1989).

1.3.1 The Cognition Hypothesis

The cognition hypothesis of language acquisition states that the acquisition of particular conceptual abilities usually precedes the acquisition of the particular linguistic terms with which they are associated. Cromer (1988) suggests that cognitive development is more closely related to the content of early language, that is, to the meanings children express, than to the more general structural features of language, for example syntax. This distinction is more clearly explained in the difference between linguistic and conceptual semantics, where cognitive development may be seen to underlie the conceptual semantics which Cromer describes as "expressed meaning", while more innate linguistic abilities may contribute to the successful expression of linguistic structures such as syntax. This may explain the finding by Curtiss, Fromkin and Yamanda (1978), who have argued that there is no link between syntactic and morphological ability and general cognition. They have noted that expressive semantics correlated with a number of non-linguistic tasks. Expressive syntax, a measure of structural complexity of language use, correlated only with auditory short-term memory. This means that memory constrains the length and complexity of utterances used by the child, but that conceptual abilities are not related to structural measures of language. It would seem from this evidence that conceptual knowledge and language are separate systems and can develop independently. Mental representations of the discourse, which are involved with the amalgamation of linguistic and cognitive information, are likely to be influenced by cognitive abilities when organising and processing conceptual linguistic information, whereas processing and therefore encoding specific linguistic structural components such as syntax in the mental representation may be hindered by memory capacity.

1.3.2 Critical Period

Another body of evidence which indicates the importance and influence of cognitive processes on language acquisition is the presence of a critical period in language acquisition. Theorists who support the notion of critical periods in development assume a modular structure of processing systems, whose processes interact. The theorists do not specify the mechanism by which these processes interact, but it is clear that mental representation of the aspects involved in the learning procedure is necessary. Research which investigates a critical period in language learning presupposes a connection between language-specific and cognitive processes, which is also assumed in the use of a mental representation. Evidence of a critical period is therefore not only useful in support of the innate capacity of language acquisition, but also to show the importance of, as well as the fine balance which must be achieved between the interaction of cognitive and linguistic abilities. The term Critical Period is used to refer to any domain in which there is a maturational change in the ability to learn, which (usually) peaks in childhood, and declines after a definable time, usually in adolescence or early adulthood.

There are two accounts which offer reasons for the decline in development. One suggests that the underlying learning mechanism itself undergoes maturational decline or decay, thus producing the decline in competence if exposure to learning is delayed; in the case of language development, decay to a language-specific ability which is intact in childhood will occur in early adulthood. The second account proposes that the behavioural decline in learning results from the maturational increase of other mechanisms which interferes with successful learning; for language acquisition relevant related abilities which have been constrained early in development, but which are now necessary for further language learning are mechanisms such as working memory, and general processing ability.

Evidence of a critical period in language acquisition has been shown both in the acquisition of the grammar of a first language (Curtiss 1977, 1988; Newport and Supalla, 1990) and of the grammar of a second language (Johnson and Newport 1989), where language learners who had been exposed to the second language at different ages show differing degrees of success, with greatest success achieved by those who had been exposed to the language close to birth. Evidence has also been shown for a critical period in pidgin and creole (Bickerton, 1984).

Lenneberg's (1967) maturational hypothesis speaks most directly of a maturational change in the ability of non-language areas of the brain to assume linguistic functions. It does not provide evidence concerning maturational changes in normal language learning abilities. Lenneberg's original proposal of a critical period in language acquisition suggested that normal language learning was possible from infancy to puberty, with a loss of abilities after this. However, findings do not show a sudden drop in ability after puberty, but rather a gradual decline from about seven to adulthood. Newport and Supalla (1990) on the other hand have noticed that a decline in performance can occur far earlier, with children exposed to a language for the first time at four–six years old performing consistently below native learners.

1.3.3 The "Less is More" Hypothesis

Newport (1988) has proposed a theory which attempts to explain the reasons for the apparent decline in ability to learn language which acknowledges the influences of cognitive processes on language acquisition and development. As Turkewitz and Kenny (1982) have noted, various sensory systems tend to develop in sequence and tend to develop at times when both the input to the system and the surrounding abilities are limited. Therefore normal development of each system occurs at a time when there are maturational limitations on competition between systems and on the complexity of the input each system receives.

Cognitive limitations of the young child during the time of language learning may likewise provide a computational advantage for the acquisition of language—which the older child and adult do not have. Young children, in the early stages of acquisition, appear to acquire only limited parts of the surrounding language: they begin with one morpheme at a time and gradually increase the number and complexity of the units they control. Adult learners in the early stages of language acquisition appear to be much more competent, producing more complex words and sentences early on. But they have permanent difficulties working out how to internally analyse the constructions they have acquired in a relatively unanalysed fashion. The child may therefore succeed at language learning because he begins with the ability to extract only limited pieces of the sentence, with a gradual increase, over maturation, in the amount of material which can be analysed. In contrast the more capable adult extracts more of the input but is then faced with a more difficult problem of analysing everything all at once. This explanation therefore suggests that language learning declines over maturation precisely because cognitive abilities increase, and suggests that the very limitations of the young child's information processing abilities provide the basis on which successful language acquisition occurs.

The "Less is More" Hypothesis therefore suggests that the more limited abilities of children may provide an advantage for tasks which involve componential analysis. If children perceive and store only component parts of the complex linguistic stimuli to which they are exposed, while adults more readily remember the whole complex stimulus, children may be in a better position to locate the components.

1.3.4 The Representational Redescription Model

An alternative model has been developed by Karmiloff-Smith (1992) which has been used to explain development in a number of domains, and which revolves around the concept of mental representations. The representations permit knowledge in a specific domain to be reorganised to allow systematic and efficient processing of the information, which results in a refined understanding and output. The redescription of representations allows them to become more flexible and complex, since independently stored representations can be incorporated into a more structured and organised system.

"Representational redescription is a process by which implicit information in the mind subsequently becomes explicit knowledge to the mind, first within a domain and then sometimes across domains" (Karmiloff-Smith, 1992, p. 18).

Both the "Less is More" Hypothesis and the Representational Redescription Model depend on mental representations as the mode by which linguistic and cognitive information is integrated. But evidence which supports the notion of a critical period would suggest that the adult linguistic system cannot attend to or represent the individual segments of language; possibly the processing systems of adults are insensitive to the way in which these segments are marked in order to process the information efficiently. "Unanalysed whole" segments of the new language can be represented and possibly organised in a systematic way, but the initial separation of grammatical markers would seem to be difficult—perhaps suggesting that sensitivity to this information does have a critical period. The representational redescription model does not address the issue of language acquisition, but concentrates on the development after the initial encoding of separate segments of language. As Karmiloff- Smith notes, adults are able to allow one processing system to influence another, while children—although influenced by the task—tend to store information separately. This advanced processing capacity may hinder the initial representation of linguistic segments because adults may immediately attempt to analyse and reorganise the information in a systematic way.

Background to the RR Model

The Representational Redescription (RR) Model is a phase model, as opposed to a stage model. Stage models such as Piaget's are age-related and involve fundamental changes across the entire cognitive system. Changes which occur in representational redescription do so recurrently within specific systems throughout development and are not age-related.

Cromer (1983) recognised that some kind of reorganisation process was likely to explain the child's linguistic development, but could not identify how or why this reorganisation should occur. The characteristic U-shaped developmental curves which can be observed in many developmental processes may be attributable to the reorganisation of information. It is necessary to focus on what occurs in the underlying processes of representational change. The procedures which the child and adult carry out are often similar in nature, however Karmiloff-Smith argues that the function and status of a procedure is not always the same for children even if the surface form is identical. What seems to be the underlying cause for the difference is the fact that children tend to treat skills in an isolated fashion allowing them to be accessed on an individual basis, although the child's performance is task-dependent, suggesting that in some instances even young children are able to store information systematically. Adults, however, are able to allow one procedure to act upon another. For example, young children's pronouns are deictic in nature—they are used to draw attention linguistically to the extralinguistic referent. While the use of a pronoun is appropriate it is not based on a systematic appraisal of previous references in the discourse: it is this apparently independent reference which marks it as linguistically deictic. Older children make intralinguistic reference: that is pronouns are used as a linguistic marker to refer to a previously mentioned linguistic form. The ability of the older child to construct a mental representation of the discourse allows them to use the pronoun anaphorically, while for younger children their mental representation of the discourse is at best a series of disjointed linguistic items. At both age levels the process of successfully using a pronoun is achieved. However, structural organisation of the referential system appears to be different. Older children are able to implement two tools in order to maintain coherent discourse. First, they are able to internally represent the referent. The context of the referent can be assessed and encoded, inferences can then be made about the likely status of the referent. Second, as a result of the reorganisation of linguistic information regarding referential devices, a systematically organised rule system is available to the older child. This governs the appropriate referential strategy which must be used for the referent, based upon the information amalgamated in the mental representation.

In order to develop the ability to maintain linguistic cohesion reorganisation of stored linguistic representations must take place so that they form a system. The organisation of entries in memory involves the progressive formation of linguistic subsystems via the reorganisation of independently stored entries. For example, in the case of pronouns, the child not only needs to represent information about the semantic features of each particular item, but also about the relationship between the pronouns themselves and other nominal devices. The organisation of these entries in the form of a system results from explicit marking of such relations in memory. Once organised systematically, the meaning of any particular term also allows for elimination of contradictory terms stored in the subsystem.

Karmiloff-Smith therefore proposes a theoretical framework for representational change which involves a three-phase cycle depicting the representational change in long-term memory organisation of linguistic entries. A refined version of this model, which has been associated with several domains of development (Karmiloff-Smith, 1992) describes the reorganisation of representations using a four tier model, stating the phases in terms of "different levels of progressive representational explicitation". The data obtained from other domains has led to the elaboration of the model but will not be considered here since, while being closely related, the initial model is most clearly appropriate since it was designed exclusively for language acquisition, and more specifically referential language development.

Phase One

Phase one is characterised by two features and is known as the "Procedural Phase". The first characteristic is that behaviour is predominantly stimulus-driven, with the main aim of the child being to match as closely as possible the adult output. The second characteristic is that the child stores representations independently. The child may produce a form which is identical to that of the adult in an identical context. In this case the representation of that form and function will be entered into long-term memory. In this phase these representations are not analysed with respect to the content of other entries in long-term memory—the representations are simply added to the existing entries without connection to other identical entries. Therefore, it may be clear why, in the case of pronoun use by a child at this phase in development, such devices are used deictically—used to point to the stimulus being focused upon. Each pronominal term, for the child, functions in its own right since it is linked only to the representation of that single stimulus, and is not intended to refer anaphorically to the stimulus. It can be seen that the child is unaware that a string of pronouns used in a single utterance could be construed as ambiguous since each one refers to a separate entity and the referents are not internally linked linguistically—each output is separated for the preceding and succeeding one. Once any independently stored representation has been repeatedly used successfully, thus marking the state of "procedural success" for that representation, these representations can be stored for operation at the second phase.

Phase Two

Phase Two is referred to as the "Metaprocedural Phase" and is characterised by an internally stimulated redescription of stored linguistic information. This process continues outside of ongoing input and output of linguistic information. Rather than analysing the input, the system now concentrates on control over the organisation of its internal representations which have, up until now, been independently stored. On the basis of the procedural success of phase one, metaprocedural devices are activated and allow the representations to become explicitly related and stored systematically. The initial procedures in phase two are ones which redescribe the previous representations. Any similarities can then be amalgamated and created as a new entry in memory. This obviously places a huge computational burden on the child, resulting in errors in previously mastered linguistic procedures (c.f. Pettito, 1987). In the case of pronouns, it will be the similarity of function rather than form which will be defined. By the end of phase one the child may produce each pronoun correctly but the functional relationship will not yet be defined, resulting in their deictic use. It is only in phase two that the functional links across each of the pronouns become explicitly defined. At the end of phase two, the redescribed entries will be organised and regrouped to create a systemically stored entry. The reorganisation allows both for pronouns being linked together and for them to be stored with the determiner system as a whole, thus leading to an awareness of discourse functions of pronouns and other nominal devices.

Phase Three

In phase three the representations resulting from phase two can be used to re-evaluate the input data. Any externalised markings which are not part of the input system are deleted, and newly updated representations are then stored. Although phase three surface output may be identical to that of phase one it is generated from different representations. The reorganised system allows the child rapid and simultaneous access to the rules governing the use of any form of reference, thus maintaining cohesive discourse while providing the correct level of information to the listener. It is the constraints of overall discourse structure that determine the way the older child chooses referential devices. Linguistic markers can be seen to change in function from local deictic markers to discourse markers: this is made possible by the systematic reorganisation of the child's linguistic representations. When the child makes use of differential markers to distinguish between main and subsidiary characters in discourse or between foregrounded and backgrounded information, it is paramount that representations which are used can be related to an organised system thus enabling the speaker to abide by the constraints of discourse.

Application of the RR Model

Using this model it is possible to identify control processes which guide and constrain the production of discourse markers across a span of related sentences. From the model it is easy to predict that the young child's production of narrative will be stimulus driven: the extralinguistic stimulus will play a predominant role in constraining the choice of linguistic encoding, and the use of nominal determiners will be drawn from a store of independently represented entries in memory. The terms will also be deictic in function—simply conveying information about the referent currently being focused upon. As the child develops their discourse is likely to be constrained by discourse structure. This may result in less full description of a scene: however, the child will be able to draw upon information which has been systematically organised to allow for marking of the structure of discourse instead of merely marking semantic features. (Further discussion and investigation of this can be found in chapter 4).

1.4 Mental Representations and Communication

The RR model has begun to address the issue of how information can be stored or organised in a systematic way to be used to maintain coherent discourse from a developmental perspective. Further models, examples of which are included in this section, have concentrated almost exclusively on the issue of maintaining coherent discourse in an adult model. Each theoretical model, relying on the existence of a mental representation, outlines a strategy by which both speaker and listener can identify the item or issue which is being addressed by the discourse.

1.4.1 Mental Models

Johnson-Laird and Garnham (1980) talk of a discourse model, which is based on the earlier work of Karttunen (1976), who argued that participants in discourse need to establish what objects are being referred to, in order to interpret correctly what is said to them. Johnson-Laird and Garnham explain that this is achieved by speaker and listener forming separate discourse models during a conversation. Discourse models contain representations of entities relevant to the present discourse, including information about the properties of those entities, as well as a representation of what the other participants know.

Garnham (1987) states that a representation is a systematically constructed object which represents another object or event. He suggests that mental models are collections of representations of real world situations which can be modified by a processing system. He also argues that mental models allow discourse to be interpreted and can be revised once the sentences have been processed. The context which the previous discourse has supplied allows subsequent sentences to be evaluated. According to this model discourse will be unsuccessful unless a representation of the discourse is constructed which can impose restrictions on what is currently relevant.

A single mental model is constructed for each discourse, even if the description in the discourse is incomplete or ambiguous. This is possible through the processes of co-reference—where entities are referred to across sentences; consistency—any properties of the entity which are referred to must not be contradictory; and plausibility—the discourse can be accurately interpreted by taking account of temporal, spatial, causal, and intentional information. The notion of a script has been suggested for the way in which information is organised in order for the listener to make a judgement about its plausibility. Since a script is a representation of an activity for which there is a standard procedure, the speaker is able to refer to such an activity while assuming the listener will access their script for that activity and supply any details which may have been omitted by the speaker which are common to all activities of this nature. However, it is likely that the discourse will address issues for which a script does not exist, but this does not prevent understanding of that discourse from occurring, since it is possible for the processing system to access relevant information from other sources. Thus Johnson-Laird points out that there is the need for an explanation of the method by which relevant information is accessed in order to understand a particular discourse. Although not advocated by Johnson-Laird, Relevance Theory (outlined below) is able to offer an explanation for the method by which this occurs, suggesting that there is a trade-off between effort and effect.

According to the mental models approach, three levels of representation contribute to the overall understanding of the current discourse; first, a phonemic representation that encodes the sounds of an utterance; second, a propositional representation, represented linguistically; and third, a mental model. Truth conditions of the semantic properties of the sentences in the discourse allow propositions to be constructed, and from these propositions a mental model.

Although the semantic meaning of a sentence is important to the construction of a representation, it merely represents an understanding of the grammatical system and the way in which word structures relate to each other within the discourse. The representation of the discourse depends upon other information which is not purely linguistic such as the consideration of the speaker's intentions. The truth conditions of the linguistic utterance which enable the formation of the propositions therefore depend on the meaning and context of a sentence, and world knowledge from which extra-linguistic information is drawn in order to make inferences about both the semantic and pragmatic meaning of the sentence. Pragmatic information is a collection of representations about interactions of linguistic information and world knowledge. Mental models depend on accessing this store in order to make pragmatic inferences which can then be used to devise the propositional representation of the utterance. This account of mental models cannot therefore explain how or why representations are initially constructed since they themselves depend on those which have been previously constructed.

1.4.2 Centring Theory

Centring theory (Grosz, Joshi, and Weinstein, 1986) suggests ways in which speakers signal their centre of attention by their linguistic choices and how such choices help the listener track changes in the focus of attention and interpret expressions in a discourse context. At any moment there is assumed to be one entity that the discourse is most about, this is the discourse centre—or the backward-looking centre. The backward centre is what is presumed to be the most salient entity at that moment by both the speaker and listener. Each utterance is also associated with an ordered set of discourse entities, or forward-looking centres that consist of all the discourse entities realised in the utterance. The centring theory predicts that speakers will pronominalise the backward-looking centre. Thus pronouns identify the entity that the discourse is most about at a particular point and that noun- phrases shift an attender's focus of attention.

Centring as a process enables the speaker to guide a listener's attention. A speaker takes a perspective on the situation and describes it, attending to different elements at different moments. Using their mental model of the situation, the speaker highlights the salient points for the listener who is then able to construct a similar model of the situation. Centring attempts to integrate notions of thematic subject, shared knowledge, accessibility of discourse entities in working memory, and the resolution of referring expressions, but fails to realise a mechanism by which this is possible. Except for saying that it may take place within the framework of a mental model, there is no clear structural explanation of how discourse is understood.

1.4.3 Focus

Garrod and Sanford (1988) have also developed the notion of focus in an attempt to explain the mechanism by which coherent discourse can be maintained: this is very similar in nature to the concepts addressed in Centring theory. They are particularly concerned with the strategy which dictates how items in the discourse will be referenced in order to ensure coherent discourse. This strategy should allow the listener to identify the relevant item from their representation of the discourse.

Focus theory involves an explanation of discourse interpretation that has much in common with the theory of mental models. An example of how focus can influence discourse interpretation can be seen in the understanding of a narrative. However, as with the mental models approach this account of discourse interpretation while explaining how discourse may be interpreted, encoded and acted upon once some information is known, does not address issues about how information is initially stored or why certain referential strategies are decided upon, or why processing constraints are imposed. However it raises some interesting points about ways in which referential strategies in narrative may be implemented, these are discussed below.

At any point in a discourse some items are focused or foregrounded and others are defocused or backgrounded. The interpretation of discourse depends on access to and use of four separate parts of memory. First, explicit focus, containing representations of the items which have been explicitly mentioned in the discourse. Second, implicit focus, containing representations of items which have not been explicitly mentioned but have been implied by the utterance, this may include world knowledge. This is information similar to Johnson-Laird's notion of scripts—here they are called scenarios, and are stored in semantic memory—the third part of memory necessary to understand discourse. The final part of memory necessary for understanding discourse is episodic memory, in which a representation of the discourse itself can be permanently stored. Garrod and Sanford claim that the referents of definite pronouns must be represented in explicit focus, and their presence in discourse initiates a search only in the representation of explicit focus, whereas definite noun-phrases can have referents in implicit focus.

Thematic Subjects

The thematic status of a character has consequences for how that character may be introduced into the story and be referred to subsequently. The reference type used for the characters can also affect whom the listener will assume is the main character. Garrod and Sanford (1988) suggest that this universal nature of narratives may well be the result of processing constraints, such as a reliance on limited "focused" memory systems for representing and interpreting text. The thematic subject, once identified, will be treated as a key entity in the explicit focus representation, and so be readily available as a default reference for any referential pronoun. However, this approach, used by Garrod and Sanford to explain the interpretation of pronouns in text, does not provide an explanation of what would occur if a pronoun is used to refer to something other than the default referent. According to this approach, which presents the process as being purely mechanistic, this would result in misunderstandings occurring between speaker and listener since a different character would be the focus of attention for each. Although one relevant source of information, thematic subject assignment cannot be solely reliant on the mechanistic strategy stated here. Discourse can be understood through an infinite number of routes, unrestricted by the form of the discourse, while being sufficiently flexible to ascertain information from many sources. The main issue which seems to be unresolved in the previous models is the consideration, by the speaker and listener, of what information should be included or accessed in the representation of the discourse and how that information is processed. This issue is central to the successful maintenance of coherent discourse and is addressed by Relevance theory (see section 1.4.4).

Marslen-Wilson, Levy and Tyler (1982) address this issue, and note that a fundamental issue, with regard to the successful participation in a conversation, concerns the cognitive conditions under which the speaker and listener jointly handle the complex processing. They were also interested in the establishment and maintenance of reference to characters in a story and suggest that the way a speaker chooses between different forms of referential device, under different informational conditions during the course of a narrative, should reflect their presuppositions about the recoverability, by the listener, of the intended referents. The actual recoverability of such referents will depend upon the ways in which the listener can link the information carried by the speech signal to their mental representation of the discourse. The mechanism by which this may be possible is supplied by relevance theory whose central theme is one in which the content of mental representations and the intentions of interlocutors must overlap.

1.4.4 Relevance Theory

Relevance theory (Sperber and Wilson, 1986) suggests that integration of processing procedures must occur in order to achieve an understanding of discourse. The information necessary for processing is identified on the basis of relevance. Relevance theory has as a basis various maxims proposed by Grice (1989), who developed a Co-operative Principle. Maxims of quantity specify that the communicative contribution made should be as informative as required, but not more informative than required. Maxims of quality require the speaker to communicate only those things they know to be true and not to suggest something for which they lack adequate evidence. Grice's maxim of relation suggests that the speaker must be relevant, while his maxims of manner demand that the speaker avoid obscurity of expression and ambiguity, as well as to be brief and orderly. However, unless it is possible to identify an underlying basis for these maxims, they perform little more than a description of how people behave in communication rather than providing an explanation of utterance interpretation. Communication is successful, according to relevance theory because of what Sperber and Wilson (1995) propose as the two principles of relevance:

1. Human cognition tends to be geared to the maximisation of relevance.

2. Every act of ostensive communication communicates a presumption of its own optimal relevance.

Relevance is defined as a trade-off between cognitive effect and effort. Cognitive effect is the new information which has been inferred as a result of cognitive effort. Relevance theory claims that in every aspect of interpretation the first interpretation consistent with the principle of relevance is the one the hearer should choose. Relevance is seen to be the key factor in successful communication. When establishing and re-establishing reference in discourse the speaker usually indicates the relevance of the reference; this requires the interaction of cognitive processes. This interaction must allow new and old information to be amalgamated and analysed, the relevance of such information depends on the context in which it is processed.

Communication occurs with its chief aim being to obtain the most relevant information possible. However, in attempting to gain the most relevant information, processing constraints are imposed on the information-gaining system. It is possible that all information which could be accessed may be supposed to have some indirect relevance on any given situation before it has been thoroughly analysed—this would impose an enormous processing burden upon every communicative act. It is for this reason that in processing information people try to balance costs of processing against the rewards gained through doing so in a search for the most relevant information available. The mental representation of the discourse supplies the context in which new information can be processed for minimal cost, while providing maximum contextual effect. The flexible nature of the mental representation allows the context to be extended, this occurs when the contextual effect will outweigh the increased processing costs.

In order for the listener to achieve the aim of the greatest contextual effect for the available processing effort only the most relevant information must be presented by the speaker. The utterance produced should be interpretable by the listener, to produce adequate contextual effect, at the minimum possible processing cost. If this occurs then "optimal relevance" is achieved. The contextual resources of the speaker, as well as the hearer's processing abilities or intellectual awareness will affect the level of optimal relevance reached. Sperber and Wilson's claim is not that speakers always succeed in being optimally relevant, but rather that they intend their audience to believe that they have achieved optimal relevance.

Optimal relevance in discourse has as its basis the underlying assumption from the first principle of relevance that the whole cognitive system seeks to achieve maximal relevance. It is therefore possible to identify cognitive effects, which are essentially similar to contextual effects but occurring in a cognitive system, where an assumption is relevant when the positive cognitive effects achieved when it is optimally processed are large, and when the effort required to achieve the positive cognitive effects is small.

The principle of relevance attempts to explain the interaction between linguistic (e.g. lexical, syntactic and semantic) knowledge and non-linguistic (e.g. contextual or pragmatic) knowledge which must occur in order to interpret an utterance. This approach assumes a modular approach to the structure of cognitive processes, where linguistic performance is a result of the interaction of a number of different systems. If a speaker is aiming at optimal relevance, then he must make assumptions about the hearer's processing abilities and contextual resources, and these assumptions will be reflected in the form of his utterance.

Coherent discourse can only be maintained through an intricate balance between the cognitive processing strategies, linguistic abilities, and world knowledge of both the speaker and listener. Successful communication occurs when the mental representations of interlocutors contain similar information which allows them to make accurate inferences about the language being used, given the context of that language. The possible inferences are limited by processing constraints, with the most likely interpretation of the language being the result of both contextual and cognitive effect. This model does not take for granted, as the other models have done, the mechanism controlling the selection of the most relevant information which is implicit in the success of the mental representation for maintaining coherent discourse.

1.5 Summary

Mental representations have been the underlying theme of this chapter, while the focus has been on the innate abilities of language, as well as other influences on language acquisition for typically developing children. Cognitive processes have been shown to be an integral part of further language development. Language is a useful medium for the communication of information, the success of that communication depends upon the maintenance of cohesive discourse. Mental representations are necessary for this to occur, since they permit the integration of both linguistic and cognitive information. Models for processing this information have been addressed and highlight the constraints imposed to allow the integration and understanding of linguistic information. That integration of information occurs in normal development is generally agreed as necessary for coherent discourse to occur. Whether these processes are functioning correctly in the development of children with Down's syndrome will dominate further discussion, where difficulties with grammatical development and use may be due to an inappropriate use of mental representations, either in construction or in the way information is selected and integrated.

Chapter 2

Down's Syndrome: Developmental Issues

2.1 Introduction

Maintenance of coherent discourse is achieved through the successful functioning of mental representations. Among other things this is dependent upon the ability to use grammatical markers. It is precisely this ability to use grammatical markers which appears to be the most distinct and severe of the language deficits experienced by children and adults with Down's syndrome. In order to understand the underlying cause of these difficulties associated developmental processes must be investigated.

It is possible that language difficulties may be caused by structural differences in cerebral organisation, which ultimately affect the ability to process language input. Processing ability may also be affected by memory development. Memory is one of the essential elements of the successful maintenance of discourse, since it is involved with processing both linguistic and non-linguistic information. Pre- or non-linguistic cognitive functions must also be considered. Cognitive abilities, as well as linguistic abilities, are necessary for the development of communicative skills. The early linguistic environment is also important for the development of language, any differences in language development between children with Down's syndrome and typically developing children may be associated with early interactions. On closer examination of the specific linguistic deficits apparent in children with Down's syndrome, it would appear that certain aspects of language create greater difficulties than others. Each of the developmental issues addressed can be seen to be related to the formation and use of mental representations in individuals with Down's syndrome, since it has been shown, in chapter 1, that mental representations are necessary for the integration and processing of both cognitive and linguistic information. Indeed, a fundamental set of abilities needed for the development and use of both language and mental representations is impaired in children with Down's syndrome, namely the ability to hold, process and alter information (Le Provost, 1983).

2.2 Cognitive Issues related to Language Development

2.2.1 Cerebral Organisation

The formation and use of mental representations in discourse depends partly on the perception and processing of linguistic input. Of the numerous possible explanations for the difficulties experienced in perception and processing by individuals with Down's syndrome one is that there may be a difference in their cerebral organisation. There is no conclusive evidence regarding cerebral specialisation, but research on cerebral organisation in individuals with Down's syndrome has received increasing attention (Pipe, 1988). This area of research is largely based on the ideas of Lenneberg who proposed that language becomes more lateralised as an individual develops. It has therefore been speculated by a number of researchers that poorer speech and language skills shown by individuals with Down's syndrome may be due to less left hemisphere specialisation for speech and language as compared with typically developing individuals. Left hemisphere superiority for speech and language is associated with superiority of the left hemisphere in processing information sequentially: speech deficits in people with Down's syndrome may be due to the right hemisphere's inability to do so. However, Sacks (1988) suggests that it is only when rule-governed language is established that the left hemisphere comes into play. Various studies have shown a left ear advantage and suggest that it is this which may be responsible for language disabilities shown by individuals with Down's syndrome (e.g. Hartley, 1981, 1985). Using the dichotic listening task other studies have presented evidence of a right hemispheric specialisation for language, (Zekulin-Hartley, 1982; Pipe, 1983; Giencke and Lewandowski, 1989). However, other studies have failed to identify any consistent differences in brain lateralisation.

Individuals with Down's syndrome who have poor speech and language skills have been compared with those who have superior skills. Sommers and Starkey (1977) found neither group to have an ear advantage. Piccirilli et al (1991) also assessed language lateralisation for children and adults with Down's syndrome using a dual task technique. Their findings were somewhat different from those of Sommers and Starkey leading them to the conclusion that a typical pattern of intrahemispheric asymmetry may not be present in all individuals with Down's syndrome, but only in those with sufficiently developed linguistic abilities.

It is possible that although people with Down's syndrome perceive speech with their right hemisphere, they depend on the left hemisphere mechanisms for the production of speech. Therefore some of the sequential language problems experienced by people with Down's syndrome may be related to a biological dissociation between cerebral areas responsible for speech perception and the production of speech. An alternative explanation is that people with Down's syndrome may be performing some language tasks, such as processing speech sounds, with a right hemisphere that is poorly designed for serial, sequential tasks (Elliot et al, 1987).

2.2.2 Processing Ability

Processing ability is essential for the formation and use of mental representations in maintaining coherent discourse. The ability to recognise input, encode in a systematic way, access related information, revise the current mental representation, retrieve information, and output a response can only be achieved by adequate and appropriate processing systems. An underlying cause for an inability to maintain coherent discourse may be the failure to create and use a mental representation because of inadequate processing resources.

Sequential and Simultaneous Information

Individuals with Down's syndrome have more difficulty with tasks in which information must be processed sequentially, as is the case in many language-based tasks, than with tasks involving simultaneous processing e.g. quasi-spatial tasks (Elliot et al, 1987; Ashman, 1982). Indeed, it has been suggested that the syntactic deficits exhibited by children with Down's syndrome might be related to difficulties with sequential processing (Hartley, 1985). Interestingly, it has been suggested that sequential coding underlies much of our language production while simultaneous coding and planning contribute to higher level thought processes (Das et al, 1979). This suggestion has implications for the formation and use of mental representations. However, successful functioning of mental representations relies on both sequential and simultaneous information processing. Therefore those aspects of mental representations which are reliant on sequential processing may hinder coherent discourse, and thus language production.

Auditory and Visual Information

Children with Down's syndrome have greater difficulty with auditory-motor and auditory-vocal processing than with visual-motor and visual-vocal processing. For example, adults with Down's syndrome have demonstrated that they are able to remember a visually presented sequence and replicate it by manipulating objects in the proper order, but verbally presented sequences accompanying the visual stimuli result in poorer performance (Kernan, 1990). This may have been due to the greater complexity of the task and thus caused the adult with Down's syndrome to be overwhelmed by the amount of information which needed to be processed. It is possible that slower encoding at progressively deeper processing levels may account for the reduced auditory processing ability. This has been clearly shown by Lincoln et al (1985). Children with Down's syndrome were able to detect and categorise simple types of auditory stimuli, but exhibited slower processing speeds of auditory information than those shown by typically developing children, which was probably due to a combination of their slower cognitive processes related to recognition or categorisation as well as their slower capacity to organise a motor response.

2.2.3 Memory Performance Difficulties

Attempts have been made to isolate difficulties in information processing underlying deficient Short Term Memory (STM) span in individuals with Down's syndrome. The functioning of memory is integral in the successful functioning of a mental representation of discourse and in the processing of related information. Attention has been focused on storage and retrieval processes, auditory-visual memory differences, and auditory sequential processing differences of people with Down's syndrome.

The Working Memory (WM) model was first proposed by Baddeley and Hitch (1974) to describe the function of short term memory in the processing and storage of information. It is comprised of three components: the phonological loop, the visuo-spatial sketchpad, and the central executive. The central executive is the most important component and has several functions which serve to regulate the information in STM. For example, it is involved with the retrieval of information from Long Term Memory (LTM), as well as the overall processing and storage of information. The limited processing capacity of the central executive dictates that resources must be regulated in order to deal with the obvious processing demands experienced. Excessive demands placed on one function of the central executive will affect the efficiency with which other functions are performed. The central executive also obtains information from and regulates information to two other components which are responsible for processing information which is domain specific. The phonological loop is responsible for auditory information, which is generally coded linguistically. This information, which is represented phonologically, decays over time. Therefore, to prevent decay and maintain the representations in memory, the information undergoes a process of articulatory rehearsal. If articulatory rehearsal is prevented the information in the phonological store will not be maintained. The visuo-spatial sketchpad is responsible for information which is visually presented or spatially encoded. This aspect of working memory has received less attention than the phonological loop, but the visuo-spatial sketchpad has been shown to be useful in the storage and retrieval of images and optimally beneficial in spatial tasks, where verbal information is not necessary. It is thought that children below the age of seven make much less use of the phonological loop. For example, when remembering the names of picture lists the images are more likely to be encoded and used for recall than using a verbally encoded representation which could then be rehearsed (Hitch et al, 1988).

It is known that individuals with Down's syndrome have a STM deficit in both the storage and non-verbal or verbal retrieval of both verbal and auditory information

(Marcell and Armstrong, 1982; McDade and Adler, 1980). Poor auditory sequential memory, and significant difficulties recalling auditory information, have been attributed to auditory memory deficits (Marcell and Armstrong, 1982; Snart et al, 1982; Ashman, 1982). There is also more specific evidence which suggests that individuals with Down's syndrome have a deficiency in retrieval and ST storage of lexical information. Difficulty is experienced with processing linguistic information, particularly when it is presented in the auditory modality, because of slow LTM access for lexical information and poor use of the articulatory loop (Baddeley, 1986). People with Down's syndrome also appear not to use the articulatory loop to maintain phonological information. Findings indicate that this is caused by a deficit in accessing LTM for auditory information, rather than problems with more general sequential processing (Varnhagen et al, 1987)

It may be the poor development of the phonological working memory in children with Down's syndrome (Hulme and Mackenzie, 1992) which is relevant to understanding the children's difficulty in learning the rules for grammatical morphology and syntax. In order to learn these rules the child will listen to their use in adult speech. The child will often need to hold a sentence of 6 or more words in WM while they process them for meaning. The growth of the phonological loop is related to increases in speech rate as children get older. Since children with Down's syndrome do not show the usual rapid increase in rate of speech production, it would seem likely that there will not be the same growth of the phonological loop. Perhaps this explains the benefits of teaching both signed and spoken language to children with Down's syndrome. The use of sign language by children with Down's syndrome is known to increase vocabulary acquisition (Miller, 1992)—perhaps because signed vocabulary is not reliant upon the phonological loop. However, Vallar and Papagno (1993) have shown that it is possible for phonological short-term memory to be preserved in adults with Down's syndrome—thus enabling vocabulary acquisition and the ability to learn non-words. However, impaired performance was found on long-term memory tasks, phonological judgements and intelligence. This would suggest that although individuals with Down's syndrome appear to have difficulty processing auditory information, which can be seen to be related to proficient use of phonological working memory, this does not impair lexical growth and functions which depend on short term memory: rather auditory information which is needed for long term memory functioning is impaired. Mental representations of discourse, based on auditory information, can therefore, theoretically be formed, but gaining access to other linguistically related information necessary to maintain the mental representation by drawing inferences about the incoming information may be affected.

2.2.4 Symbolic Knowledge and Object Understanding

The manipulation of symbols and the representation of objects in an abstract way is also a central ability necessary for the formation and use of mental representations. Research assessing this ability is therefore relevant to this discussion, since without this ability mental representations cannot be formed, and therefore cannot be used for the maintenance of coherent discourse. Assessment of the object concept and symbolic play has been suggested to be a good way to investigate cognitive processes in a young child with Down's syndrome, because many see it as one of the few cognitively directed behaviours in infancy which may predict later intellectual development (e.g. Wishart, 1986). Some maintain that acquisition of the object concept is a prerequisite for language development. The relationship between the domains of language and cognition, particularly for development, was addressed in chapter 1. The process of development has been shown to be represented by two opposing schools of thought. There are those who view development as a domain general process, while others see language development as separate from cognitive development. It seems likely that both views are too extreme and exclusive, while a more liberal stance encompassing aspects of both opinions may more closely reflect the true nature of development. This issue can be seen to be central to any discussion which attempts to outline possible causes for language impairment, especially one which advocates the use of mental representations for the success of discourse. The few studies reported here serve only to highlight the range of investigation which continues to examine this extremely complex and controversial issue.

Although emerging at a delayed pace, the symbolic play of children with Down's syndrome progresses through the same developmental sequences of decentration, decontextualisation and integration in object and social play. However, areas of deficit have been identified, involving the ability to use objects in a decontextualised fashion (Gibson, 1981). This type of symbolic play has been associated with an analytical style of language learning which has been used to predict the later acquisition of grammar in typically developing children (Bates et al, 1988). The abstract nature of grammar may therefore pose a problem for acquisition for children with Down's syndrome, particularly since the mental representations of discourse rely on the intricacies of grammar for the interpretation of an utterance (see chapter 1).

However, children with Down's syndrome have been shown to be more advanced in non-linguistic domains of symbolic representation, suggesting that linguistic representations may be an isolated area of difficulty for children with Down's syndrome. According to Beeghly and Cicchetti (1987), affective, motivational and cognitive aspects of symbolic development apparent in the play of children with Down's syndrome are organised similarly to those of normal children at a comparable level of cognitive development. Bates et al (1988) has shown that children with Down's syndrome are delayed in self-related language and play development. In fact children with Down's syndrome were significantly less advanced than their MA controls (but not MLU controls) on most linguistic measures of self-other representation, but nevertheless were able to demonstrate some low level ability to represent linguistic information.

An inability to use mental representations effectively may be due to a difficulty in reorganising stored information: as can be seen in section 2.2.3, access to long term memory may be impaired in individuals with Down's syndrome. This is consistent with the representational redescription model (Karmiloff-Smith, 1992) which states that systematic reorganisation must take place for efficient and flexible functioning to occur. Within the domains of sensorimotor development, children with Down's syndrome may have more difficulty in moving from one stage to the next, and more difficulty in reorganising their abilities into integrated and coherent structures. The plateau in the mental growth of children with Down's syndrome at 18 months was interpreted by Gibson (1978) as evidence that they have more difficulty in making the transition from sensorimotor to symbolic functioning.

Representational development seems to adhere to the normal pattern, particularly the aspects of objects children with Down's syndrome attend to, and the way they organise concepts. It is possible that although systems may be inter-related and coherent in their organisation, the organisation of these systems may be untypical. This difficulty in organisation may provide an explanation for the inability to acquire and use grammar effectively, since it is the organisation of the structure of the language input which must be attended to during the acquisition of grammatical rules: this may also be hindered by the memory deficits already considered. Overall, it can be seen that the ability to represent, organise and process linguistic information effectively is a difficulty for individuals with Down's syndrome. Such tasks have been shown to be co-ordinated by the efficient functioning of a mental representation (as seen in chapter 1).

2.3 Early Language Development

2.3.1 Language: Interactions Affecting Acquisition

Being aware of the pattern of language development as well as deficits in acquisition of language is a necessity when attempting to assess possible causes for apparent language difficulties. Interacting with the environment and early linguistic input, often provided by the mother, are elements which have been used to predict the later language development of the child. As has been discussed in chapter 1 it is indeed useful to be aware of prerequisites for and precursors to language. Some studies suggest that the verbal and non-verbal interaction between mothers and children with Down's syndrome may be influenced by the children's difficulties in ways that may affect language learning (Berger, 1990; Mervis, 1990)

Early language and communicative development (e.g. lexical development) has been thought to be influenced by eye contact and joint attention (Harris, 1992). Children with Down's syndrome show delays in the onset of eye contact; once it has been established eye gaze is more prolonged. This may suggest difficulties such as the slower maturation of the peripheral visual field (Salapatek, 1975) the inhibitory mechanisms (Parmelee and Stern, 1972) a slow development of competing responses, and a low distractability (Miranda and Fantz, 1974). The ability to process incoming information is one factor which is common to each of the skills which has been shown to be impaired in children with Down's syndrome. If such an inability to process information can be found for linguistic information then this may have implications for the ability to maintain coherent discourse, which depends on the assimilation and integration of numerous items of information.

Maternal linguistic style in relation to early lexical development has been examined and shows that when mothers talk two different styles emerge, either directive—which reflects an intention to control the child's behaviour, or conversation-eliciting—which reflects an intention to elicit the child's participation in the conversation. McDonald and Pien (1982) suggest that the directive style may be less adequate for fostering language development, which is unfortunate since mothers of children with Down's syndrome are more likely to use features characteristic of a directive style. However, contradictory findings indicate that the directiveness of the language heard by the child may assist language development. In the Bristol longitudinal study of language development, children between 15 and 42 months old were studied. Results indicated that the faster developers of language (for specific aspects of language) received more directive language input than slower developers (Ellis and Wells, 1980). Directiveness has been shown to be important because it allows frequent references to the object of the child's attention. Therefore, these language features should make the relation between the object word and its referent particularly salient to the child, thus facilitating vocabulary acquisition (e.g. Zukow et al, 1982). Harris et al (1996) have suggested that typically developing children may be better able to cope with a maternal speech style which is balanced between directive and non-directive. However, it has also been acknowledged that the overall quantity of language input to which the faster developers were exposed far exceeded that of slower developers. It is therefore seen to be the amount of language available to the child which affects speed of language development rather than a particular aspect of the language style (Harris, 1992).

Once they are involved in the vocal interaction, infants with Down's syndrome tend to vocalise in continuous strings or to repeat vocalisations with a very short time lapse left for the partner to take turns in the exchange. Such patterns of vocalisations cause a relatively high frequency of vocal clashes between children with Down's syndrome and their mothers (Berger and Cunningham, 1981). The failure to take turns may point to underlying cognitive deficits, such as the inability to take account of the other person.

This has implications for issues which have been raised with respect to maintaining coherent discourse between interlocutors.

The importance of the process of mother-child interaction has been intensely debated—fuelled by conflicting findings. The way in which the mother talks to the child has been thought to be influenced by the child's level of comprehension and communicative competence, as well as the mother's expectations about the child's linguistic potential (Cross et al, 1980). Motherese has been seen as important for the child's learning of syntax by some (e.g. Bates et al, 1988), although this view is rejected by others (e.g. Gleitman et al, 1984). Whatever the influence of maternal speech style to language development it has been shown that both infants with Down's syndrome and typically developing infants have shown preferences for baby talk (talk directed to babies) over adult talk. But infants with Down's syndrome significantly reduce their preference for baby talk over time while typically developing infants significantly increase their preference for baby talk over time (Glenn and Cunningham, 1983).

The implication is that the older typically developing infants understand baby talk better and thus are more motivated to produce language. During the second year the stimulus of the mother talking to the infant with Down's syndrome loses some of its ability to maintain responses in the group of children with Down's syndrome because they have greater difficulty understanding the language. Between 12 and 24 months the receptive language abilities of children with Down's syndrome decline even after having previously had a normal response rate (Gunn et al, 1982). This suggests that infants with Down's syndrome have a particular problem with word comprehension rather than with word recognition, leading to a decrease in attention to spoken stimuli.

The suggestion that children with Down's syndrome do not attend to the correct information alerts us to the fact that it may be this which prevents them from organising, storing and retrieving information about their language input in a manner suitable for acquiring grammar. Creating an accurate mental representation of an event or discourse allows the individual to be aware of, and therefore attend to, the most relevant information. The most relevant information can then be incorporated into the mental representation which is continually being revised. Accessing relevant context-related information is also integral to the effective functioning of a mental representation. This can only be possible if information is stored in a systematic way.

2.3.2 Language Ability Relative to Cognitive Development

Language development in children with Down's syndrome lags behind other areas of their development, particularly their cognitive development (Cunningham et al, 1985). There is also evidence that this gap enlarges as the child gets older (Coggins and Stoel-Gammon, 1982). Some aspects of language development itself seem to be more delayed than others (Rondal, 1988; Miller, 1988). It is important to be clear on what measure children are being matched. For example, when matched on syntactic ability typically developing children are seen to have a smaller vocabulary than that for children with Down's syndrome, while the opposite is true when matched on mental age (MA) (Miller, 1992). Closer inspection of vocabulary development when matched on MA has revealed some interesting results. Miller (1992) assessed vocabulary size at eleven, 14, 17, 20, 23 and 26 months (MA) and has shown that, until 20 months the vocabulary size is similar for both typically developing children and children with Down's syndrome. However, it has been noted that early vocabulary development can be successfully supplemented by the use of signs, which are used to enhance the overall communicative ability of children with Down's syndrome. When the sign vocabulary of children with Down's syndrome is measured in conjunction with spoken vocabulary the vocabulary size is still similar for both groups at eleven and 14 months (MA). At 17 months the vocabulary size of children with Down's syndrome is twice the size of that of typically developing children. Children with Down's syndrome also show that their sign vocabulary (a different set of words from their spoken vocabulary) is twice the size of their spoken vocabulary at this age. This advantage disappears by 20 months when typically developing children demonstrate a vocabulary spurt. Children with Down's syndrome do not show a spurt until 26 months when their spoken language accelerates while their sign vocabulary remains at the same level. Therefore, sign vocabulary can be shown to develop at a rate similar to that of typically developing children prior to a vocabulary spurt, this further indicates the importance of sign language in the development of spoken language development in children with Down's syndrome. It also emphasises the relationship between visual and auditory memory abilities and language development. Language comprehension and production has been compared with measures of non-verbal cognitive abilities of children with Down's syndrome (Miller et al, 1987). From 18 months an increasing proportion of the children showed delay in language production relative to their language comprehension. Children with Down's syndrome also show increasing linguistic deficits in relation to their non-verbal cognitive abilities with increasing chronological age (Miller, 1990). However, their language comprehension has been shown to be equal to their non-verbal cognitive ability. Indeed, studies of cognitive prerequisites for early language and the transition to first words in children with Down's syndrome have documented that the onset of referential comprehension and production appears to be consistent with children's sensorimotor and cognitive attainments (Berger, 1990). Children with Down's syndrome have also been shown to be at the same level of cognitive development as normal children at the onset of both comprehension and production of object names (Cardoso-Martins et al, 1985). However, soon after language acquisition begins, early vocabulary development of children with Down's syndrome begins to lag behind their cognitive development.

Previously Miller et al (1981) had identified three different patterns of functioning relative to cognitive development with respect to language skills, which are first, a pattern of production delay; second, a pattern of delay both in production and comprehension; and third, a pattern of language functioning consistent with cognitive level. The existence of three different delayed patterns rules out a simple pattern of language development in children with Down's syndrome as a slow version of normal development. Such patterns of development may be the result of delay combined with other factors, such as the inability to create and use mental representations. Such an inability would affect the way in which information about the environment is integrated with the language input associated with that environment. This may result in the child's inability to develop language, or at least prevent successful language production because the appropriate information will not be accessed and integrated effectively.

At a relatively superficial level, and particularly for the phonological, lexical, and semantic structural aspects of language, it is possible to compare children with Down's syndrome to younger typically developing children. However, when more detailed analyses are made, particularly on the morphological and syntactic aspects of language, it is much more difficult to make the same sort of comparison. Most children with Down's syndrome are late in using their first words, their vocabulary grows more slowly, and although they may use the same two-word phrases, they have difficulty in mastering the grammatical rules which string them together in a grammatically correct way. Problems with early vocabulary development may lead to a further delay in the onset of syntax. As we have seen the manipulation of symbols and images seems to be extremely difficult for individuals with Down's syndrome (Gibson, 1978). Even within language some areas seem relatively less impaired in Down's syndrome while others such as grammatical and relational aspects, seem especially deficient.

2.3.3 Lexical Development

Before being able to use words to talk, the baby has to begin to learn their meanings. There are major similarities between normal children and children with Down's syndrome at the initial stages of language acquisition, such as the early productive vocabulary acquired, although the rate of productive vocabulary acquisition has been reported to be considerably slower for children with Down's syndrome than for typically developing children of the same chronological age (e.g. Mervis, 1990; Gillham, 1979). Early stimulation and mental age seem to be two key variables in the vocabulary development of Down's syndrome (e.g. Rondal, 1994). For children with Down's syndrome the onset of meaningful speech is delayed by at least eight or nine months and does not emerge until about 24 months. Rondal's (1978) study indicates that between the ages of three and eleven years the MLU of children with Down's syndrome increases from 1.00 to 3.00. When the MLU is matched with typically developing children (approximately 20–32 months) the content seems to be similar. The type of utterance is predominantly declarative, fewer questions are asked, though when they are they tend to be Wh-questions. It can therefore be seen that at similar mental ages children with Down's syndrome and typically developing children are able to define, understand, and use the same number of words.

Rondal et al (1988) found that the MLU of children with Down's syndrome correlated highly with chronological age. MLU was also found to predict grammatical complexity, specifically the complexity and diversity of bound morphemes and major syntactic structures. Rondal concedes that though MLU is a good measure of language development of children with Down's syndrome between MLU 1.00 and 3.50, it may not be a satisfactory index of language development beyond 3.00 or 3.50, according to results put forward by Klee and Fitzgerald (1985).

2.3.4 Developing Comprehension Skills

Various studies have indicated that the language comprehension ability of children with Down's syndrome is similar to that of MA-matched typically developing children, and certainly in advance of expressive language abilities. This indicates that linguistic processing involved with comprehension (e.g. perception, encoding) may be intact, while processes associated with production may not (e.g. retrieval, amalgamating numerous sources of information). Bridges and Smith (1984) report similar sentence interpretation strategies used in Down's syndrome matched for verbal comprehension to typically developing children. However, as with expressive language, syntactic comprehension appears to lag behind vocabulary comprehension. Single word comprehension has been seen to match MA controls, while syntactic comprehension was significantly worse (Rosin et al, 1988). Hartley (1982) found poorer performance on syntactic comprehension tasks in children with Down's syndrome than in children with other learning difficulties, matched on vocabulary comprehension. This difference between lexical and syntactic comprehension has been found to increase with age (Chapman et al, 1991). These differences again indicate that, while it may be possible to encode incoming linguistic information it may not be systematically stored. This can prevent the efficient use of that information in the formation and revision of any mental representation of discourse.

2.3.5 Expressive Language Development

The most striking difference in the sequence and structure of language development of children with Down's syndrome is the dramatic delay in the expressive language development. Although productive language is slower to develop than MA or comprehension skills would predict, it is faster to develop than syntactic skills—many children with Down's syndrome do not progress beyond early stages of syntactic development. (e.g.

Miller 1987, 1988; Rosin et al 1988; Miller and Chapman, 1981). Several studies have noticed that there is a long plateau of little observable development between the first few words and the appearance of two- and three-word phrases. It is not until about the age of four that children with Down's syndrome combine two or three words, though it is likely that the semantic relational structure of the language is similar and develops similarly in children with Down's syndrome and typically developing children (Rondal, 1988).

2.3.6 Understanding Grammar

The understanding and use of grammar is a problematic aspect of language for children with Down's syndrome. While it is clear that these children are able to build up a lexicon of words, they may have a specific difficulty with acquiring the grammar and syntax of language. The deficiencies in understanding and use of grammar are seen even when children with Down's syndrome are matched for MA with typically developing children. It may be that too many operations are involved in grammatical marking for the cognitive capabilities of children with Down's syndrome, particularly as these operations involve long-term memory knowledge and the retention in short term memory of several pieces of information. The time available to perform these operations in the real-time processing of the sentence is too short for children with Down's syndrome who are known to have limited processing capabilities. As has already been discussed, the manipulation of linguistic information is dependent upon it being successfully encoded and incorporated into a mental representation of the discourse. It is possible children with Down's syndrome do not develop grammatical skills partly because they find it difficult to represent grammatical information.

2.3.7 Development of Syntax

Syntactic development fails to emerge until after the child with Down's syndrome has shown a vocabulary spurt. Although not a necessary prerequisite for syntactic development in normal development, a vocabulary spurt preceding syntactic development has also been shown to be the case in some studies of typically developing children (Anisfield, 1984; Gleitman and Wanner, 1982; Lenneberg, 1967). Children with Down's syndrome use the same range of two word constructions in their speech, but they tend to have a larger single word vocabulary when they begin to put two words together—about 100 instead of 50 (Mervis, 1990). A major reason for this is that the vocabulary spurt for children with Down's syndrome does not begin at the mental age that would be expected.

Children with Down's syndrome continue to have a larger overall vocabulary for the length of utterance used, but show more difficulty in being able to pick up and use grammatical markers and syntax rules (Miller, 1988). Differences between typically developing children and children with Down's syndrome in rate of vocabulary acquisition are probably due in part to specific cognitive deficits that children with Down's syndrome have, such as deficits in storage abilities (McDade and Adler, 1988), in retrieval abilities (McDade and Adler, 1980), and in the ability to encode and decode verbal stimuli (Bilovsky and Share, 1965). Generally it is accepted that expressive language skills appear to lag behind non-verbal cognitive abilities and constitute the area of most delay (Mundy et al, 1988).

Adolescents with Down's syndrome have been compared with MLU matched typically developing children (MLU of approximately 3.00) in order to assess the association between utterance length and syntactic complexity (Fowler, Gelman and Gleitman, 1980). The two groups did not differ on the types of syntactic constructions produced, although the individuals with Down's syndrome supplied early grammatical morphemes and grammatical objects less consistently, and produced less complex noun phrases. Where individuals with Down's syndrome functioned above the normal children interesting differences occurred. Although they had a more extensive closed class vocabulary, they were unable to use these same forms appropriately and consistently to serve syntactic functions. Also, although they produced complex sentences of appropriate length and word order, these sentences were not supported by appropriate grammatical markers. While children with Down's syndrome up to the age of three to four years exhibit similar syntax, semantic and discourse skills to those of normal children matched on MA or general language skills (Miller, 1988), studies of older children report variations in the development of syntax. A widening semantic-syntactic gap can be seen to occur as CA increases. The ultimate syntactic and morphological levels achieved by most individuals with Down's syndrome are consistently low across a number of studies, independent of assessment procedures (Fowler, 1990). Children with Down's syndrome are unlikely to move beyond the level of simple phrase grammar found in normal children aged three. For example, Semmel and Dolley (1971) found that most children with Down's syndrome (CA six to fourteen years; IQ 22–62) could comprehend and reproduce only simple declarative sentences.

2.3.8 Relationship between Lexical and Syntactic Ability

The relationship between lexical and syntactic acquisition has not received much attention. Cromer (1987) argues that vocabulary learning involves both referential and grammatical aspects, while the development of syntax requires a reorganisation process to accommodate new grammatical data. Fowler (1984) suggests that children with Down's syndrome may be unable to reorganise their grammar beyond a particular point resulting in a plateauing of their syntactic skills. However, although Fowler (1990) claims that a syntactic ceiling is imposed by the genetic condition, other findings indicate that it is possible to improve the expressive grammar of teenagers with Down's syndrome (e.g. Buckley, 1993; Rondal, 1988).

Children with Down's syndrome demonstrate differences in lexical learning which suggests that they may be demonstrating well developed referential vocabulary acquisition skills but deficiencies in the grammatical marking of their lexicon. The asynchrony of lexical development with syntax suggests specific cognitive linguistic deficits may be associated with the productive language problems of children with Down's syndrome. Hartley (1982, 1985) found that difficulties in syntax surpassed those in the lexicon which could be because children with Down's syndrome are poorer in processing syntactically complex information and process simultaneous information more easily than sequential information.

2.3.9 Asynchrony of Syntax and Pragmatics

Although children with Down's syndrome have been found to be more delayed linguistically than cognitively with respect to their vocabulary production, they have also been shown to perform significantly better than linguistically matched controls when measures of communication and pragmatic development were considered. They also differ from MLU matched typically developing children in the context of their speech acts, which showed fewer conversational devices, more responses, descriptions and statements. Therefore the data seems to indicate an asynchrony between syntactic and pragmatic development in Down's syndrome (Beeghly and Cicchetti, 1987).

Communicative skills exhibited by children with Down's syndrome have been shown to be at least equivalent to, and often more advanced than, communicative behaviour of non-Down's syndrome children also at stage 1 of syntactic development, even when matched for MLU and MA (Beeghly and Cicchetti, 1985). Other studies of older children with Down's syndrome suggest that functional communicative skills may exceed verbal abilities (e.g. Nisbet, Zanella and Miller, 1984).

The available data suggest that adults with Down's syndrome are able to take part in conversation and to demonstrate similar types of conversational controls and constraints as typically developing adults. However the relationship between formal and functional aspects of language behaviour in adults with Down's syndrome has been seen to be different from that of normal adults. Rondal and Lambert (1983) identify a consistent difference between adults with Down's syndrome and typically developing adults, particularly in the morphological and syntactic aspects of the language, where complex grammatical sentences are rarely used and formal means of expression are limited in use. It has been shown that the ability to communicate far exceeds syntactic development in childhood. Rondal and Lambert clearly show that this remains the case in adulthood.

2.3.10 Continuing Language Development

Some have questioned whether language development continues beyond childhood in individuals with Down's syndrome. Findings from a longitudinal study conducted by Seagoe (1965) support the view that language development continues after the age of 14 years, and indicate that it may continue to develop until after 20 years, contrary to the findings of Lenneberg (1964) who suggested that after the critical period the left hemisphere may no longer be able to function in language acquisition leaving the right hemisphere to assume control. Although development may continue, research has indicated that after puberty some quite central aspects of grammar may be difficult to acquire e.g. interrogative structures, third person, relative, indefinite and demonstrative pronouns, much of the structure of the auxiliary verb (Newport, 1988). The critical period as defined by Lenneberg (1967) may not accurately predict the particular growth curves seen in language development for children and adults with Down's syndrome, chronological age seems to exert considerable influence on the rate of language learning (Fowler, 1988). However, at least some people with Down's syndrome make substantial progress in syntactic development during adolescence (Rondal, 1988), but usually language development ceases during the middle childhood years (this is further discussed in chapter 3). Such a slow down is also apparent in the growth curves of general intellectual development. Age-related deficits have been noted in older adults with Down's syndrome, characterised by selective impairment of the ability to form new LT memories and visuo-spatial construction but relative sparing of language and immediate memory span (Haxby, 1989). This indicates that it may be possible for adults with Down's syndrome to continue to acquire certain linguistic knowledge, probably associated with lexical ability, while processes associated with grammatical development and integration of information necessary for the functioning of mental representations may be increasingly impaired. The extent to which grammatical development occurs and is impaired can be investigated by assessing the use of grammatical markers in adults with Down's syndrome. Various studies have investigated the use of individual grammatical markers by adults with Down's syndrome. The use of a wide range of grammatical markers by adults with Down's syndrome has been further assessed in the next chapter in order to ascertain which grammatical markers are easily produced and those which create problems.

2.4 Summary

The research presented in this chapter has indicated that language development in children with Down's syndrome is a complex process, which cannot easily be predicted from the language development of typically developing children. Some general patterns emerge from studies which use normal development as a comparison with that of children with Down's syndrome which indicate that from a purely linguistic perspective lexical development and the development of communicative skills are similar to normal development, while the development of complex grammar is rare. This pattern of development has been shown to be associated with various processing difficulties faced by children with Down's syndrome. Sequential processing is seen to be more problematic than simultaneous processing in general. Where this has been investigated in relation to language possible associations with differing cerebral structure have been suggested as an underlying cause. Additional explanations for language deficits include difficulties with memory encoding, storage and retrieval of auditory information as well as the use of the phonological loop. Accessing information from long-term memory also appears to be problematic. This research suggests that language development may be affected by various specific processing difficulties.

Evidence from the development of symbolic knowledge and early interactions suggests that while information processing and organisation of non-linguistic information appears to be less difficult, except for extremely abstract concepts, linguistic information appears to have little meaning for children with Down's syndrome. But again, developmental progression seems to be hindered by the inability to attend to and reorganise information once it has been stored. The ability to reorganise information underpins the use of mental representations in discourse, this research therefore indicates that storage and retrieval of information which allows the mental representation to function—particularly in the linguistic domain—may be one of the underlying causes of the language difficulties faced by children with Down's syndrome. Mental representations allow the child to draw upon stored linguistic information in order to analyse the input in order to interpret the utterance. Once the mental representation has been revised to take account of the new information and that information stored systematically, it can form the basis for the continuation of the discourse. This can be used for any number of linguistic functions, from learning grammatical systems to the maintenance of discourse using those systems.

Further research dispels any misconception that linguistic deficits may be purely a result of cognitive processing difficulties, since it has been shown that cognitive abilities function at a generally higher level that those of language. This suggests that it is likely that any underlying cause for the difficulties involved with the development of language must be associated primarily with the processing and manipulation of linguistic information. While this seems likely research also indicates that a purely linguistic deficit is not the cause for the difficulties experienced, since certain aspects of language—though developing slowly—do function adequately, and above that which would be expected for the mental age of the child. It would seem then that an inability to use a structure which allows the analysis, integration, manipulation and processing of cognitive and linguistic information which is largely abstract in nature (i.e. a mental representation) may be a possible underlying cause for the inability to maintain coherent discourse in children with Down's syndrome. However, the use of such a mechanism is largely dependent upon short term memory ability. The known memory limitations of individuals with Down's syndrome may therefore contribute to the problems exhibited by both adults and children with Down's syndrome in language production.

The central debates which have been briefly highlighted are those which surround normal development. For example, issues concerning domain-specificity and domain-generality of language have been discussed. Evidence has shown that language development is dependent on the development of a language-specific "module"—vocabulary development occurs relatively normally in children with Down's syndrome. In addition, general cognitive abilities are necessary for language development to proceed normally: memory deficits and processing problems associated with auditory information are seen to hinder the language development of children with Down's syndrome. There is also a body of evidence which suggests that external factors, such as the mother's communicative style may also have some influence on the language development of some children. This has also been shown to influence the language development of children with Down's syndrome, which also indicates that language development is not purely dependent upon internal linguistic abilities. When examining these issues in relation to the development of children with Down's syndrome evidence clearly indicates two points: first, that development occurs quite differently for children with Down's syndrome when compared with typically developing children; second, the importance of certain processes functioning adequately for normal language development to occur—since without them, coherent discourse cannot be maintained.

Chapter 3

Experiment 1: Grammatical Performance in Down's syndrome

3.1 Introduction

The development of grammar is generally agreed to be distinctive in people with Down's syndrome. However, it is difficult to obtain a clear, overall picture of development since grammatical rules have been studied in isolation from each other. This study was designed to investigate the comprehension and production, by adults with Down's syndrome, of sentences which have been specifically constructed to test twelve grammatical rules, using a grammaticality judgement task, an imitation task, and a spontaneous speech sample.

There is a wealth of data concerning language variability in Down's syndrome, but the information comes from a number of isolated studies and the results cannot be integrated in a coherent way in order to produce an overall picture of language ability in Down's syndrome (Rondal, 1993). However, there seems to be general consensus on two points, as suggested in chapter 2. First, that lexical and semantic aspects of language in people with Down's syndrome tend to develop at a rate which can be predicted by the individual's cognitive developmental level (Berger, 1990): implying a developmental route which is similar to, but much slower than that of typically developing children. However, when signed vocabulary is measured in conjunction with spoken vocabulary for children with Down's syndrome, the rate of acquisition seems to be similar to— if not beyond that of typically developing children, although this is true for a very limited period of development. Second, that full command of syntax and morphology is obtained only rarely in individuals with Down's syndrome, creating difficulty in both the use and understanding of grammar (e.g. Fowler, 1990; Miller, 1987; Rosin et al, 1988). Surprisingly, very little research has attempted to identify an underlying cause for the grammatical difficulties experienced by people with Down's syndrome. In this study the achievements of adults with Down's syndrome regarding their comprehension and production of a range of grammatical rules have been specifically investigated in order to assess which aspects of grammar can be mastered and which seem impossible to acquire and use effectively. Such an investigation must be carried out before assessing the development and functioning of grammatical rules in a wider linguistic context (such as a narrative) in relation to the use of mental representations. As can be seen from the previous chapters, an important integral part of language development seems to be the formation and use of mental representations of linguistic information. The use of mental representations by individuals with Down's syndrome may therefore expose underlying causes for difficulties exhibited in the development and use of grammar. The experiment reported in this chapter assesses the grammatical functioning of adults with Down's syndrome. Several factors have been considered as important to the design and implementation of this experiment in order to gain an understanding of grammatical achievement upon which later studies can be based. These considerations are outlined below.

3.1.1 Predictors of Grammatical Development

Mental representations may assist in the continuing development of grammatical skills, since they allow both linguistic and non-linguistic information to be integrated in order for meaning to be assessed and interpreted. The resulting representation may then be stored as a long-term representation. Such representations may then be re-organised in order to systematise the linguistic information gathered into a rule-based system. The measurement of MLU by some researchers has indicated that although the grammatical organisation of the productive language of Down's syndrome remains deficient, MLU does increase with age. Although MLU will not be considered in this study, research which has assessed it has found it to be a more reliable and valid index of early productive grammatical organisation than non-verbal cognition. For typically developing children aged between 20 and 32 months MLU has been found by some researchers to correlate with the frequency, diversity, and complexity of various grammatical constructions found in spontaneous speech such as bound morphemes and major syntactic structures: the same has been found for children with Down's syndrome whose MLU was between MLU 1.00 and 3.50 (Rondal et al 1987; Rondal, 1988; Miller and Chapman, 1984). Curtiss and Yamanda (1981) have suggested that it is possible that syntactic abilities may develop with little influence from most non-linguistic cognitive skills, except for auditory short term memory, which has already been noted as being deficient in individuals with Down's syndrome. Research has indicated that it may be possible for grammatical development to increase beyond childhood, that it may not be dependent solely on cognitive ability and that it may be possible to predict later development of grammatical organisation and use. That it can be predicted suggests that grammatical development must progress systematically, this presupposes the organisation of information, which is in turn dependent upon accessing the relevant information—thus indicating the use of mental representations. However, the fact remains that children and adults with Down's syndrome experience great difficulty in the use and understanding of grammatical rules.

3.1.2 Evidence of Grammatical Difficulties

The understanding and use of grammatical morphemes is one of the linguistic areas in which children with Down's syndrome have particular difficulty. Most grammatical morphemes are correctly understood and used in obligatory contexts by typically developing children by the age of nine or ten. Among the things which have been noted as being particularly difficult for children with Down's syndrome are inflections on the verb to express temporal and aspectual relationships, marking number between subject and verb, marking number and gender for pronouns, use of indefinite and definite articles. These difficulties seem to go beyond those expected on the basis of mental age, but seem likely to be caused by the inability to process the volume of information necessary for correct comprehension and production of grammatical rules, especially when this is dependent on retrieving information from long term memory. Rondal and Lambert (1983) speculate that individuals with Down's syndrome may never reach the stage where they would make proper use of grammatical morphology. It has been suggested that these grammar-specific deficits may be due to difficulties with sequential processing (Hartley, 1982) which has been discussed in chapter 2. This processing difficulty may be restricted to that of linguistic information since it has been demonstrated that adults with Down's syndrome (mean age 56 years), when presented with sequenced visual stimuli, are able to remember the sequence and replicate it. When verbally presented sequences accompany the visually presented stimuli, performance declines. It may be argued that the need to attend to both stimuli increased the complexity of the task and may have resulted in an information-processing overload. However, when the stimulus was purely verbal adults with Down's syndrome's performance was reduced further (Kernan, 1990). Non-Down's syndrome adults with learning disabilities (matched on IQ) were shown to perform significantly better overall than adults with Down's syndrome on such tasks.

That children with Down's syndrome function linguistically below the level that would be predicted by cognitive abilities (Rondal, 1994) undermines the Piagetian approach which claims that cognitive structures and processes are causally involved in the acquisition of the grammatical system. However, one must be careful to remember that cognitive processes and mechanisms are still likely to be involved in grammatical development. This would suggest that although the cognitive structures and processes may be functioning the child with Down's syndrome fails to use this ability to successfully communicate using grammatical rules. This can be highlighted by the fact that, for children with Down's syndrome, the first multi-word productions—which are not simply produced as unanalysed wholes—do not usually occur before the age of four or five. Specific studies of language and communicative development or functioning in adolescents and adults with Down's syndrome are rare, but it has been found that sentence complexity remains low, with very few utterances being grammatical clauses (this has been discussed in chapter 2). Articles have also been found to be infrequently used, grammatical morphology and function words (e.g. articles, auxiliaries, conjunctions, prepositions, pronouns) cause difficulty for adults with Down's syndrome (Rondal and Lambert, 1983). These grammatical devices will be assessed further in this study.

3.1.3 Age-related Linguistic Development

The aim of the experiment reported in this chapter is to assess the grammatical ability of adults with Down's syndrome. Other relevant findings, therefore, include indications that grammatical complexity continues to increase beyond adolescence in Down's syndrome (Rondal, 1993). Lenneberg (1964, 1967), having found that language development for adults with Down's syndrome ceased after the age of 14 years, predicted that no significant progress should be expected in basic language capacity beyond puberty. However, Seagoe (1965) reported evidence to the contrary, and has observed noticeable linguistic progress in adults with Down's syndrome up to 30 years old.

Models of cognitive development for individuals with Down's syndrome often suggest that development decelerates with advancing age, at a greater rate than that of other groups. Gibson (1981) has identified three mental age growth periods followed by a temporary plateau for the first and second and a gradual decline after the third. The first plateau is reached by four–six years and corresponds to a mental age of 18 months. The second plateau is reached between eight and eleven years, with a functional mental age of 30 months. If the third plateau is reached, it is achieved by 12–17 years, and equates to a mental age of 48 months. However, the findings of Berry et al (1984) indicate that on measures of a range of adaptive skills of a social and academic nature, as well as those reflecting linguistic and cognitive abilities, adults with Down's syndrome continue to learn and develop beyond the age of 30. For adults with Down's syndrome between the age of 40 and 60, however, some studies have indicated that linguistic functioning declines with increasing age, this was thought to be more evident in receptive skills than in expressive language (see also the discussion in chapter 2). The extent to which the decline is purely linguistic rather than the result of linguistic decline combined with the decline of other cognitive abilities is not addressed in these studies (e.g. Miniszek, 1983; Carter-Young and Kramer, 1991; Cooper and Collacott, 1995).

3.1.4 Tasks using Judgements about Grammar

One of the tasks used in the experiment reported in this chapter involves assessing participants' judgement about the grammaticality of sentences. Hypotheses regarding the grammars of adults are typically evaluated by eliciting judgements from them concerning the well-formedness and meanings of sentences in their languages. It has been assumed until recently that this is not a possible method of gaining data about children's use of grammar because they simply lack the ability to make overt judgements about grammaticality (e.g. Slobin, 1971), and for similar reasons it has not been widely used with adult participants who have learning difficulties. This has been reinforced by research into metalinguistic skills which suggests that a child must be in the concrete operational stage of cognitive development, therefore able to decentre, before they can make the distinctions between form and content necessary to give reliable linguistic judgements regarding the form of sentences (e.g. van Kleeck, 1982). Therefore, it has been suggested that it is not until the age of six or seven that children become able to separate the form of a sentence from its content, and identify sentences as acceptable or not, solely on linguistic grounds. However more recent studies have contradicted this belief by indicating that children as young as three or four years, who were unable to conserve, demonstrated that they were able to ignore their real world knowledge to judge as "silly" sentences that were perfectly sensible in real-world terms, but nevertheless ungrammatical, and did so reliably and systematically (e.g. Schlisselberg, 1988; Goodluck, 1989). Judgements about sentences made by trained subjects has been shown to be an activity less affected by factors such as memory limitations, response biases and discourse contexts than are other types of performance—such as production of a sentence or acting out a sentence, and so is seen as an activity minimally affected by factors other than grammatical knowledge (McDaniel and Cairns, 1990). Given the qualities of the judgement task outlined above, which match almost exactly the deficiencies experienced by individuals with Down's syndrome, and the evidence which has indicated that relatively young children are able to make judgements about sentences, this task clearly offers the most direct method for assessing grammatical ability while creating least cognitive strain to the participants.

However, care must be taken in designing the judgement task since studies have shown that certain characteristics of judgement tasks can affect the answers given by the subjects. It is clear that grammaticality judgements given in isolation do change through repetition: both grammatical and ungrammatical sentences have been shown to be judged as more ungrammatical if repeated (Nagata, 1988), whereas syntactic and/or semantic aspects of a sentence, when embedded in contexts, are firmly established and tend to resist the effects of repetition. Even without repetition, when sentences are presented in isolation they are judged to be less grammatical than those presented in context. It is likely that, in order to make a judgement about the grammaticality of a sentence, a context is sought in order to enable the hearer to interpret it; thus grammaticality judgements have been found to be higher for sentences with higher imagery (Levelt et al, 1977). These findings indicate that results from this study indicating which grammatical rules are found to be difficult by adults with Down's syndrome should be more closely examined using a task which involves context. This finding also highlights the importance of the ability to construct mental representations. Such a skill is needed to maintain coherent discourse, where the listener attends to those utterances which have first been judged to be both grammatical and relevant.

Other effects of presentation upon judgement of sentences have been shown. The order of presentation is known to affect grammaticality judgement such that the sentences presented first received lower grammaticality judgements than those presented later (Greenbaum, 1976). Knowledge and understanding of the language has also been shown to be important in making judgements about sentences. For example it has been shown that non-linguists reject more sentences as ungrammatical with greater confidence than linguists, also foreigners reject more sentences than do native speakers (Ross, 1979). Some criticism has been made of the value placed upon performance on grammaticality judgement tasks in relation to the level of linguistic knowledge they reveal. This is due to findings that self-awareness affects subjects' performance on grammaticality judgements. It is possible that performance therefore reflects the psychological processes produced by performance mechanisms rather than linguistic competence or understanding (Nagata, 1989). However, one would expect that linguistic performance may not be truly reflected in such a constrained task, and it is for this reason that this task has been used in conjunction with other tasks in this study, alongside a sample of spontaneous speech which should indicate the participants' productive language ability.

Although grammatical development in individuals with Down's syndrome has been investigated, previous research has focused on a limited number of grammatical devices in any one study. For example a study which is often cited by Rondal as an example of morpho-syntactic ability (Rondal, 1978) assessed sentence types: declaratives, imperatives, reversed yes/no questions, Wh-questions. Other studies which have assessed language ability of adults with Down's syndrome have assessed the occurrence of grammatical markers: compound verbs and subordinate clauses, number and gender markers, articles, verb inflexions, pronouns. (Rondal and Lambert, 1983). For this reason a grammaticality judgement task, based upon one used by Johnson and Newport (1989), has been used in this study to assess a range of grammatical constructions. Such a task also allows comparisons to be made with other studies and populations. Johnson and Newport's grammaticality judgement task was used to investigate representational differences which occur due to processing constraints, and was based largely on one developed by Linebarger et al (1983), who investigated the ability of agrammatic aphasics to make grammaticality judgements. It has been argued that agrammatic aphasics experience difficulties with comprehension and sentence structure which stem from an inability to retrieve information regarding syntactic structure, thus suggesting an inability to construct mental representations of syntactic information. In order to test whether agrammatic aphasics were able to construct syntactic representations of spoken sentences Linebarger et al developed a new grammaticality judgement task which was designed to sample systematically from across a broad range of sentence structures. Their aim was to assess whether agrammatic aphasics were insensitive to the constraints that determine syntactic well-formedness. Given the reasons for its implementation and the characteristics for which the task was specifically designed this grammaticality judgement task was seen to be most relevant to this study. Grammatical development and achievement of second language learners was the focus for the Johnson and Newport study. As outlined in chapter 1, in accordance with the "Less is More" hypothesis, they proposed that adults are able to sample a large amount of linguistic information at any one time but they are unable to process it and consequently deal with sections of language to which they are exposed in "unanalysed wholes".

Newport (1988) suggests that normal development of a system always occurs in the context of a particular array of surrounding abilities and disabilities in other systems. The context of acquisition, in this view, is therefore affected by the maturation of other processes. The theory implies that while other systems are limited, providing only a selected input and so reducing behavioural and neural competition, the target system may be optimally developed. Newport argues that this can be shown in language development. The memory and perceptual system are immature in childhood, which results in the ability to analyse only a limited proportion of the available language input. Language development therefore relies on a process of matching the language sample to innate rule-systems. Due to the capacity of the adult perceptual system, the process of matching rules to the language perceived and encoded is thought not to be possible in adulthood, since the computational demand far exceeds the resources available.

Late learners assessed in the study by Johnson and Newport (1989) typically used frozen structures: these were whole-word, unanalysed phrases which were produced in contexts where morphologically constructed forms were required. The late learner fails to perform the appropriate internal morphological analysis, because of this late learners also produce highly variable and inconsistently used structures. The errors made by native learners, on the other hand, mainly involve component parts of the language and occur in the early stages of language learning. Whole morphemes may be only partly produced or completely omitted, leading to selective production and omission. Native children are able to gradually acquire more morphemes, while late learners continue to use holistic forms or attempt broad overgeneralisations of patterns for some additional forms.

It has been proposed by Johnson and Newport that these differences may derive from differences between adults and children in the way linguistic input is perceived and stored, and perhaps not from differences in their knowledge of linguistic constraints or in their ability to perform linguistic analyses once the input is stored. This speculation can also be applied to the differences in the use of language by individuals with Down's syndrome. It has been noted that cognitive processes involving the perception, storage and organisation of linguistic information may be the main cause of linguistic difficulties, rather than a purely linguistic deficit. Perceptual, storage and organisational abilities, which function less effectively for individuals with Down's syndrome than for typically developing individuals, are necessary for the creation and use of mental representations. The formation and use of mental representations may not occur successfully in individuals with Down's syndrome. Mental representations cannot therefore be used to analyse, interpret and produce coherent discourse. The inability to create and use mental representations may therefore contribute to the apparent language difficulties experienced by individuals with Down's syndrome.

Research has shown that the information-processing ability of people with Down's syndrome is inhibited, imposing performance limitations on a large range of tasks, including linguistic ones (see Lewis, 1986, for a review). Newport proposes that processing difficulties account for adults' difficulty in using grammatical constructions. Such difficulties have been assessed using grammaticality judgement tasks (e.g. Johnson and Newport, 1989). Given that adults with Down's syndrome also have difficulty processing linguistic information a grammaticality judgement task has also been used here. The task was similar to the one used by Johnson and Newport, and was therefore used to investigate the grammatical ability of adults with Down's syndrome. The aim of the study is therefore to assess comprehension and production of certain grammatical categories using a grammaticality judgement task, together with an imitation task and a spontaneous speech sample.

3.1.5 Tasks using Imitation

Sentence imitation has also been used in this study since it has been identified as a useful task for exploring auditory-verbal short-term memory and expressive language difficulties in individuals with learning disabilities. It is assumed to assess several skills, including verbal knowledge, comprehension, expressive syntax, short-term auditory memory, attention and left-hemisphere functioning. Various studies have revealed that when asked to repeat a spoken sentence, children with Down's syndrome make more mistakes than other children with intellectual disabilities (Rondal et al, 1981), they also show more errors of omission, and imitate simple declarative sentences more accurately than sentences with more complex grammatical structures (e.g. Lenneberg et al, 1969).

Sentence imitation of adults with Down's syndrome has been compared to that of other intellectually disabled groups (Marcell et al, 1995) and has indicated that problems associated with performance on such tasks may be due to processing difficulties rather than recognition and understanding of the language. Adults with Down's syndrome correctly repeated fewer sentences than those in other groups and exhibited slower response time which was possibly due to one of a number of factors, such as a less effective initial processing of auditory information, slower retrieval of information stored in immediate memory, or more poorly developed syntactic knowledge base. Imitation of sentences of both low and high information load was found to be difficult: the information load constrained the adults with Down's syndrome more than those in the other groups who were matched for age and intellectual ability. Poor performance on sentence imitation was thought to be related to the reduced capacity to accurately process or precisely reproduce relatively small amounts of verbal information in short-term memory, rather than to a lack of initial understanding or an inability to store key words of a sentence, since although imitation was impaired, answers to questions about longer sentences indicated understanding of the sentence. Performance on imitation tasks by children with Down's syndrome has also been found to be influenced by immediate recall ability and the syntactic complexity of the sentence (Marcell et al (1995).

Impaired performance on sentence imitation tasks has been correlated with poor performance on language comprehension measures, indicating that impaired syntactic capacity has consequences for both language expression and comprehension (Adams, 1990). Memory span limitations may be the cause of poor performance since these have been related to sentence comprehension difficulties especially when preservation of exact content or precise word order are essential for understanding (Vallar and Baddeley, 1984). It is possible for meaning to be extracted from the language input, but attention to and storage of precise details, which would be necessary for acquisition and accurate use of grammatical rules, is found to be difficult for the individual with Down's syndrome. In general memory span limitations (for auditory and visual information) are predictive of sentence imitation difficulty. For adults with Down's syndrome, whose average memory span has been found to be about three items (whether measured by digits or sentence recall), only poor memory span for auditory information is predictive of performance on sentence imitation.

The Role of Imitation in Acquisition

Research has investigated the role of imitation in language acquisition, which has implications for this study, especially when it is considered that participants may not yet have developed language fully. Although there are some research findings to the contrary (e.g. Stine and Bohannon, 1983), the general consensus seems to be that imitation is not a mechanism of acquisition. Children seem to imitate mainly the sounds which they have already spontaneously applied to the world about them (Slobin, 1971). Some children do not imitate at all, therefore it cannot be seen as a prerequisite for language development (Bloom et al, 1974). However, in high-imitating children Bloom concluded that imitation did appear to play a role in language acquisition, reflecting the active processing of linguistic information about which the child has already developed some knowledge and understanding.

Imitation has been shown to occur at relatively high rates for children with Down's syndrome and other children with language acquisition difficulties (e.g. Fowler, 1984). Previous research has shown that imitation performed by children with Down's syndrome is similar in nature to that of typically developing children (Lenneberg et al, 1964). Therefore, from Bloom's conclusions it must be assumed that imitation plays a facilitative role. Fowler has suggested that this may be especially true for the grammatical development of children with Down's syndrome. However, Tager-Flusberg and Calkins (1990) believe that while imitation does not facilitate grammatical development in children with Down's syndrome or typically developing children, one possible function of imitation for children who are frequent imitators may be to maintain topic relevance in a conversation, and so sustain communication. From this it can be seen that imitation tasks can be used to assess grammatical ability without influencing the development of the grammatical constructs being tested.

Previous research has shown that both imitation and grammaticality judgements can be used to assess underlying processing ability involved with comprehension and production of grammatically correct language. It is for this reason that the tasks used in this study are comprised of a grammaticality judgement task and an imitation task, as well as a sample of spontaneous speech. The overall aim of the study is to assess the developmental achievement of adults with Down's syndrome with regard to comprehension and production of twelve pre-selected grammatical rules.

3.2 Hypotheses

The overall aim of the study was to assess the extent of the difficulty or ease with which adults with Down's syndrome are able to comprehend and produce twelve grammatical rules. Assessing the performance of adult participants allows the conclusion to be drawn that linguistic problems experienced must be as a result of an inability to comprehend or produce those linguistic devices—possibly as a result of processing deficits, rather than as a result of the language system not yet have been fully developed. However, it should be borne in mind that although the participating adults were over the age of 25 they may not have reached their full language potential, since it has been noted that it is possible that language continues to develop beyond the age of 30 in adults with Down's syndrome (Rondal, 1993). It is therefore expected that:

1. Imitation and judgement of grammatical rules will be impaired, especially those found difficult in the judgement task.

2. Those grammatical rules found difficult to imitate and / or to make judgements about will not be used accurately in the sample of spontaneous speech.

As a result of the vast differences in the abilities and experiences of second language learners when compared with adults with Down's syndrome no prediction can be made about the comparison between these two groups regarding either the proportion of errors made, or the specific rules found to be most difficult.

3.3 Method

The method was largely based on that of Johnson and Newport's (1989) investigation of the understanding of grammar by second language learners, specifically by the use of the grammaticality judgement task. The twelve grammatical forms assessed in this study were four morphological and eight syntactic forms (see Table 3.1). This study was largely exploratory, since few studies have investigated the linguistic achievements of adults with Down's syndrome in relation to a wide range of specific grammatical forms.

Morphology	Syntax
Past Tense	Determiners
Plural	Pronominalisation
Third Person Singular	Particle Movement
Present Progressive	Subcategorisation
	Auxiliaries
	Yes/No Questions
	Wh-Questions
	Word Order

Table 3.1: *The Grammatical Categories Assessed in the Three Tasks of this Study*

3.3.1 Design

A repeated measures design was used. Each participant was asked to take part in both experimental tasks. The order of participation in the two tasks was counterbalanced, to ensure that order effects would be minimised. Therefore, half of the participants were involved in the grammaticality judgement task first and the imitation task second. For the other participants the order of participation in tasks was reversed. The order of presentation of the sentences was randomly allocated, again to avoid order effects. Each participant was exposed to all sentences in both tasks.

3.3.2 Participants

The participants were selected from two day centres catering for adult clients with learning disabilities and were chosen on the basis that they each had some communicative speech, were not affected adversely by hearing difficulties, were willing to participate, and were all over the age of 25. No standardised measures of either linguistic or cognitive ability were taken in order to select participants. The participants were three females and eleven males, all adults with Down's syndrome. Ten typically developing adults also participated in a pilot of the grammaticality judgement task to ensure clarity of the sentences used.

3.4 Procedure

3.4.1 Part 1—Spontaneous Speech Sample

A spontaneous speech sample was obtained so that the participants' usage of the particular grammatical categories could be assessed. This was achieved by recording the participants on video tape in a natural and familiar setting such as activity sessions and lunch breaks. The video-recorded speech sample was approximately eight hours in length. However, the quantity of language contributed by each subject varied considerably within this sample. The video was transcribed in order for the sample to be assessed for the presence of, and more particularly errors made in, the relevant categories of syntax and morphology. Each video was transcribed and the utterances from each partipant were then examined for errors in the twelve grammatical categories being assessed in this experiment. The video and transcript were assessed simultaneously in order to maintain accuracy in scoring the grammatical errors made.

3.4.2 Part 2a—Judgements about Pictures

The participants were introduced to the notion of judgement, using a pilot task constructed in order to assess whether or not the participants could understand the concept of judgement and follow the instructions accurately regarding the making of judgements about things with which they were familiar. Each participant was shown a set of drawings of two sorts, they were either accurate in every respect (e.g. a violin), or constructed so that their structures were in some way altered (a duck's body with the head of a mouse) (see appendix B for drawings). The participants were asked to indicate whether they thought the drawing was sensible (correct or accurate), or silly (incorrect or inaccurate). The participants continued to the next part of the study if they were able to obtain a rate of accuracy above 80% on this task, since this indicated that they were not hindered by any constraints imposed by the concepts involved in making a judgement.

3.4.3 Part 2b—Judgements about Sentences

A partial replication of the methodology used by Johnson and Newport (1989) was designed to address the question of whether or not participants were aware of the grammatical constructs, and could understand them in settings of correct and incorrect usage, regardless of whether or not they made productive use of them. 264 relatively short sentences were constructed, this list consisted of pairs of sentences, one grammatical and one ungrammatical. Each grammatical sentence had an ungrammatical counterpart which was made ungrammatical by violating a single rule observed in normal adult English. The method by which this was achieved is outlined below.

To try to ensure that sentences tested the rules under study and not extraneous factors, sentences were constructed to contain only relatively high frequency words (using the word frequency list compiled by Thorndike and Lorge (1972). The length of the words ranged from one to three syllables. The location of the error and the sentence length were varied for each group of sentences. The set of sentences used can be found in appendix A.

Morphology

For the sentences testing morphology, the grammatical sentence always contained the target morpheme in a required context, while the grammatical violation was created using one of four formats:

1. Omitting required morpheme.
2. Replacing required morpheme with an inappropriate morpheme from a different class.
3. Making an irregular item regular.
4. Attaching a regular marking to an already irregularly marked item.

1. Omitting Morpheme. This format was used to make ungrammatical sentences for all four types of morphology. The sentence pairs were constructed so that the grammatical context required the target morpheme, making it a grammatical violation when the morpheme was omitted in one of the sentences of the pair.

For Example:

Third person singular:

1a) The boy thinks he is clever.

*1b) The boy think he is clever.

Present progressive:

2a) The little boy is speaking to the policeman.

*2b) The little boy is speak to the policeman.

2. Inappropriate Morpheme This format applied only to verb morphology: one sentence of the pair was correct while the other had an inappropriate tense marking for the context.

For Example:

Past tense:

3a) Yesterday the hunter shot a deer.

*3b) Yesterday the hunter shoots a deer.

3 & 4. Regular/Irregular Items The last two formats for creating the ill-formed sentences could be used only for past tense and plural forms.

For Example:

Plural:

4a) A shoe salesman sees many feet throughout the day.

*4b) A shoe salesman sees many foots throughout the day.

Past Tense:

5a) A bat flew into our attic last night.

*5b) A bat flewed into our attic last night.

Syntax

To test subjects' knowledge of determiners, the grammatical member of the sentence pair was constructed so that a determiner in a particular position was either necessary or not allowed. The ungrammatical counterparts were then formed by one of three methods:

1. by omitting them in required contexts (see sentence 6b).

2. by substituting the indefinite for the definite article(see sentence 7b).

3. by inserting them where neither article is allowed (see sentence 8b).

For Example:

6a) Tom is reading a book in the bath.

*6b) Tom is reading book in the bath.

7a) The boys are going to the zoo this Saturday.

*7b) A boys are going to the zoo this Saturday.

8a) Larry went home after the party.

*8b) Larry went the home after the party.

The ungrammatical sentences for pronominalization were formed to include one of the following violations:

1. the wrong case marking on the pronoun: this involved using nominative pronouns in objective positions and objective pronouns in nominative positions (see sentence 9b).

2. an error in gender or number agreement for the pronoun: this was tested by capitalizing on the fact that reflexive pronouns have to agree with the noun they are coindexed with (see sentence 10b).

3. an erroneous form of the possessive adjective: the error is the form the word takes, so some ungrammatical items have a possessive adjective with the possessive marker added (see sentence 11b).

For Example:

9a) Susan is making some cookies for us.

*9b) Susan is making some cookies for we.

10a) The girl cut herself on a piece of glass.

*10b) The girl cut himself on a piece of glass.

11a) Carol is cooking dinner for her family.

*11b) Carol is cooking dinner for hers family.

In particle movement (of verbs) the sentences take advantage of the differences between particles and prepositions. The ungrammatical sentences were formed by treating prepositions as particles—that is by moving the preposition to the right of the object NP (see sentence 12b). These were contrasted with grammatical sentences in their moved and unmoved positions. Other sentences were made ungrammatical by moving the particle outside its own clause. So for this rule type the set of sentences are not pairs but triplets (see sentence 13b and 13c).

For Example:

12a) The man climbed up the ladder carefully.

*12b) The man climbed the ladder up carefully.

13a) The guard dog barked at the intruder yesterday.

*13b) The guard dog barked the intruder at yesterday.

*13c) The guard dog barked the intruder yesterday at.

Subcategorization tested subjects' knowledge of the frames of various verbs. Individual verbs determine the type of syntactic frames that may follow them. Because the details of these frames are lexically determined, ungrammatical sentences were created by changing the structure of the required frame for a particular verb while keeping the meaning intact; the change in these sentences involved using the subcategorization frame of a semantically similar verb (see sentence 14b and 15b).

For Example:

14a) The man allows his son to watch TV.

*14b) The man allows his son watch TV.

15a) The man lets his son watch TV.

*15b) The man lets his son to watch TV.

The affix requirements for different auxiliary verbs were tested. The ungrammatical sentences were constructed by violating three rules of auxiliaries:

1. "have" requires a past participle (see sentence 16b).

2. following any form of "be" the main verb must take the progressive (see sentence 17b).

3. only the first element of the auxiliary verb is tensed (see sentence 18b).

For Example:

16a) The lamb has fallen into the ditch.

*16b) The lamb has fall into the ditch.

17a) It has been raining all week.

*17b) It has been rain all week.

18a) Joseph should have written a letter to his mother.

*18b) Joseph should has written a letter to his mother.

For the rule type investigating yes/no questions, the ungrammatical sentences contain primary errors in subject-aux inversion, the errors are of three types

1. two auxiliaries are moved in front of the subject (see sentence 19b).

2. both the auxiliary and the verb are fronted (see sentence 20b).

3. the verb is fronted in a sentence where do-insertion would normally occur (see sentence 21b).

Additionally there were some ungrammatical sentences formed by copying instead of moving the auxiliary verb (see sentence 22b).

For Example:

19a) Has the king been served his dinner?

*19b) Has been the king served his dinner?

20a) Can the little girl ride a bicycle?

*20b) Can ride the little girl a bicycle?

21a) Did Bill dance at the party last night?

*21b) Danced Bill at the party last night?

22a) Are they playing cricket in the park?

*22b Are they are playing cricket in the park?

The ungrammatical wh-questions have three forms: two of them also dealing with auxiliaries.

1. no subject-auxiliary inversion occurs (see sentence 23b).

2. do-insertion is omitted (see sentence 24b).

3. a question was ill-formed by substituting an incorrect wh-word for a correct one (see sentence 25b).

For Example:

23a) When will Sam mend his car?

*23b) When Sam will mend his car?

24a) What do they sell at the corner shop?

*24b) What they sell at the corner shop?

25a) Where did she put the blanket?

*25b) Why did she put the blanket?

In the last rule type basic word order rules are tested. Within each type of sentence the ungrammatical sentences were formed by systematically rearranging the verbs and noun phrases so that all of the possible orders of the constituents occurred. Three sentence types were used:

1. intransitive (NP-V) (see sentence 26b)

2. transitive (NP-V-NP) (see sentence 27b)

3. dative (NP-V-NP-NP) (see sentence 28b)

For Example:

26a) The woman paints.

*26b) Paints the woman.

27a) The boy bounces the ball.

*27b) The ball bounces the boy.

28a) Martha asked the policeman a question.

*28b) Martha a question asked the policeman.

Each participant took part in four trials, each consisting of 31 sentences. These were read slowly to the participant using standard intonation in both the grammatical and ungrammatical sentences. The participants were asked to indicate whether the sentence being read was a "sensible" sentence (correct), or a "silly" sentence (incorrect). Some practice sentences were worked through with the participant before embarking on the test sentences in order to try to clarify the instructions.

In order to assess whether the participants made errors more frequently on a particular type of rule, only the ungrammatical items were used. It is only the ungrammatical items which can be said to be testing any particular rule type. This is because when participants mark a sentence as ungrammatical, it is unclear what part of the sentence, or grammar, is being found difficult. In contrast, when participants mark an ungrammatical sentence as grammatical, they must have failed to represent just that structure under test as a normal language user would have done. The total number of correct responses and errors for each category was also noted. The judgements made by each participant were recorded by the experimenter immediately after the participant made each judgement. Errors were then scored from the record sheets.

3.4.4 Part 3—Imitation of Sentences

The final part of the study involved the imitation of the sentences about which the participants had previously made a judgement. Participants were asked to repeat the sentence which had just been read to them. The assumption of this task was that the participant would be unable to imitate correctly those parts of speech which were not already mastered: this is in keeping with the belief that young children, when acquiring language, do not imitate grammatical forms until they have reached the stage in their language development which allows them to be used spontaneously (Slobin, 1971). The participants were expected to respond in one of three ways to each of the sentences: to copy exactly (which would show that they had the potential to use the grammatical category), to copy incorrectly (showing an inability to use the category correctly), or to correct the ungrammatical sentences (showing understanding of the sentence type and ability to use the category correctly). The participants' utterances were recorded on audio-tape. These were transcribed and analysed for errors in the same way as that for the spontaneous speech sample.

3.5 Results

Johnson and Newport (1989) showed that the later an individual is exposed to a language the less adequately they are able to acquire certain parts of grammar. Thus, second language users in their study found the categories selected difficult by varying degrees but in general those which were found to be most difficult were determiners and plural morphology, while those which were dealt with at a near-native level were word order and present progressive.

The main aim of the present study was to assess the ability of adults with Down's syndrome on a range of grammatical categories in order to identify any difficulties, as well as to highlight aspects which were found to be less difficult on each task. A sample of the transcriptions obtained from participants can be found in appendix C. Poor performance on the picture judgement task resulted in the exclusion of three participants. Therefore, the analysis reported in this section involves data obtained from the remaining eleven participants.

3.5.1 Grammaticality Judgement Task

Johnson and Newport's grammaticality judgement task provided a relatively broad range of categories which could be tested, and which also allowed for possible comparison between the performance of adults with Down's syndrome, and adults in Johnson and Newport's study whose acquisition of the language had occurred at different ages. Figure 3.1 shows this comparison, where the age of the subjects indicates the age of exposure to the second language. For clarity, Johnson and Newport's five age-groups have been amalgamated into two larger age-groups. Native learners from their study are also shown. The errors made by typically developing adults in the pilot of the grammaticality judgement task used in this experiment are not represented here since they were very similar to those made by the native learners in the Johnson and Newport study. It must also be noted that the results indicate only the errors obtained on sentences where the subject identified as correct those items which were in fact ungrammatical, all further data analysed for the grammaticality judgement task accords with this, as stipulated by Johnson and Newport (1989).

It can be seen clearly from Figure 3.1 that adults with Down's syndrome found all the grammatical categories being tested more difficult than any of the groups tested by Johnson and Newport. Using a Pearson's product moment correlation, no significant correlation was found between performance by adults with Down's syndrome and the adults in the Johnson and Newport study ($r = 0.04$, correlation with native speakers; $r = 0.16$, correlation with adults exposed to the language at 25–39 years of age). This indicates that the categories which were found difficult by adults with Down's syndrome were not the same as those which were found difficult by typically developing second language learners.

For adults with Down's syndrome, a one-way Analysis of Variance was performed. The independent variable was the grammatical forms tested and the dependent variable was the proportion of errors made for each grammatical form by each subject. This analysis showed that there was a significant variation in errors made in each category, indicating that certain categories were found to be significantly more difficult than others, ($F = 6.09$; $df = 11$; $p = 0.0001$). A post hoc test (Newman-Keuls) revealed that both Particle Movement and Word Order were found to be significantly less difficult than the other grammatical forms being assessed. Significant differences were also found for Pronominalisation and Yes/No Questions, where significantly lower scores were found when compared with the categories found most difficult—namely Present Progressive and Wh-Questions.

It was also interesting to note that there did appear to be a response bias. Analysis, using a t-test, showed that significantly more positive responses than negative ones

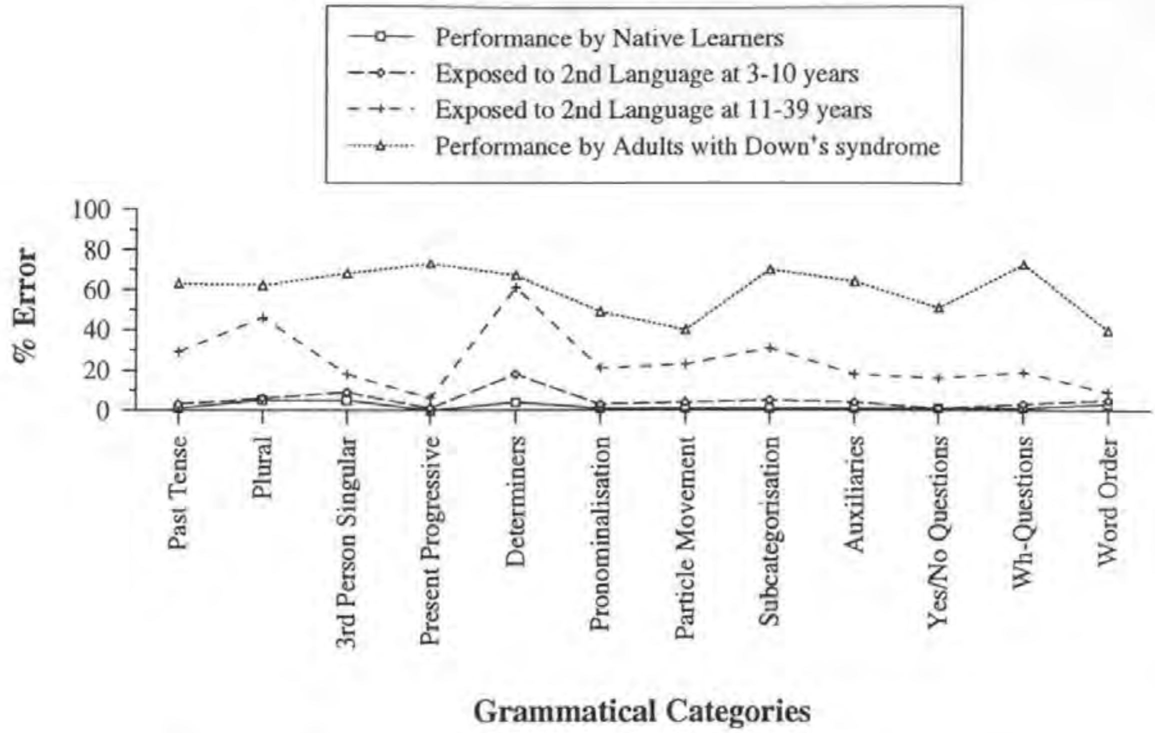


Figure 3.1: *The proportion of errors made by adults with Down's syndrome compared with those made by second language learners*

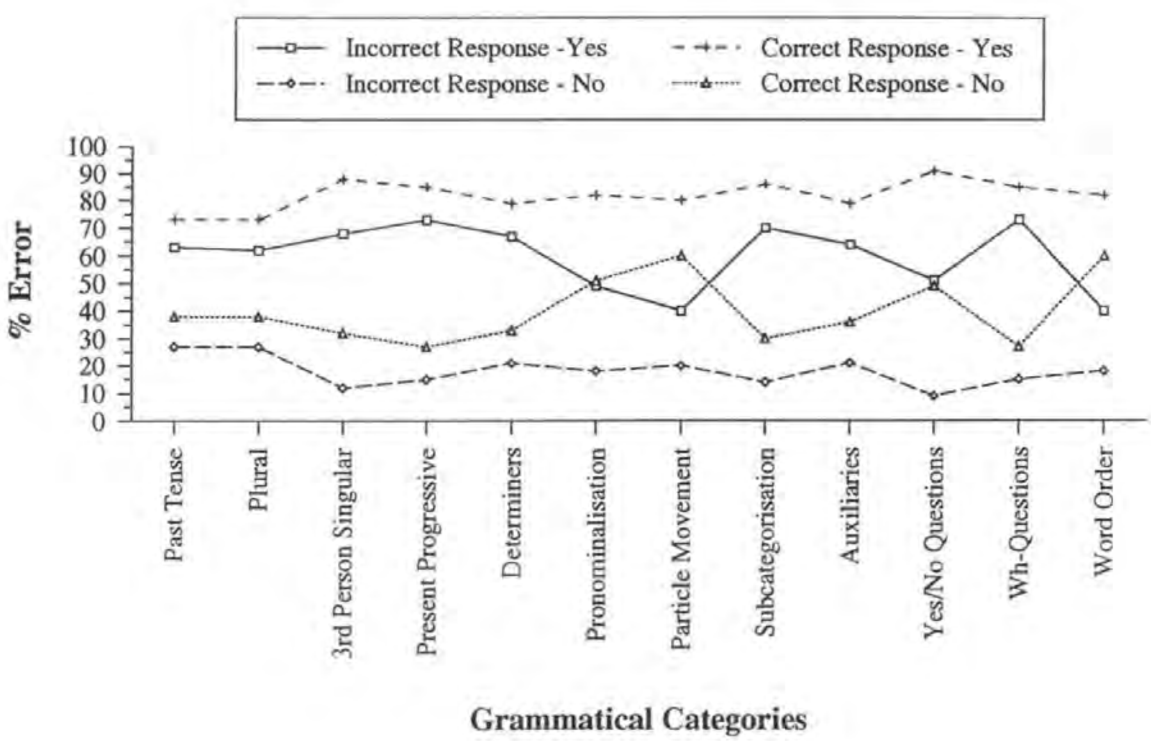


Figure 3.2: *Percentage response type used by adults with Down's syndrome for each grammatical category*

were given (t = 9.7; df = 11; P = 0.0001). Figure 3.2 indicates the proportion of affirmative and negative answers given by adults with Down's syndrome. It also shows the proportion of responses which were identified correctly and incorrectly.

Summary Of Findings

Grammaticality Judgement Task

- Adults with Down's syndrome made more errors on all grammatical forms than any of the subjects assessed by Johnson and Newport (1989).
- No significant correlations were found between subjects assessed by Johnson and Newport and adults with Down's syndrome.
- The fewest errors were made for sentences which tested particle movement and word order.
- The most frequent errors were made on sentences which tested present progressive and Wh-questions.
- A response bias was noted: adults with Down's syndrome were more likely to give a positive than a negative response.

3.5.2 Imitation Task

Each subject was asked to imitate both grammatically correct sentences and grammatically incorrect sentences. Ungrammatical sentences were given to imitate in order to assess whether or not they would be copied exactly or corrected. Any errors which occurred as a result of copying exactly, are referred to in the analysis as "forced errors". Such an error may be made because the subject is correctly imitating the sentence—

the error is already present in the sentence and so the subject is forced to copy the error. It must therefore be noted that the data which has been analysed from the imitation task are errors which have been made on grammatically correct sentences—or "unforced errors". The subjects were not forced to make the errors since there were no errors present in the sentences which they were asked to imitate. Results are shown as a proportion of the possible errors which could be made on each of the grammatical categories.

A one-way Analysis of Variance was performed on the data for the imitation task. The independent variable was the grammatical forms tested and the dependent variable was the proportion of errors made for each grammatical form by each subject. This analysis on the "unforced error" data showed that some categories were being found significantly more difficult than others, ($F = 13.6$; $df = 11$; $p = 0.0001$). A Newman-Keuls post hoc test was performed and revealed that Auxiliaries were significantly more difficult to imitate than any other category. Plurals, Particle Movement and Word-Order were found to be significantly less difficult to imitate—that is fewer unforced errors were made on the these categories when compared to the others. These results can be seen in Figure 3.5.

A Pearson's product moment correlation was also performed to examine whether forced and unforced errors occurred equally for each grammatical category. A negative correlation was found ($r = -0.6$; $p = 0.05$), suggesting that when unforced errors were high, forced errors were low and vice versa, this result can largely be explained by the scores obtained for two categories—Auxiliaries and Word-Order (See Figure 3.3).

For interest, the number of spontaneous corrections to ungrammatical sentences can be seen in Figure 3.4. It was expected that where most corrections occurred, the categories corrected would be those which were found to be least difficult to imitate—producing fewest errors. While those categories for which more errors were produced,

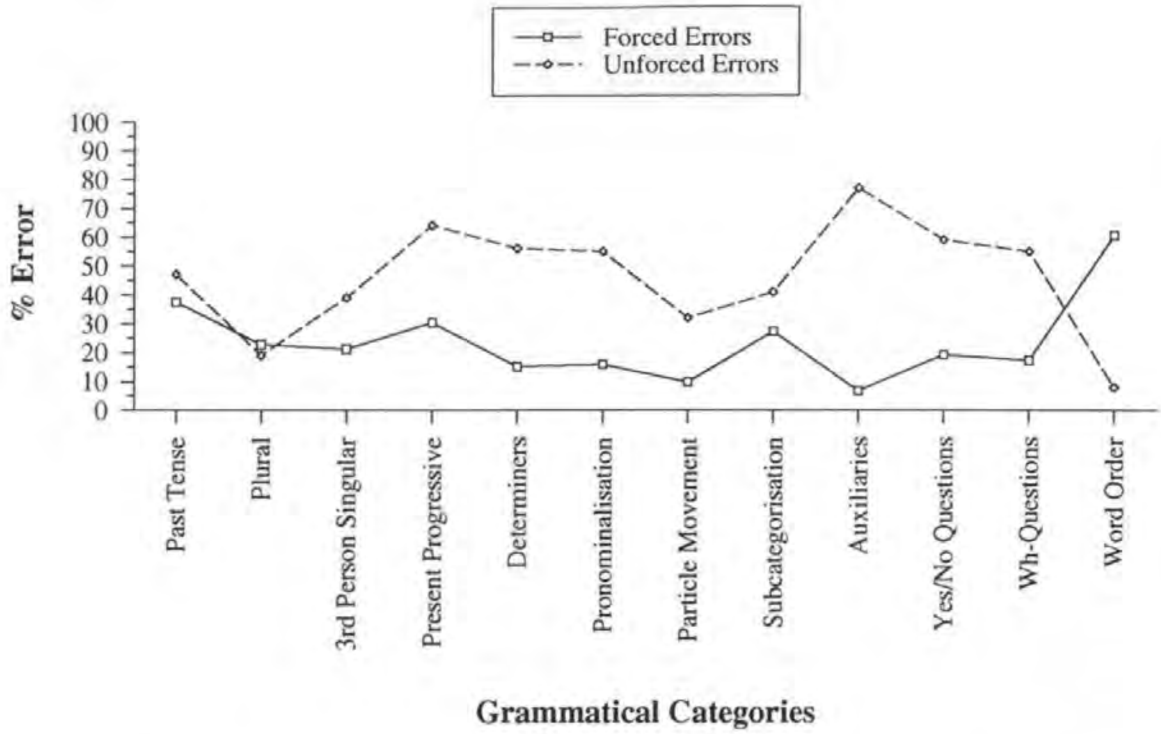


Figure 3.3: *Percentage unforced and forced errors made on the imitation task*

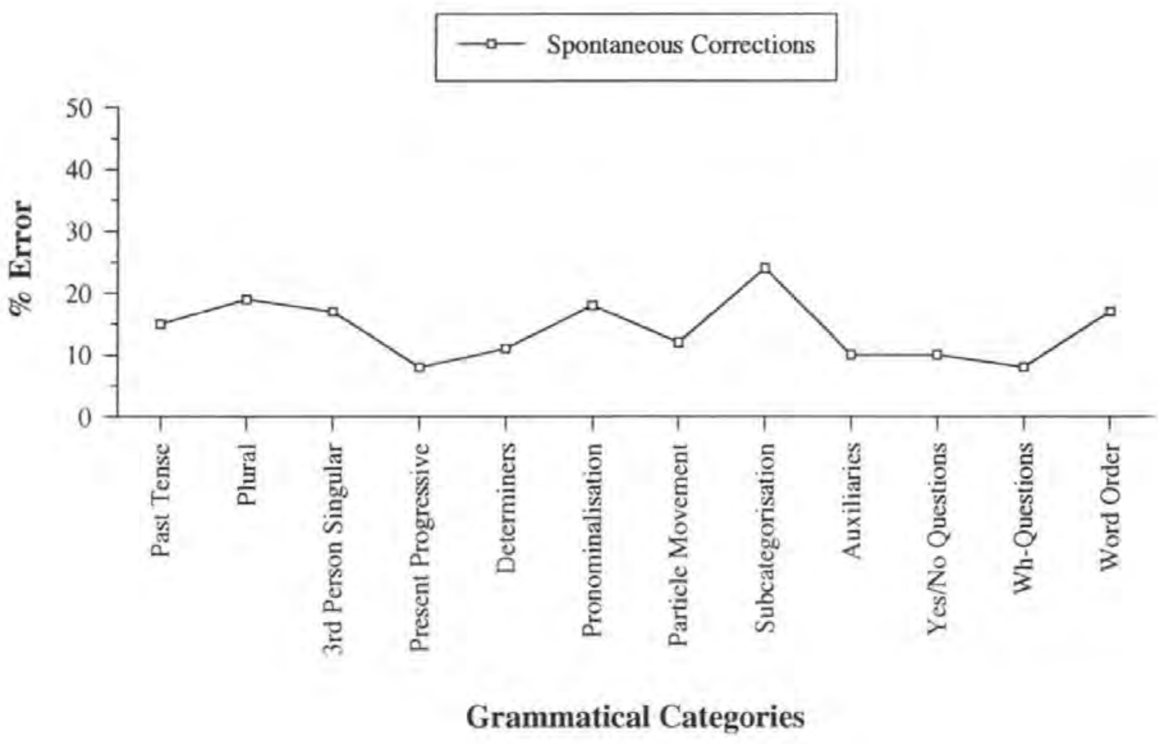


Figure 3.4: *Percentage of errors which were spontaneously corrected in the imitation task*

fewer spontaneous corrections were expected to occur. A negative correlation ($r = -0.57$; $p = 0.053$) proved this to be the case.

Summary Of Findings

Imitation Task

- The fewest errors were made for sentences which tested plurals, particle movement and word order.
- The most frequent errors were made for sentences which tested auxiliaries.
- More errors were made on correct grammatical forms than on ungrammatical forms.
- More spontaneous corrections occurred for grammatical categories which were found least difficult to imitate.

3.5.3 Spontaneous Speech Sample

Data obtained from the spontaneous speech sample is shown in Figure 3.5 where the errors indicated are a proportion of the total number of occurrences of any given category. Table 3.2 shows the total number of occurrences of each grammatical category in the spontaneous speech sample.

Analysis of Variance was performed on the data, as for the previous tasks and showed that certain grammatical categories were produced spontaneously with significantly less success than others ($F = 4.2$; $df = 11$; $p = 0.0001$). A Newman-Keuls post hoc test was performed and showed that Auxiliaries were produced with significantly more errors than all categories except for Present Progressive and Yes/No Questions.

Grammatical Category	Total Occurrances
Past Tense	212
Plural	93
3rd Person Singular	41
Present Progressive	113
Determiner	290
Pronominalisation	838
Particle Movement	145
Subcategorisation	12
Auxiliaries	418
Yes/No Questions	64
Wh-Questions	60
Word-Order	-

***Table 3.2:** Total number of occurrances of Grammatical Markers used by Adults with Down's syndrome in the Spontaneous Speech Sample*

While the proportion of errors produced by these two categories (Present Progressive and Yes/No Questions) was high, they were found to be significantly higher than only one category—that of Word Order. This can be explained by the fact that there were very few Word Order errors—though not significantly fewer than for those made in most other categories (see Figure 3.5).

Summary Of Findings

Spontaneous Speech Sample

- The fewest errors were made for sentences which tested word order.
- The most frequent errors were made for sentences which tested auxiliaries.

Task	Grammaticality Judgement	Imitation	Spontaneous Speech
Grammaticality Judgement	1		
Imitation	0.25	1	
Spontaneous Speech	0.48	0.79*	1

* indicates significance at ($P < 0.05$)

Table 3.3: *Correlation of Performance on Each Task*

3.5.4 Comparison of Performance on Each Task

A Pearson's product moment correlation was performed on the data obtained for each of the tasks. The results of this correlational analysis show that errors occurred on similar grammatical categories for the imitation task and the spontaneous speech sample, but no significant correlation was found with errors occurring on the grammaticality judgement task; this, therefore, partly supports Hypothesis 2, while Hypothesis 1 must be rejected. However, the correlation between the grammaticality judgement task and the spontaneous speech sample (r = 0.48) is moderately sized and might well have been significant with a larger subject group. If this were the case then Hypothesis 1 which has predicted that errors would occur in the imitation of sentences for which errors were made in the judgement task would be supported. The results of the correlation are summarised in Table 3.3.

Given the findings of the correlations, it is useful to show the extent and pattern of the proportion of the errors made by adults with Down's syndrome in comparison with the errors made on the other tasks. Figure 3.5 shows the proportion of errors made on each of the tasks for each of the categories being tested, and shows clearly the categories which were found to be more and less difficult by adults with Down's syndrome.

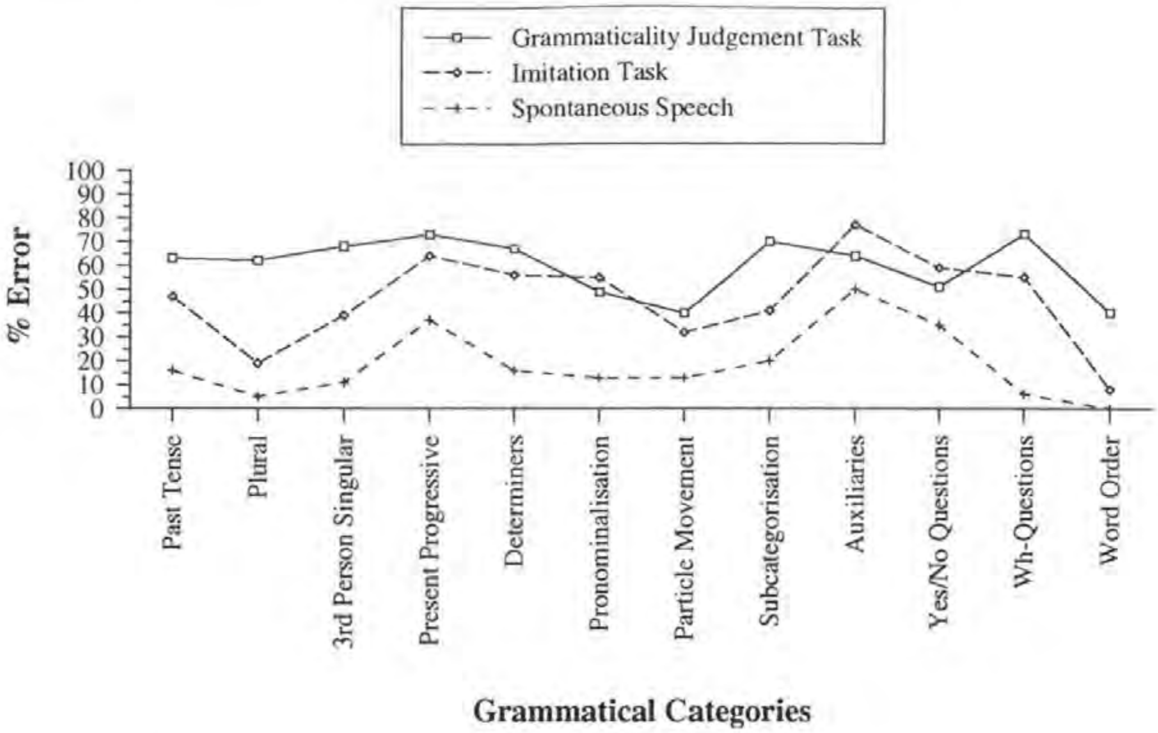


Figure 3.5: *Percentage errors made by adults with Down's syndrome on each of the tasks*

Summary Of Findings

Performance on All Three Tasks

- No significant correlation was found between the grammaticality judgement task and the other tasks.
- A significant correlation was found between errors made on the imitation task and those made in the spontaneous speech sample.

3.6 Discussion

Johnson and Newport have argued that the processes involved in the analysis of language input and the representation of that language input can be affected by the age at which the person is exposed to the language. Adults with Down's syndrome found all categories more difficult to make judgements about and although there was also a different order of difficulty for the categories for the adults with Down's syndrome and the second language learners, it is possible that processing and representational problems are occurring in both groups. The absence of a significant correlation between the categories found difficult by adults with Down's syndrome when compared with both native speakers and second-language learners indicates that the effective use of processes for language analysis and representation may be more impaired or different for the adults with Down's syndrome.

There are a number of linguistic and pragmatic features which must be considered in order to begin to understand why certain grammatical categories were found more difficult than others. Both the understanding of individual rules within a sentence, the ability to take into account other contextual information and the ability to represent the meaning of the sentence will affect performance on the tasks in this study.

The complexity of the sentence is a prominent feature which will increase the difficulty of the sentence for people with Down's syndrome because of their known memory limitations. The amount of information about the sentence which must be taken into account by the listener in order to understand it will affect the ability to detect errors or to produce errors. For example results from this experiment indicate that adults with Down's syndrome have particular difficulty with those grammatical categories containing abstract words and with those which add no apparent meaning to the utterance, such as endings. This may be due to an inability to integrate such information into a mental representation of the discourse because it is less easily represented. Alternatively, a difficulty in integrating information may indicate that what is lacking is the necessary linguistic knowledge.

It can be seen that if the general meaning is conveyed by the key words in the sentence then no error is detected, but where the meaning is disrupted (for example, where word order is changed, or omissions occur: as with Particle Movement, Yes/No Questions and Word Order) then the error is more easily detected. Therefore, although it may be necessary to take account of other parts of the sentence for a grammatically correct utterance (e.g. Third Person Singular or Present Progressive) these endings may be omitted and an understandable utterance may still be produced.

It would seem from the results of this study that adults with Down's syndrome have difficulty comprehending and producing abstract words and word endings. This may be due to the fact that they do not attend to or understand them in the language to which they are exposed. A possible reason for not attending to these may be because they convey no obvious meaning, thus resulting in them not being understood. As long as the key words of an utterance have been identified and understood, other more subtle syntactic and morphological information may safely be discarded, since contextual cues may suffice to provide the additional information needed to understand the overall meaning of the utterance. Instead a form of script, where available, may be relied on for dealing with certain forms of utterance. This has been discussed in chapter 1 as a useful means of extracting meaning from linguistic input and surrounding context in conjunction with the function of mental representations. By attending to the utterance in an unanalysed complete format, scripts for utterances used in certain contexts can be generated, while at the same time removing the necessity to learn the individual rules. Such a strategy may be used by adults with Down's syndrome in order to produce acceptable utterances which convey the required meaning without understanding the individual grammatical rules used.

The importance placed on gaining the overall meaning of an utterance while disregarding other grammatical features can be seen from the performance on sentences which tested word order. If word order is important for sentence comprehension and also for production, it will not be found to be a problem for production, but altering the word order may cause confusion for comprehension. This is borne out by, for example, the performance by adults with Down's syndrome on the grammaticality judgement task, where word order was found least difficult, while word-ending categories and those of infrequent use were found more difficult. Therefore, where meaning can be inferred from information other than that which is linguistic, there is less of a necessity to learn the relevant grammatical rules. For example, adults with Down's syndrome found ungrammatical present progressive endings hard to detect, they also made many of these errors in spontaneous speech. Since meaning is relatively intact without this ending it may be more difficult to detect the error in a grammaticality judgement task or to encode the meaning of the ending. Conversely, for word order, fewer errors were made in the spontaneous speech sample and more errors were detected in the grammaticality judgement task, this indicates that the adult has access to an internally represented or encoded word-order rule system, with the main aim being to convey meaning as clearly as possible. Word order errors were also found to be least difficult for second language learners to detect (Johnson and Newport, 1989). This suggests that, while other grammatical rules may be difficult to acquire, word order grammatical rule which is more readily acquired—perhaps because it is necessary in order to understand the meaning of an utterance. Therefore, where processing demands exceed processing resources, word order can be acquired while other grammatical rules cannot.

It is also interesting to note that errors on the specific rules being assessed in spontaneous speech and the imitation task correlated highly and significantly, whereas this was not the case for the grammaticality judgement task. This is most likely to be due to the different processes involved in producing grammatically correct sentences from those involved with making a judgement about them. Perhaps this is another example in support of the notion that grammatical markers in the sentence may not be attended to or understood sufficiently in order to notice errors, especially when those grammatical markers do not have to be produced. This may also explain why more errors were made on the tasks where sentences were not constructed by the participant, namely the imitation and grammaticality judgement tasks. Fewer errors were made on the spontaneous speech sample, perhaps indicating that the production of rules is dependent on either an understanding of the specific rule or on the use of a script for a particular type of utterance. Where the rules were not understood or where no script was available the rules were rarely used. It must also be noted that for the grammaticality judgement task there was a response bias. This has implications for the validity of the test since it is the "Yes" responses to sentences which were ungrammatical upon which the analysis depends. This may therefore partly explain the reason for the lack of a significant correlation between the grammaticality judgement task and either of the others. The fact that the error rates on this task are higher than the other two may also be explained by this response bias.

3.7 Conclusions

It is hoped that this study has highlighted the specific difficulties involving grammatical comprehension and production for adults with Down's syndrome, to enable further work to investigate the development of these areas in childhood. It is possible that it is the way the linguistic information is stored, organised, retrieved and applied to different linguistic contexts which results in the problems experienced by adults with Down's syndrome. The implicit assumption has been that reorganisation plays a relatively minor role, one that is confined to certain domains such as inflectional morphology. However, reorganisational processes seem to be particularly important during the preschool years, after the child has acquired a workable vocabulary and some basic ability at sentence construction. Before reorganisation in any particular linguistic domain takes place, the child may be able to produce elements from that domain quite fluently. However, the knowledge that enables them to do this may in many cases be relatively superficial, consisting of piecemeal rules and unintegrated information for dealing with different kinds of words, sentence patterns and situations. The major types of widely recognised reorganisational processes include the child's analysis of unanalysed forms, the successive replacement of one rule by another, and systematic changes over time in the way children comprehend words or sentence structures. The context in which language is produced and comprehended, as well as the participants in that language context must all play an important part. Karmiloff-Smith's model outlined in chapter 1 gives a clear example of reorganisation of linguistic information, where it is applied to referential language and the context in which it is used. The use of mental representations in relation to the reorganisation of information which is necessary for language development in childhood will be the focus of the following chapters. One grammatical category from this study which provides a clear example of the importance of the use of mental representations in order to understand and use that category to maintain coherent discourse is that of pronominalisation (and nominal reference in general)—a category which has been indicated as being one which causes a limited but nevertheless moderate amount of difficulty for language comprehension and production in adults with Down's syndrome. This will be further assessed in the remaining chapters.

Chapter 4

Experiment 2: Use of Referential Devices in Narration

4.1 Introduction

In the previous chapter the ability of adults with Down's syndrome to make judgements about, imitate, and use a range of grammatical categories was investigated. The results showed that the majority of grammatical forms tested were more difficult for this group than for both other adults and second language learners. The purpose of the study presented in this chapter was to assess possible reasons for the difficulty experienced with one of the categories previously investigated—namely the use and understanding of pronouns and other referential devices. Adults with Down's syndrome displayed some ability to use and understand these forms, it is therefore expected that a developmental pattern may be found in children with Down's syndrome which could be compared with that of typically developing children. Pronouns form part of a complex system and their use is dependent upon a number of pragmatic factors as well as purely linguistic ones. The development of the use of both pronouns and referential strategies in general is assessed here, both for typically developing children and for children with

Down's syndrome. Previous research on referential strategies is outlined below.

4.1.1 Referential Devices

Discourse rules involve syntactic and semantic rules, as well as the analysis of factors of context, task, and partner (Nelson and Nelson, 1978). As has been discussed in chapter 1, one factor which contributes to the cohesion of discourse is the use of rules to establish a topic and maintain reference to that topic. For the successful communication of information the speaker must ensure the integration of language and context so that the meaning will be clear to the listener. Clarity is achieved by both establishing reference and maintaining reference through cohesive devices of reference (Clarke and Marshall, 1981; Tanz, 1980). Dent (1984) and Lyons (1979) argue that the earliest devices for discourse cohesion appear to be based on direct reference to the context—situational indexical reference. However, conventions of reference and cohesion become increasingly important and lead to more textual anaphoric reference. As understanding of discourse develops referential use is influenced by considerations other than purely communicative ones (e.g. Karmiloff-Smith, 1992).

4.1.2 Discourse Models

The study of pronouns provides an example of the way in which the successful maintenance of discourse depends upon different sources of information. Four different knowledge sources have been identified as necessary to interpret pronouns: syntax, semantics, pragmatics, and social knowledge (Stevenson, 1988). It may be argued that pragmatics is precisely the ability to draw together various sources of linguistic and non-linguistic information, rather than—as suggested above—being an additional source of information (Sperber and Wilson, 1995). Garnham (1987) argues that syntactic and semantic information are used only to determine reference and then forgotten. Pronouns cannot, therefore, be comprehended purely on the basis of linguistic knowledge. Linguistic knowledge is required for the appropriate use of pronouns, for example the information conveyed by the word itself (semantics), as well as the structural constraints imposed by grammatical rules that govern the interpretation of pronouns (syntax). Non-linguistic knowledge such as the way in which interpersonal roles are understood and identified by different pronouns must also be accessed in order for pronouns to be used and understood successfully ('social' or world knowledge). Anaphoric pronouns can only be understood by means of internal representations from which information concerning the object can be drawn.

4.1.3 Representation and Reference

Within discourse, the relationship between an utterance and its context has been examined (Tyler, 1983; Bamberg, 1986; Brown and Yule, 1983). Mental representations of discourse are necessary for the ongoing understanding of that discourse. Associations between the previous and present referents in discourse need to be made to understand the speaker: for this reason the speaker must be aware of referential devices that will aid the listener in understanding the discourse. Immediate access to previous representations and ability to represent information rapidly is a necessary prerequisite for the successful use of pronouns in discourse.

Marslen-Wilson, Levy and Tyler (1982) suggest that the way the speaker decides upon the referential device to be used is dependent upon the assumptions made concerning the ability of the listener to correctly identify the referent. The ability of the listener to link previous information to the current discourse is in turn dependent upon an ability to integrate utterances into the existing mental representation of the discourse. In order for this to be performed successfully by listeners Marslen-Wilson and Tyler (1980) suggest that on-line speech processing must occur. Lexical, structural and interpretative information is integrated, resulting in a speech processing system that involves an immediate attempt at a mapping onto a mental representation of the previous and current discourse interpretation. There must therefore be some property of the utterance that enables the listener to connect it directly to both linguistic and non-linguistic information already represented, or which indicates that general and contextual knowledge must be used to interpret the utterance.

4.1.4 Anaphora

There are numerous strategies which have been put forward as explanations of the way in which anaphoric pronouns are assigned to a referent, but these concentrate on anaphoric references within sentences and do not provide any explanation of the discourse and contextual constraints on the use of pronouns (e.g. Parallel function strategy: Grober, Beardsley and Caramazza, 1978; Conservation of semantic role: Ferreiro et al, 1976; Minimum distance principle, Chomsky, 1969).

Anaphoric devices include not only pronouns and nominal substitutes, but also full definite noun phrases linked in some way to a previous referent. In a very general definition, Garnham (1987) defines anaphoric expressions as "those that take their meaning in certain ways from some preceding or following part of the text, or from non-linguistic context." Garnham identifies three main aspects of the interpretation of anaphoric expressions: first, recognising that an expression in a text is an anaphor; second, deciding which aspects of linguistic and non-linguistic context are relevant to its interpretation; third, assigning it a meaning on the basis of those aspects of context, and its relation to them.

It has been claimed that for children of around five years of age a pronoun merely acts as a marker of the current focus of attention, rather than matching the pronoun to the antecedent by following discourse rules and thereby using a referential strategy

(Karmiloff-Smith, 1985; Tyler, 1983). However, for children above the age of seven, pronouns and noun phrases have been shown to be used as successful anaphoric devices (Karmiloff-Smith, 1985). Such anaphoric devices indicate that the appropriate antecedent must be identified and integrated into the current mental representation of the utterance for the discourse to be understood. Mental representations of the discourse allow potential antecedents to be accessible for the processing of the current utterance. The use of a pronoun by a speaker usually signals to the listener that the utterance requires the listener to identify the most relevant antecedent, given linguistic and contextual constraints, in order to understand the utterance (Sperber and Wilson, 1986). In contrast to the findings cited above, understanding and producing anaphoric devices has been identified in children as young as five years old (Clibbens, 1992). This ability is clearly dependent upon the integration and processing of both linguistic and cognitive information.

4.1.5 Referential Devices used by Individuals with Down's Syndrome

McDade and Adler (1988) note that differences observed in rate of vocabulary acquisition for children with Down's syndrome when compared with typically developing children may be due to specific cognitive deficits which children with Down's syndrome have, such as difficulty with storage and retrieval abilities as well as difficulty in the ability to encode and decode verbal stimuli. Sequential processing or short term memory deficits are more typically reported for auditory than visual memory in children with Down's syndrome. This may suggest that representational and reorganisational ability in this modality is found to be more difficult.

There is a need to understand the processes which govern the production of language, and more specifically, the normal route by which grammatical and discourse rules are developed. For an understanding of their use by children with Down's syndrome it is first necessary to discover the processing constraints and developments occurring in typically developing children. It is for this reason that Karmiloff-Smith's (1985) model proves useful, both in order to investigate normal development and also to provide a framework for speculation about the possible cognitive and linguistic difficulties with discourse faced by children with Down's syndrome. For example, as can be seen from the Karmiloff-Smith three-phase model, the final stability of phase one, which cues the passage beyond success to phase two and its representational reorganisation, is based on repeated positive feedback. Thus procedural success is the prerequisite for real representational reorganisation which ultimately results in the successful use of referential strategies. It is possible, based on the predictions from this model, that the process of representational reorganisation is not initiated in children with Down's syndrome because of their lack of procedural success. It is also possible that the processing requirements needed for such a reorganisation procedure may be beyond their available resources.

This difficulty in processing is generally accepted in many areas of the development of children with Down's syndrome. Processing resources are needed for the initial reorganisation of information, however, even after reorganisation, processing of information is necessary, for example for the interpretation of discourse. It would therefore be interesting to discover whether these later processing difficulties arise purely because of an inability to reorganise information successfully—which allows rapid access for retrieval, or whether they are primarily due to inability to understand the input. Karmiloff-Smith (1985) notes that during the reorganisation process in typically developing children, the load on the child's internal processing may be too great, making it necessary for them to mark externally the new links to which they have become sensitive. This may also be linked to Johnson and Newport's (1989) claim that successful grammatical development in second language learners may be beyond reach due to the overwhelming number of computations expected of adults learning language— since Newport argues that adults sample more of the linguistic input than they are successfully able to process. Children, on the other hand, sample only the amount of linguistic information that they are able to process. Perhaps the knowledge that processing constraints can hinder language understanding and use emphasises the importance of the need from an early age to represent and reorganise information systematically.

4.1.6 Representing Narrative by Children with Down's Syndrome

An investigation into the referential strategies used by children with Down's syndrome may therefore provide some insight into the methods of representation and organisation of information, since it has been recognised that a task such as the successful use of referential devices depends on the integration of otherwise independent sources of information. Information must therefore be represented in a systematically organised way to allow the rapid processing which is necessary in discourse—for example, in story-telling. A number of studies have used story-telling tasks in order to investigate referential devices used by typically developing children, (e.g. Karmiloff-Smith, 1985; Bamberg, 1986; Clibbens, 1992), as well as for those with learning disabilities (e.g. Hemphill et al, 1991; Loveland et al, 1990).

Problems have occurred in interpreting the results of previous research which has investigated the use and development of anaphoric referential devices. For example it has been suggested that since each study uses a different task, comparisons of findings are made difficult (Stevenson, 1988). Stevenson (1988) has also suggested that the tasks which have been used to elicit the speech which is subsequently investigated to assess the child's use of referential devices are too complex for the children in each study to undertake. However, it must be possible to devise and use tasks which are age-appropriate. Story telling is a skill which is acquired and practised by mother and young child making this type of methodology appropriate since even young children will be familiar with it. Bamberg (1986) argues that the activity of picture-book narration is one which is relatively stable so that it presents a discourse domain that can be compared developmentally over large stretches of time more effectively than other discourse activities. It offers a clear referential and communicative context for the child. The medium by which the information is presented has also been a cause for concern. It has been suggested that static story-book presentation may impose greater cognitive demands than a story presented using a video. In a story book the child must maintain an overall representation of the story and relate events in each picture to events in each subsequent one. In a video, events unfold for the child, there is less demand placed on the child to form an independent explanation of events (Clibbens, 1992). Indeed, when investigating children's narrative competence, it has been suggested that the method by which information is presented is highly influential on the way upon which it will be reported by children. For example, Spinillo and Pinto, (1994) asked children to create a story from one single picture, from a series of three pictures, and from their own imagination. The resulting narrative structures varied for the three tasks. When a non-linguistic cue is not available, children pay more attention to linguistic structure with specific conventions of narrative structure. Narratives produced in the presence of a pictorial stimulus resulted in a less advanced narrative structure, which was more related to spoken language than written language. Criticism has also been made of the fact that experimenters have, in some previous studies, been able to see the pictures while the child has been telling the story (Stevenson, 1988). One would assume that the position of the listener is of great significance when using referential devices, since the way in which a speaker refers to people and objects depends critically upon what the listener knows, and more accurately what the speaker assumes the listener knows. (See chapter 1 for a relevance theoretic explanation of this phenomenon). The design of the present experiment was devised in the light of these criticisms., by combining methodologies from two previous studies of typically developing children (those of Karmiloff-Smith, 1985; and Clibbens, 1992).

Among the tasks which Karmiloff-Smith used was a series of stories which were presented in the form of six, individually seen, lined drawings, which she asked the child to narrate. The stories included a main character who was present in all six of the drawings, and a peripheral character who was present in only one of the pictures. It was possible for the child to narrate the story accurately without reference to the peripheral character in these stories. The experimenter turned the pages of the book—and was thus able to see the pictures as the child narrated. Karmiloff-Smith was able to identify a developmental sequence of three levels, corresponding to the narrative abilities of four-, seven- and nine-year-olds. At the first level children used pronouns, often even as the initial introduction of a character. Second-level narratives were characterised by the use of full referring expressions for the initial introduction of characters, pronouns were used anaphorically, and the initial slot for each sentence was rigidly restricted for reference to the main character only. This internal control process is termed the Thematic Subject Constraint. At level three the Thematic Subject Constraint still applies though not as rigidly because the child is using separate referential forms to distinguish between the discourse roles of the characters. For example, once the main character has been introduced with an indefinite article the main character is consistently referred to with a pronoun, with a definite article being used to refer to peripheral characters—thus signifying the different discourse roles assigned to the characters.

In the study by Clibbens (1992), each child was asked to narrate two stories, both of which were presented on video. Each story featured one main character and two peripheral characters, and it was impossible to narrate the story fully while omitting any reference to the peripheral characters. Clibbens (1992) found no evidence for the specific Thematic Subject Constraint which Karmiloff-Smith had found to occur in children functioning in her second level ability group, since all children referred to both the main and peripheral characters in the initial slot of the sentence. However, a thematic subject strategy of a different nature was identified, where the children did distinguish between the main and peripheral characters. After an intervening reference to another character, five-year-olds referred to peripheral characters using a definite noun phrase, while reference to the main character was performed by use of a pronoun rather than a definite noun phrase. By the age of seven, children used a definite noun phrase for the introduction of any character.

Assessment of the use of referential devices in typically developing children has largely been in order to ascertain the developmental pathway of children's mastery of such devices. More recently they have been used as a useful indication of the child's increasingly efficient organisation and manipulation of (linguistic) information. The current debate which is of interest here is one which assesses the pragmatic factors involved with the organisation and use of referential information. Some of these issues are addressed in this study and further investigated in the following one (chapter 5) with regard to children with Down's syndrome and typically developing children.

In the present experiment, in order to elicit examples of referential strategies used by children with Down's syndrome and typically developing children at various developmental stages, children were asked to narrate stories which were presented on a video monitor. The claim that information which is shared between speaker and listener usually affects the manner in which the speaker relates events to the listener (Stevenson, 1988; Sperber and Wilson, 1986) was investigated. The ability to alter the referential strategy used, based on such shared information, was assessed by altering the position of the listener (who was the experimenter): for some stories the listener was able to see the video screen, while in others they could not see the video screen. Such contextual information will affect the clarity with which the child will describe events. For example, the child must consider whether or not the listener shares the same information about the story before continuing the narration.

Another condition assessed claims that the method by which a story is presented affects the type of referential strategy used by children. The amount of cognitive processing needed, first to understand a story, and then to narrate it, is thought to be increased in stories which are presented in a story book. This is because each picture must first be assessed to determine what event is being represented. The child must internally represent such information in order to assess how this is related to preceding events in the story. The child is then able to narrate these events to the listener. Therefore, stories which are presented on video attempt to remove the initial processing required to interpret events within pictures and their relationship with preceding ones. This enables cognitive processing resources to be made available for other processes necessary for narration—such as the successful use of referential strategies. In the following experiment all stories were presented on a video monitor. Some used still pictures while others used moving pictures. The narrations produced for both presentation types were compared.

Attention was therefore given to the use of referential strategies in the narration produced by each child. An example of a thematic subject strategy is one in which one character may be identified as the most prominent by using a pronoun to refer to them, while others can be marked as peripheral by using full noun phrases. The referential strategies used by the children can most clearly be identified when the child has to re-establish reference to one character after having referred to another one. The speaker must clearly mark which character is being referred to and indicate that the focus of attention has changed to enable the listener to interpret the utterance correctly.

4.2 Predictions

The hypotheses focus primarily on the use of a thematic subject referential strategies used by each of the subject groups when referring to characters after an intervening reference to another character.

1. (a) Given the results of previous research, it is expected that typically developing children will not be constrained by the thematic subject precisely as defined by Karmiloff-Smith, but will nevertheless use certain referential discourse markers to maintain a cohesive discourse, similar to those found by Clibbens. The initial slot of an utterance will not be restricted for the main character, but will be used for both the main and the peripheral characters.

   (b) References used to re-establish reference to the main character will be reduced referential forms: pronouns, nominal substitutes, or zero anaphora. References used to re-establish reference to the peripheral characters will be full referential forms: proper names, indefinite NP, definite NP, or a noun phrase without a determiner.

   (c) The success with which this is carried out will increase with age.

2. Findings from experiment 1 indicate that individuals with Down's syndrome experience difficulty in using pronouns. Previous research (outlined in chapter 2) has also indicated both cognitive processing and auditory memory deficits. Therefore, it is expected that there will be differences between the referential strategies used by typically developing children compared with those of children with Down's syndrome. Typically developing children will use the referential strategy outlines in Hypothesis one, with varying degrees of success—dependent on

age. Children with Down's syndrome will not consistently use different referential forms to mark the status of each character.

3. For the conditions where the mode of presentation is varied between still pictures and moving ones it is predicted that there will be more use of a referential strategy (as specified in 1b) in the moving condition than in the still condition, because the moving condition allows the narrator to concentrate on their linguistic performance, rather than needing to concentrate on the interpretation of pictures and the relationship between them.

4. The position of a listener while listening to the narrative is likely to affect the type of referential strategies used: it is likely that more full references, to both characters, will occur when the listener (experimenter) cannot see the screen.

4.3 Method

4.3.1 Design

A repeated measures design was used, with two independent variables each having two levels. The first independent variable was the type of video shown, the two levels were moving or still characters. The second independent variable was the position of the listener, the two levels were watching or not watching the story presentation with the child.

Typically developing children and children with Down's syndrome were asked to narrate a story which they were watching on a video monitor. The sequence of events presented on each video was either moving or still. All subjects performed under each condition, seeing four videos in total. Two "moving" and two "still" videos were seen, one in which the listener watched the story with the child, for the other the listener was unable to see the screen. Each videoed story was of very similar theme and construction, differing only in the characters and the objects (see appendix F for an exact description of each video, or see the brief description in the Materials section). For each age group of typically developing children, as for children with Down's syndrome, the conditions were counter-balanced, so that each video was seen in each listener-position an equal number of times. The order of the conditions and videos was counter-balanced for each subject.

4.3.2 Participants

Two subject groups participated in this study. The first was a group of 40 children with Down's syndrome whose ages ranged between 5;1 and 17;2 with a mean age of 9;9. Approximately half of the subjects fell within the age range of 7;0 to 9;6 years old. The sample was taken from children attending special schools in Devon. The second group consisted of 45 typically developing children. Three age groups were represented with 15 children in each: a group of five-year-old children, whose ages ranged from 5;0 to 5;11 (mean age 5;5); a group of seven-year-old children, whose ages ranged from 7;2 to 7;8 (mean age 7;4); and a group of ten-year-old children, age range 10;0–10;9 (mean of 10;5). The 15 children in each of these groups were pupils attending a mainstream primary school in South Devon. The age groups corresponded to age groups used in previous research with which this study will be compared. Each of the groups contained approximately equal numbers of boys and girls.

4.3.3 Materials

Standardised Tests

To assess the language ability of each subject two standardised language measures were used. First, the British Picture Vocabulary Scale (BPVS) (Dunn and Dunn, 1982), which assesses a large range of words. The child must point to the correct object or action being depicted in one of four possible pictures which corresponds to the word being read to them by the experimenter. The words get progressively more difficult. The second language measure was the Test for the Reception Of Grammar (TROG) (Bishop, 1973), which assesses the comprehension of a wide range of grammatical devices. The procedure is very similar to that of the BPVS, while the sentences or phrases being read to the child increase in length. Receptive language tasks were used in order to obtain a measure of language ability without it being dependent on the child's ability to produce language. It was seen as particularly important in the case of children with Down's syndrome to use a language measure which did not exclude children whose language ability may be below that assessed by tests standardised on a typically developing population. The cognitive ability of the subjects was tested using Raven's Progressive Matrices. The child is requested to point to the correct square which would complete the pattern being shown. The task is devised so that various pattern types are tested, giving the opportunity for the children to display certain biases in their answers should the correct item not be indicated. This test was taken to be a useful measure of non-verbal ability, following much research which has regarded this test as an accurate measure of cognitive ability. This combination of standardised tests has been used with considerable frequency in research projects. Each of these tests was relatively short and easy to administer, while providing useful information about some of the skills which are necessary to produce a narrative. These tests were chosen with the subject age and level of ability in mind, and special consideration was given to the type of instruction needed to perform the test. However, it must be borne in mind that each test has been standardised on a population of typically developing children, so, while the performance of the typically developing children in this study may be compared with the population upon which the test was standardised, the same cannot be said of the children with Down's syndrome. The results must be seen purely as a measure of the capabilities of the individual children, and age equivalents— where they may be obtained from the raw scores—are not of much direct importance for the purposes of this study.

Narrative Task

Four stories were devised, enacted using glove puppets, and recorded onto video tape. They each had a very similar theme and sequence of events. Each story had two versions; in one the characters were moving—as is generally expected when viewing a video; in the second type the characters in the story were still. It was intended that presentation of still pictures would preserve some features of story-book presentation while enabling comparisons to be made with the moving version.

The story involved a main character, who was a shop keeper (MC), and two peripheral characters, who were customers (PC). The setting for each story was a shop with a shelf displaying the items on sale. Secondary props such as a till, money and shop signs also aided the story line. The main character is seen inspecting and cleaning the shop and preparing for the business of the day by stacking the shelves or constructing new displays with relevant items. Once this is complete each PC enters the shop and is served by the MC. Once the PCs have left all that remains is for the MC to replenish his stock, usually ending in a minor catastrophe. The moving stories lasted for approximately four minutes, the still stories consisted of twelve pictures each displayed for 15 seconds. Neither sound effects nor speech was used in either type of video since these could not have been used in both the moving and still conditions.

A video camera was used to record the narratives produced by each subject. This was recognised as being potentially distracting; however, given the likelihood of the use of signing and/or pointing by younger subjects and subjects with Down's syndrome, an audio tape recorder would have lost useful information.

4.4 Procedure

The tasks were carried out in a small, quiet, familiar room by each of the subjects individually. The tasks were completed in two sessions of approximately 15–20 minutes for typically developing children. Subjects with Down's syndrome needed two longer sessions lasting 30 minutes each to complete all the tasks since they took longer to perform the standardised tests and lost concentration more easily. The three standardised tests were interspersed with the four videos: an order for this was randomly allocated.

For each of the standardised tests the specified instructions were used, these can be found in the manuals provided with the test. For the video task the experimenter explained that each subject was going to watch two different videos which did not have any sound or narration. The type of video—whether moving or still—was introduced each time to avoid confusion to the subject. The positioning of the listener (experimenter)—whether watching or not—was also made clear to the subjects. They were then asked to narrate the story as it was being shown. Prompts were given to children only when they had stopped narrating and seemed to be merely watching the story. The prompts were very general and were designed not to direct attention to one particular character but rather to encourage further description by the child, for example "What is happening now?" or "What happened then?". Attention was not drawn to the video camera unless it was necessary to put the subject at ease with regard to its purpose.

Narrative was obtained in order to assess a sample of discourse which was controlled and which instigated the use of referential forms. The video-recorded narration provided by each participant was transcribed so that the use of the referential forms could be assessed. Each referential form used was coded according to the character being referred to and the point in the narration when the reference occurred. It was possible to code all referential forms produced into one of seven categories for each character, by simultaneous investigation of both the video recording and the transcription produced. These categories are listed below in the Results section.

4.5 Results

The data collected from typically developing children was assessed first, in order to see if the results from this study replicated or contradicted previous findings, thus providing information about the way in which task-specific differences affect performance by typically developing children. Results from typically developing children were also used to establish a model of typical performance with which to compare the performance of children with Down's syndrome.

The types of reference which were used by the children fell into two main categories:

1. full references—which included:

   (a) proper names, any phrase or word used as a label to distinguish one character or object from others. For example, "Mr Frog".

   (b) indefinite noun phrases (NPs), a noun phrase which is prefixed by the indefinite article 'a'. For example, "A Frog".

   (c) definite NPs, a noun phrase which is prefixed by the definite article 'the'. For example, "The Frog".

   (d) a noun phrase without a determiner, a noun phrase which is not prefixed by a determiner. For example, "Frog".

2. reduced references—including:

   (a) pronouns, a word (third person pronoun) used instead of a noun to refer to a character or object. Pronouns can be used anaphorically to indicate that the character has previously been mentioned in the discourse. For example, "The frog is in the shop. He is dusting."

(b) nominal substitutes, 'One' is substituted for the head of the noun phrase previously used to refer to a different character or object in the same class of objects or characters. For example, "The frog put down an orange tin, but the rabbit wanted a blue one".

(c) zero anaphora, although implied, explicit reference to the character or object is absent from the utterance. For example, "The frog knocked over the tins and then ____ left the shop".

By examining the way in which individual reference types were used, useful information is provided about the ability to use them by each subject group. However, referential strategies used by each subject group can be investigated by assessing the use of either a full reference or a reduced reference for each character: which specific reference type has been used within these summary categories is not necessary.

There are several ways in which these forms of reference could be used, these have been divided into three categories:

1. as an initial reference to a character,

2. as a further reference to a character in the absence of an intervening reference to another character,

3. as a further reference to a character after an intervening reference to another character.

It was the third group which was considered of greatest importance in this study since these references provided more information about:

1. the way in which the child refers to characters of different thematic status in the story

2. whether different strategies are employed for each character regardless of their current importance in the story

3. how the child chooses to re-establish reference to each character once another character has been referred to

However, the other forms of reference listed above have also been measured in order to examine whether or not the full range of linguistic forms has been used by the children being tested. Initial analysis examines the references used by children to refer initially to a character in a story. Further references to characters will then be examined. First, those which occur as a further reference to a character in the absence of an intervening reference to another character. Finally, those references which are used to re-establish reference to a character will be assessed. Each analysis first describes the individual referential forms used for each character. Further analysis uses the summary reference groups for clarity. A sample of transcriptions of the narratives constructed by each subject group can be found in appendix G. As can be seen from the sample transcriptions shown in appendix G the narratives produced by each subject group differ in volume and complexity. It can also be seen that the children with Down's syndrome and five-year-olds needed continuous prompting to provide a full account of the story, which was also shorter than that provided by seven- and ten-year-olds.

4.5.1 Performance on Standardised Tests, showing the Range of Ability for Each Subject Group

Before each subject group's performance on the narration task is described, a brief summary of performance on the standardised tasks is given. Narration-task data can then be examined in the light of the findings outlined by the standardised tasks. A summary of the mean score on each task is given for each subject group. This is followed by figures which indicate both the standard deviation from the mean score and the range of scores given by each subject group.

Figure 4.1 clearly shows that, while children with Down's syndrome are functioning at a level slightly below that of the five-year-old group for each of the tests, the other groups are achieving age-equivalent scores of approximately their chronological age. Typically developing children are functioning at the level predicted by each of the tests. Ten-year-olds are seen to be performing at approximately one year above their chronological age for all tests. Five-year-olds are functioning at a level approximately one year above their chronological age for BPVS, while for Ravens and TROG they are functioning at a level consistent with their chronological age. Seven-year-olds achieved an age-equivalent score approximately one year above their chronological age for BPVS, while performance on Ravens indicates that they are functioning at a level consistent with their chronological age, but for TROG the scores indicate that there may be a delay in ability for this skill, since their age-equivalent score is below their chronological age. Children with Down's syndrome achieved greatest success on the non-verbal task, performing at a similar level to that achieved by the five-year-olds. Vocabulary proved the easier of the two verbal tests, but on both language tests performance was considerably below that of five-year-olds.

The following four figures (figures 4.2–4.5) indicate the mean age equivalent scores, together with standard deviations, achieved on each of the tests and the mean chronological age for both the typically developing children and children with Down's syndrome. These figures clearly show the variability of scores in each of the subject groups.

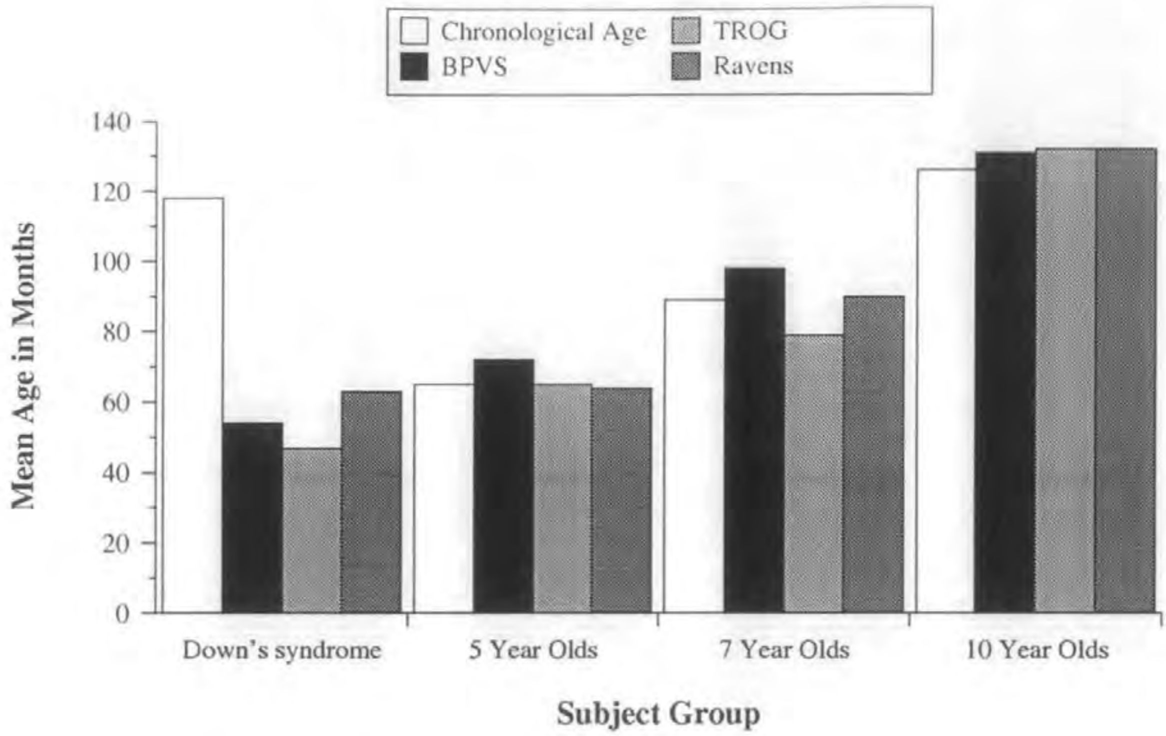


Figure 4.1: *Mean language and cognitive age for each subject group*

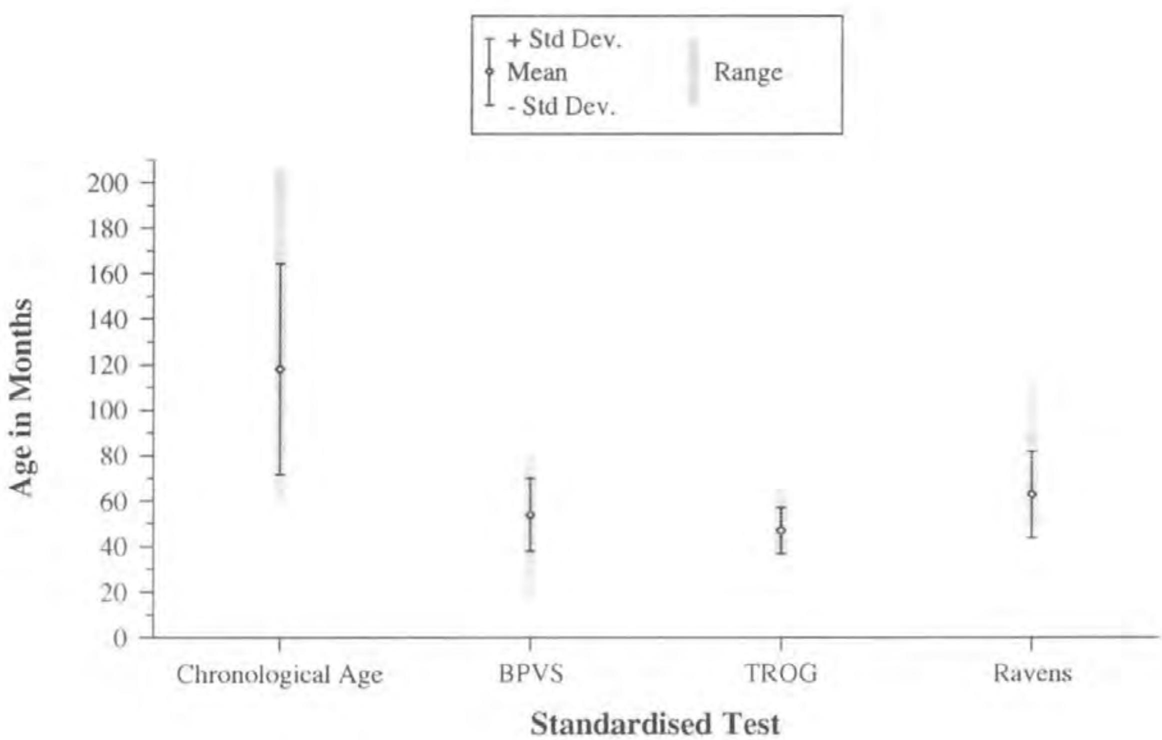


Figure 4.2: *Distribution of chronological, language and cognitive age for children with Down's syndrome*

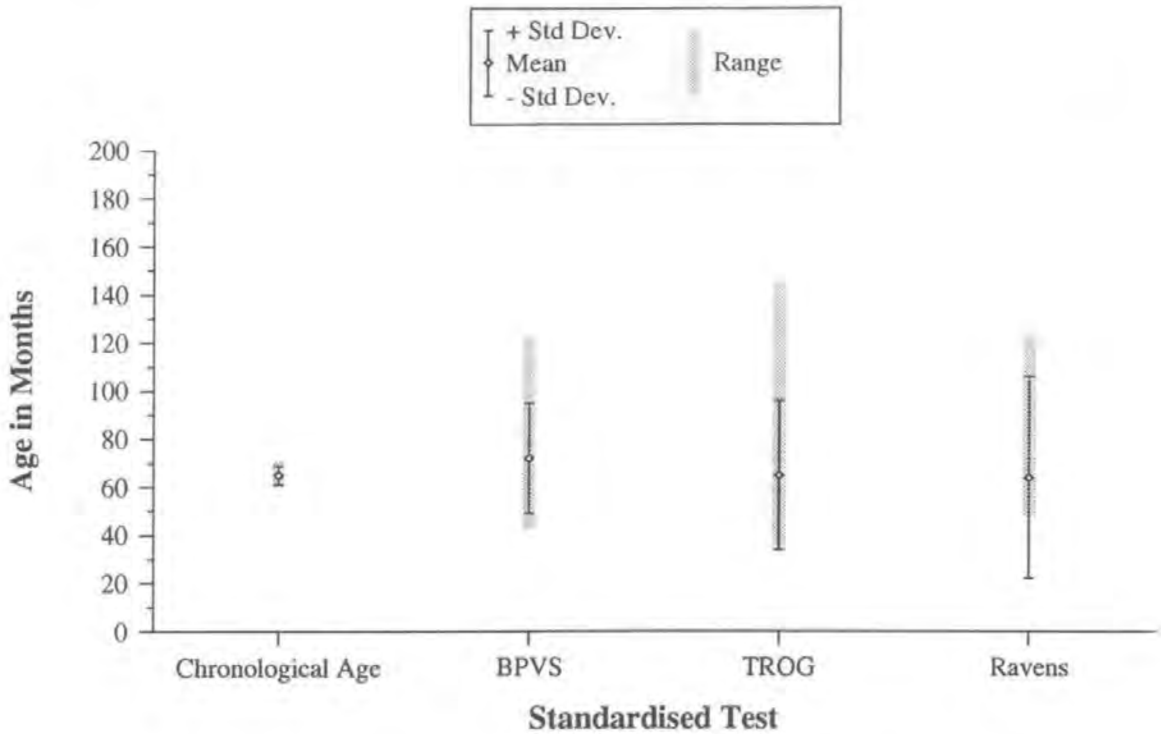


Figure 4.3: *Distribution of chronological, language and cognitive age for typically developing 5 year olds*

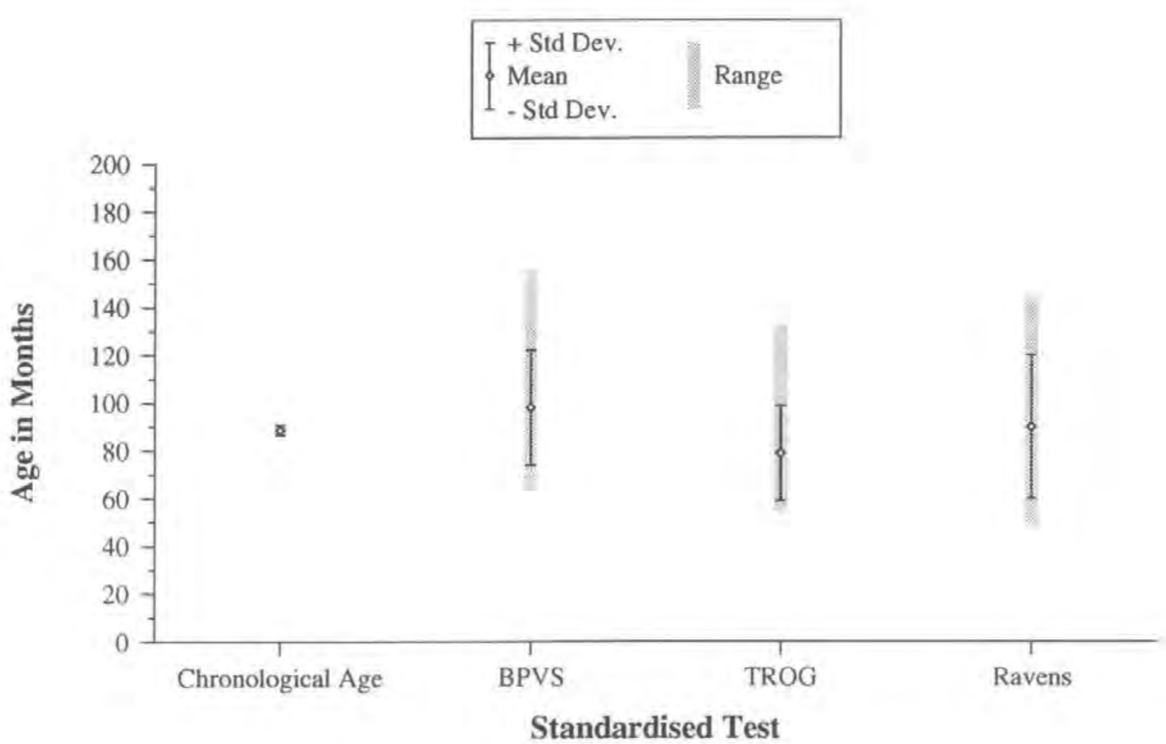


Figure 4.4: *Distribution of chronological, language and cognitive age for typically developing 7 year olds*

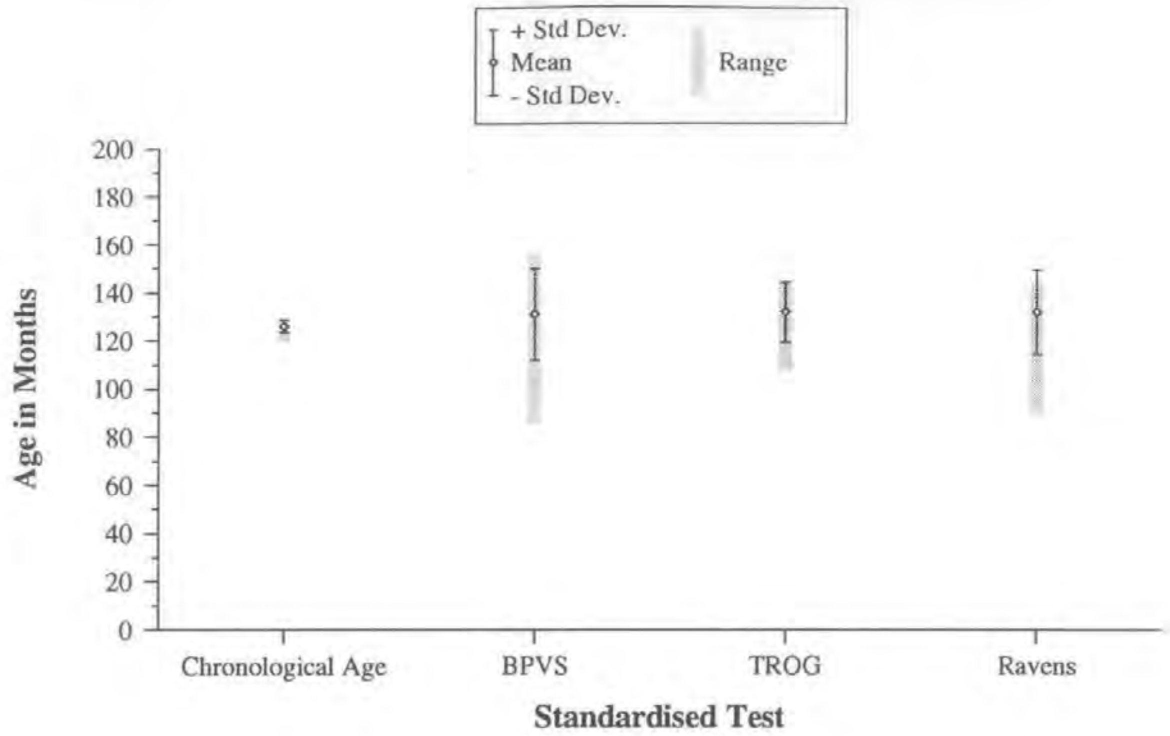


Figure 4.5: *Distribution of chronological, language and cognitive age for typically developing 10 year olds*

Summary Of Findings

Performance on Standardised Tests

- Typically developing children performed at or above the expected level for all tests, except seven-year-olds on TROG.
- For children with Down's syndrome, mean chronological age is almost equivalent to that of ten-year-olds, performance on BPVS and TROG is below that of five-year-olds. For Ravens mean performance is identical to that of five-year-olds.

4.5.2 Overall Reference Types used by Each Subject Group

As an introduction to the types of references used and the frequency with which they were used, figures 4.6–4.7 show each reference type as a percentage of the total references used overall in the narratives by each age group. Tables in appendix H show the total number of references used for each referential form for each character in each condition. It is immediately clear to see, both here and in subsequent figures throughout the chapter, that children with Down's syndrome are capable of using all of the reference types used by typically developing children, while it is equally apparent that the frequency of usage is much different from that of the typically developing children. That there is a difference in the pattern of usage of referential forms suggests that referential strategies used by typically developing children may not be being used by children with Down's syndrome. Moreover the subtleties of correct usage given the context of the utterance may not be understood by this group.

The pattern of use of each referential form by typically developing children can also be seen in Figures 4.6–4.7. Initially, at five years old, the dominant reference type is that of pronouns (c.f. Karmiloff-Smith). In subsequent years there is an increased usage of fuller referential types which replace the use of the pronoun. Two possible reasons why fuller references may be used are: first, in order to avoid ambiguity, and second as a result of the child's increased awareness of certain referential strategies which can be employed to refer to each character.

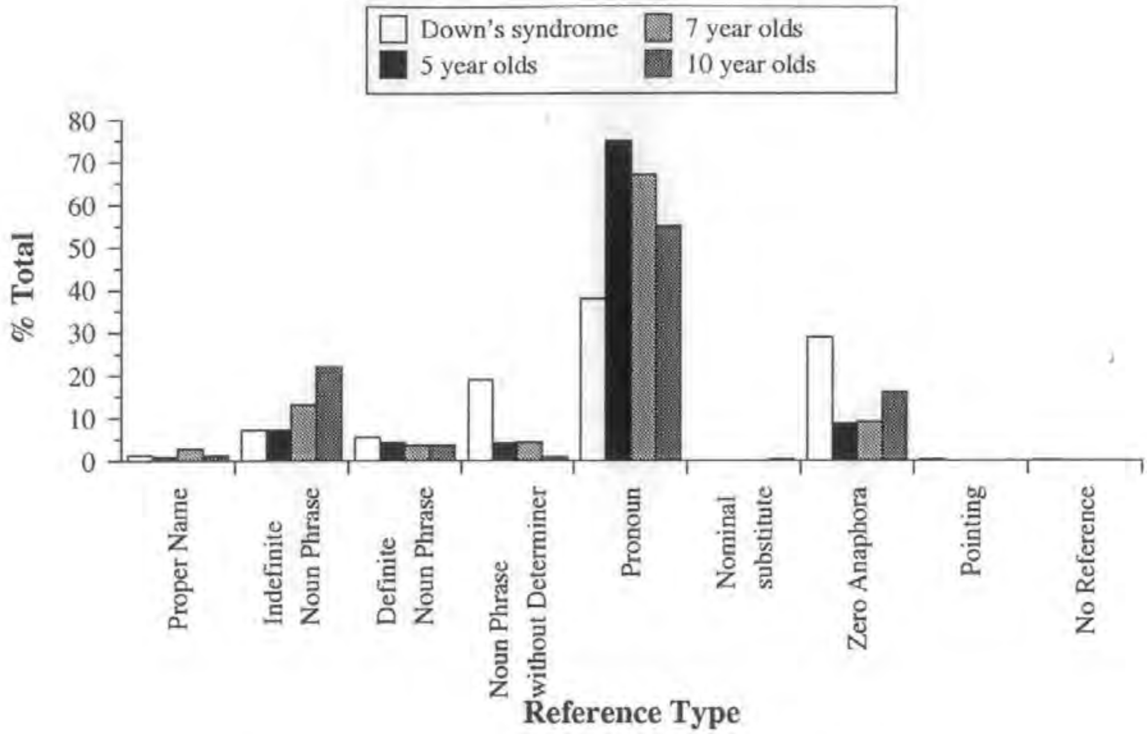


Figure 4.6: *Percentage of each reference type used for the main character by each subject group*

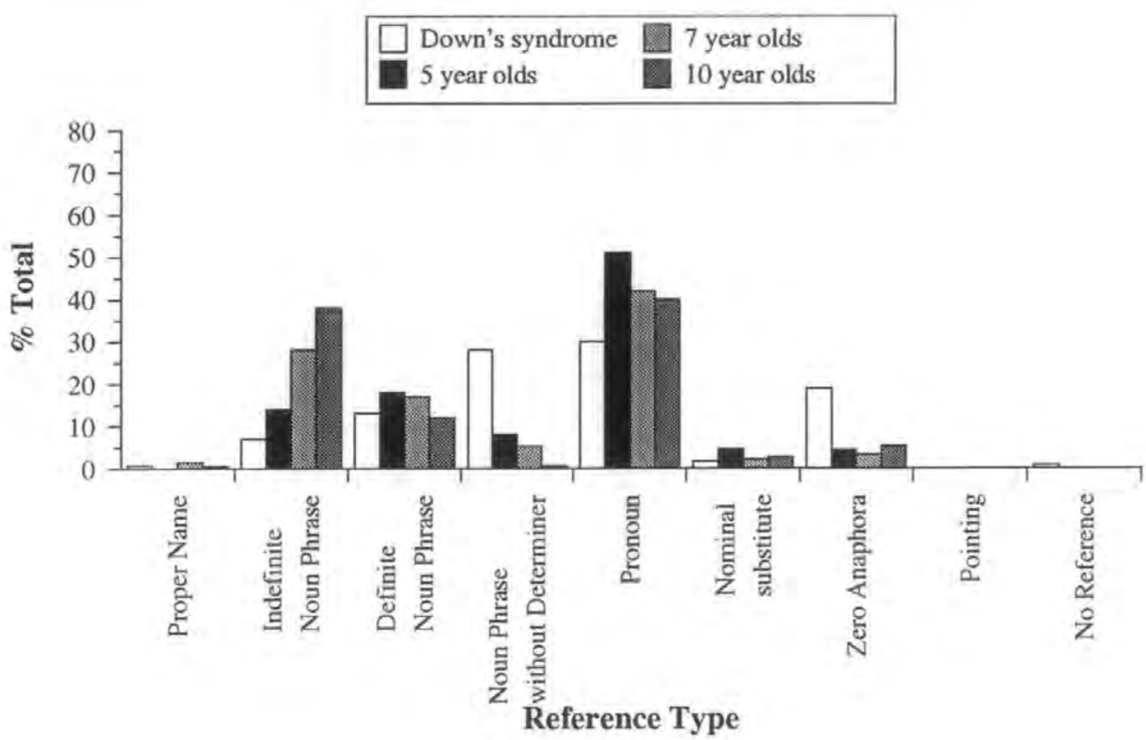


Figure 4.7: *Percentage of each reference type used for the peripheral characters by each subject group*

Summary Of Findings

Overall Use of Referential Forms

- Children with Down's syndrome prefer the use of noun phrases without a determiner, pronouns and zero anaphora.
- Typically developing children prefer pronouns, with increasing age there is more use of full referential forms.
- More full forms were used for the peripheral character than for the main character by typically developing children, this distinction is not clearly seen for children with Down's syndrome.

In the following sections focus is given to the referential strategies used for reference to the characters in the story in order to examine the typical developmental progression and to investigate the ability of children with Down's syndrome to distinguish between characters using referential forms. By assessing the way in which children use referential forms, insight can be gained into the ability of each subject group to represent the content of the story, including the status of each character. By using a full range of referential forms children demonstrate that it is not a limitation imposed by language which hinders them from using linguistic strategies to distinguish between the characters, but that it is more likely to be a difficulty in the ability to successfully integrate numerous sources of information. For example, Karmiloff-Smith (1985) noted that not only the choice of specific linguistic form is important for the use of a referential strategy, but also the way in which it is used in the utterance. Part of the linguistic strategy which Karmiloff-Smith described involved the use of the initial slot of an utterance. This aspect of the referential strategy can also be seen as dependent upon the ability to internally represent the discourse. Reserving a particular structural location for reference to a particular character was therefore shown to be an important way to mark the status of the character for some age-groups—this is examined below.

4.5.3 Use of the Initial Slot of a Sentence for each Character

One of the differences between the observations made by Karmiloff-Smith (1985) and those of Clibbens (1992) concerned the use of the initial slot of a sentence. Karmiloff-Smith noted that children of approximately seven years old rigidly reserved the initial slot of a sentence for the main character in the story, while for Clibbens, using a task very similar to the present one, the initial slot was used by all age groups for both characters. Figure 4.8 shows that the findings of Clibbens have been replicated in this study, since it can clearly be seen that the initial slot was used by all age groups for both characters. Figure 4.8 shows the references used for each character in both initial and non-initial positions in sentences used by the children in their narratives as a percentage of the total references used by each age group. The main character was more often the occupant of the initial slot than the peripheral character, for all subject groups. In addition, the use of the non-initial slot for reference to either character can be seen to increase with an increase in age. Children with Down's syndrome rarely used a non-initial slot for reference to a character whether main or peripheral. This use of the initial slot reflects the shorter sentences which children with Down's syndrome use which generally report a single action, and usually a single character.

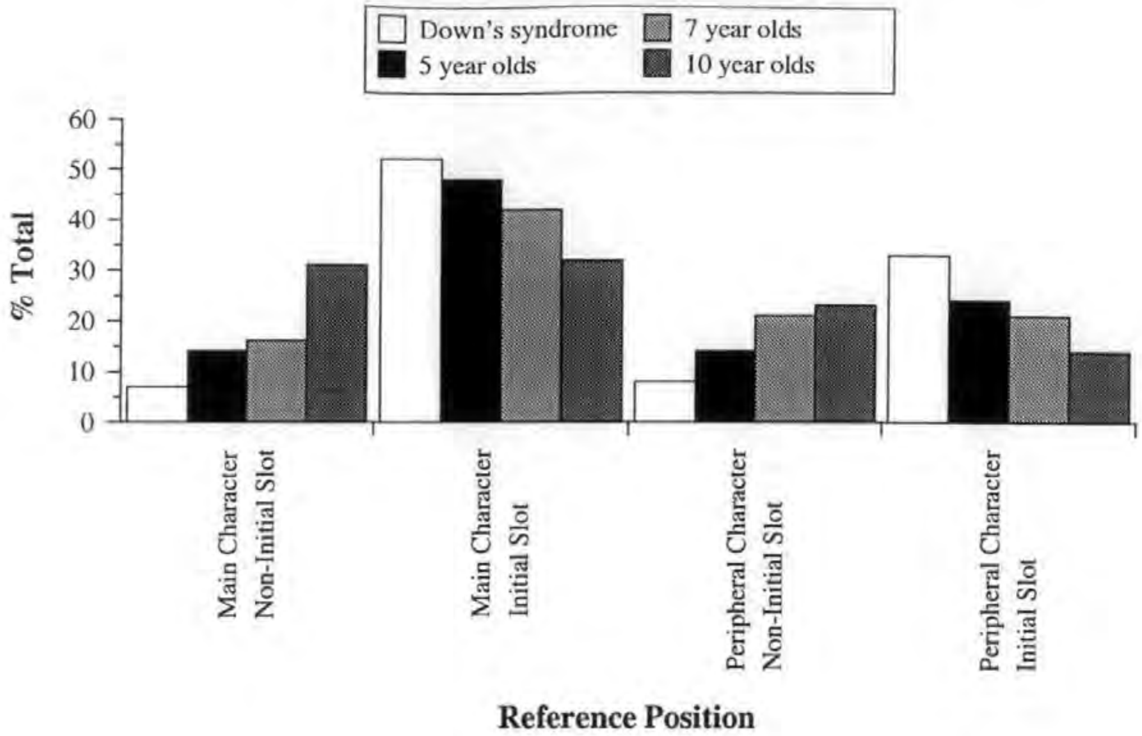


Figure 4.8: *Percentage of full references used by each subject group for each character, according to the positioning of the reference within the sentence*

Summary Of Findings

Use of Initial Slot

- The initial slot was not exclusively reserved for the main character, since all characters were referred to in the initial slot by all groups.
- A greater proportion of references to the main character was made in the initial slot than for the peripheral characters by all groups.

4.5.4 Initial References to the Main and Peripheral Characters

The form of reference used to introduce each of the characters gives some indication of the subject's understanding of the story. Moreover it also allows assessment of one aspect of the referential strategy which the child may use. The individual referential forms which were used by each subject group can be seen in figures 4.9–4.10 which show each referential form as a percentage of the total initial references made by each group. The overall strategy which can be seen from these figures for children of all age groups and children with Down's syndrome is one in which the characters in a story will be introduced using a full reference type. Interestingly this is more closely adhered to for the peripheral character, probably because the child recognises the greater necessity to mark more clearly the introduction of a second character, while another is still present, in order to avoid ambiguity. From Figures 4.9–4.10 it can also be seen that children with Down's syndrome use more noun phrases which do not contain a determiner than the typically developing children. Typically developing children preferred the use of definite noun phrases to introduce a character. Tables in appendix H show the total number of initial references used for each referential form for each character in each condition.

Analysis of Variance was performed on the data concerning initial references to the characters, full analysis of variance summary tables and tables of means are given in appendix I. For this analysis the reference types used were amalgamated into the two summary categories: full and reduced. For this analysis only the proportion of full references which were used by each child in each condition was assessed. The use of a high proportion of full references indicates that the child considers it necessary to use an unambiguous reference for the character to which they are referring.

In order to compare the proportion of full references used for the main and pe-

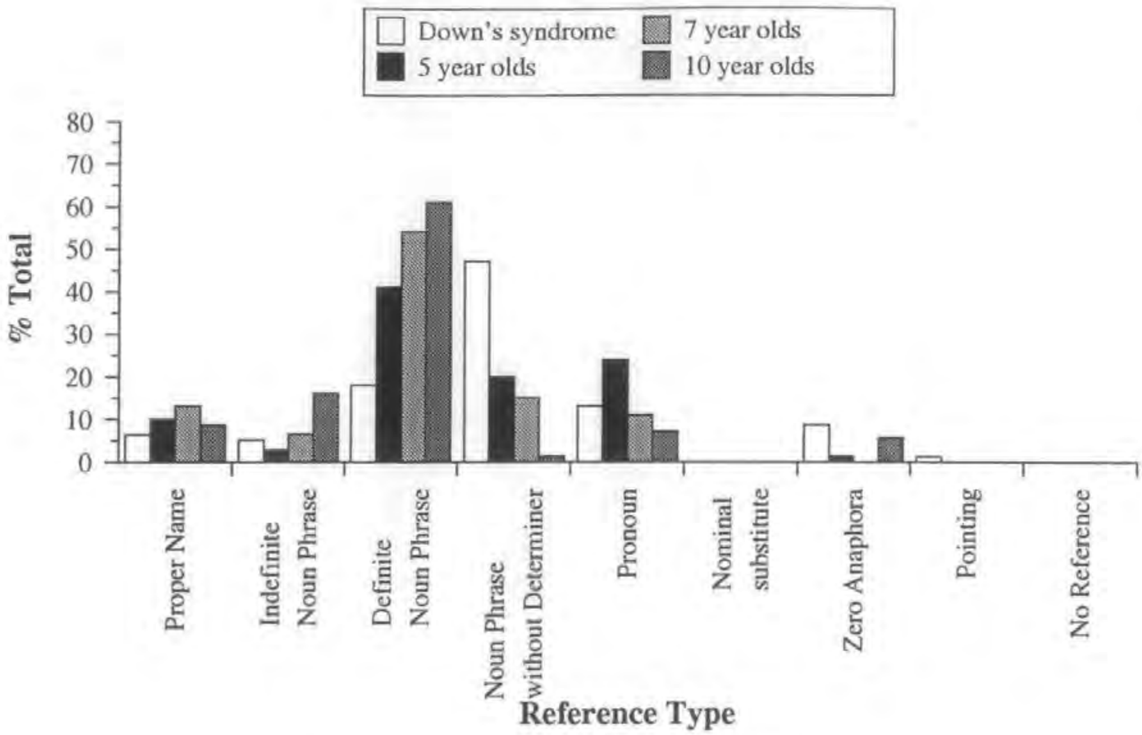


Figure 4.9: *Percentage of reference types used for the initial reference to the main character by each subject group*

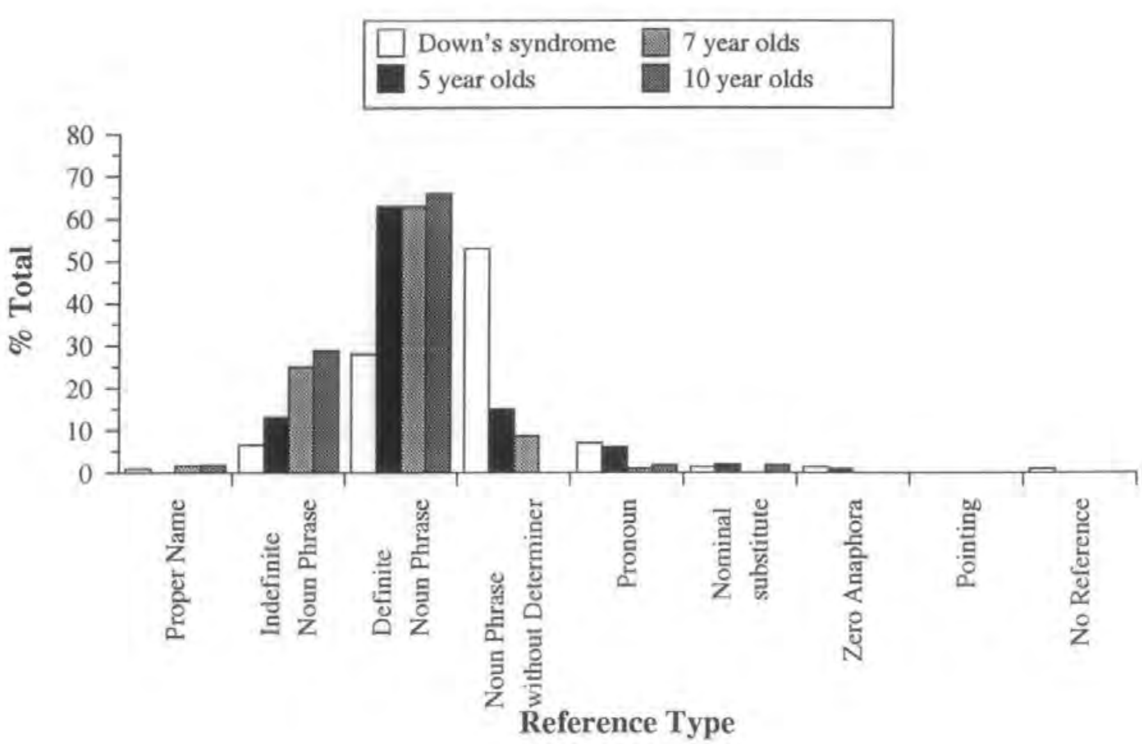


Figure 4.10: *Percentage of reference types used for the initial reference to the peripheral character by each subject group*

Effect	df effect	df error	F	p
1. Subject Group	3	81	4.3	0.007
2. Character	1	81	15.6	0.0001
3. Position of Listener	1	81	4.6	0.03
4. Video Type	1	81	6.8	0.01
1*4	3	81	3.1	0.03

Table 4.1: *ANOVA findings for Initial References used by All Subject Groups*

ripheral characters in each condition, a 4 (subject group) x 2 (character type) x 2 (position of listener) x 2 (video type) analysis of variance was performed on the percentage of full references used by each child as an initial reference (dependent variable) in each condition. Children with Down's syndrome and the age groups of typically developing children formed one independent variable (called "subject group"). The performance by children with Down's syndrome was directly compared with that of typically developing children. Table 4.1 indicates the results for the main effects and any significant interactions resulting from this analysis. Significant results were found for each main effect. There was one significant interaction between subject group and video type. Figures 4.11–4.12 indicate the way in which full references were used by typically developing children and children with Down's syndrome in each condition.

Each of the main effects was further assessed using post hoc tests in order to establish more precisely the reason for the significant effects. First, the significant main effect of character type was investigated. Post hoc Newman-Keuls tests indicated that the character to whom five-year-olds were referring significantly affected the proportion of full references used, where more full references were used for the peripheral characters than for the main character ($p = 0.04$). However, further analysis revealed that this distinction was significant only in still videos when the listener was watching

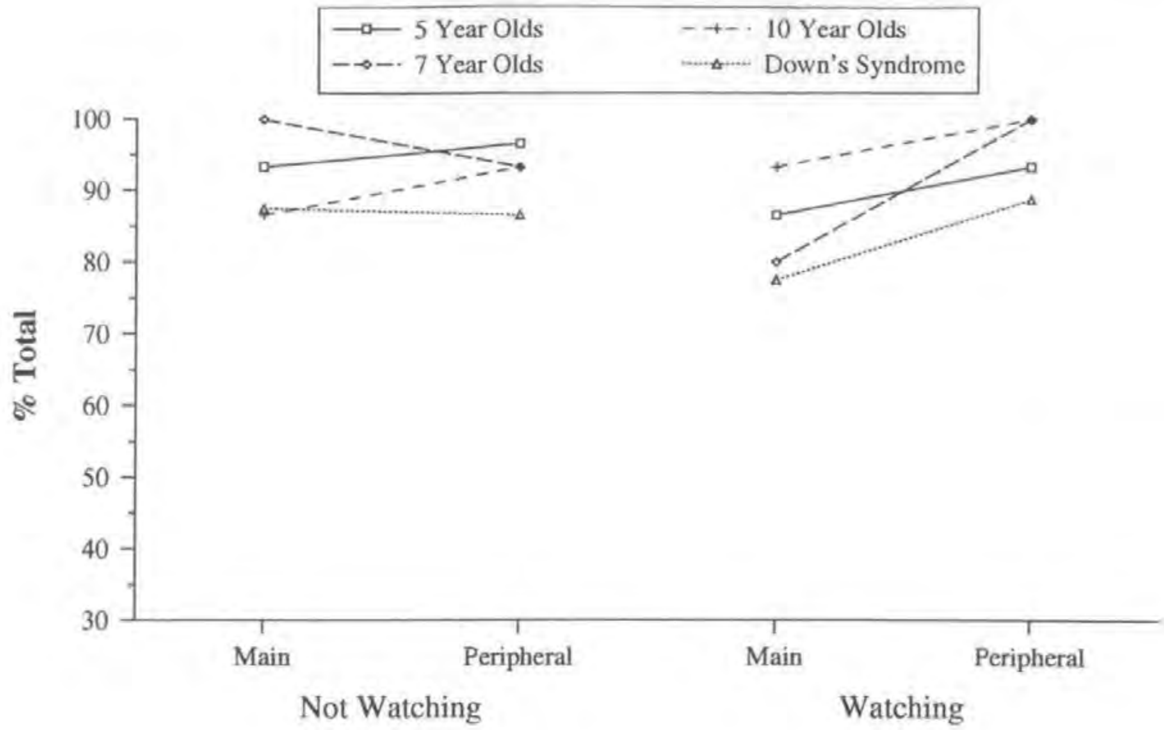


Figure 4.11: *The effects of character type and position of listener on the percentage of full references used in initial references to characters, when watching moving videos*

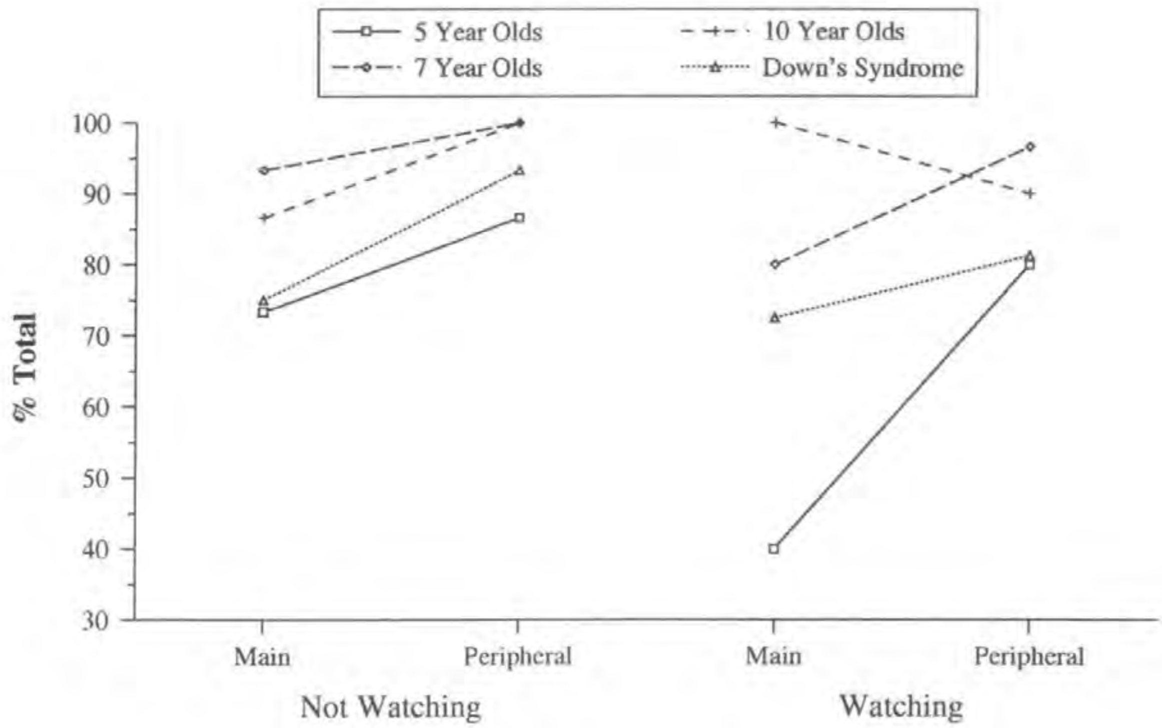


Figure 4.12: *The effects of character type and position of listener on the percentage of full references used in initial references to characters, when watching still videos*

(p = 0.001) where significantly fewer references were used for the main character than for the peripheral character. No other group used significantly different proportions of full references for the main and peripheral characters, although this result approached significance for children with Down's syndrome (p = 0.07). Further follow-up tests, which compared the proportion of full references used for each character by each subject group, revealed that when referring to the main character children with Down's syndrome used significantly fewer full references than ten-year-olds (p = 0.03) and approaching significance for seven-year-olds (p = 0.07). Five-year-olds also showed that they used fewer full references for the main character than either seven-year-olds (p = 0.04) or ten-year-olds (p = 0.02). Significant differences between groups were not found for references to the peripheral character. It can therefore be seen that the significant main effect of character type was largely the result of the references used for the main character by five-year-olds in still videos when the listener was watching.

Whether or not the listener could see the screen created a significant main effect, indicating that significantly more full references were used if the listener could not see the screen than if they could. This result was also further assessed. The only group found to use significantly different proportions of full references for each listener-position was the five-year-olds (p = 0.03). Again, as can be seen from Figure 4.12, this is mainly due to the references used for the main character in the "watching" condition in still videos. This can also be seen as the greatest contributor to the significant main effect found for listener position. When the effect of the position of the listener was assessed in relation to the proportion of full references used by each subject group, children with Down's syndrome were found to use significantly fewer full references than ten-year-olds (p = 0.01) when the listener could see the screen. Five year-olds also used fewer full references than ten-year-olds when the listener could see the screen (p = 0.01). As has already been noted, five-year-olds were also found to use fewer full references than all other groups when referring to the main character when the video was still and the listener could see the screen (p = 0.001).

The type of video the children were narrating also produced a significant main effect, more full references were used when the video was moving than when it was still, this significant difference was seen to occur only for five-year-olds (p = 0.002). The significant main effect of video type can also be shown to be a consequence of the use of full initial references for the main character in still videos—where significantly fewer references were used than in moving videos.

Subject group also produced a significant main effect. Follow-up analysis using Newman-Keuls tests showed that overall, children with Down's syndrome were performing significantly differently from both seven-year-olds (p = 0.01) and ten-year-olds (p = 0.03). Five-year-olds were also identified as performing significantly differently from seven-year-olds (p = 0.04) and approaching significance when compared with ten-year-olds (p = 0.07), showing a significant effect of age on the proportion of full references used by typically developing children. The significant difference between five-year-olds and the other typically developing children can largely be identified as being a consequence of the proportion of references used for the main character in still videos when the listener was watching. The significant difference shown by children with Down's syndrome, however, is due to the use of fewer full references overall than typically developing seven- and ten-year-olds.

Summary Of Findings

Initial References

- All subject groups used more full references than reduced references.
- Fewer full references were used for the main character than for the peripheral character.
- More full references were used for still videos than moving videos.
- The significant main effects were a largely a consequence of the full references used for the main character by five-year-olds in the still, watching condition.
- Children with Down's syndrome favour the use of noun phrases without a determiner for both the main and peripheral characters.
- Typically developing children used mostly definite noun phrases for both the main and peripheral characters.
- Children with Down's syndrome and five-year-olds used significantly fewer full references than either seven- or ten-year-olds, in particular for reference to the main character.
- Children with Down's syndrome and five-year-olds used significantly fewer full references than ten-year-olds when the listener could see the screen.

4.5.5 Further Reference to the Main and Peripheral Characters in the Absence of an Intervening Reference to Another Character

The references in this category are those which are used when the child has continued to refer to only one character without any mention of any other character. An example of this category may be when only one character is present, or when one character is performing a sequence of uninterrupted actions. Therefore this category, when compared with both initial references to the characters and those in which the character must be re-introduced, gives us insight into the understanding of the referential strategies. For example, whilst retaining the need to avoid ambiguity, one may presume that the listener understands (in accordance with the principle of relevance) that since no other character has been referred to, the current focus of attention—and thus the most relevant interpretation of the reference being used—must be the character which has most recently been referred to. However, a pronoun may not always be taken to refer to the most recent referent—for example when combined with a pointing gesture or with other information by which the intended referent can be inferred.

One would expect that for references to characters which occur in the absence of an intervening reference to another character more reduced than full references would be used, since reference to the character is being maintained. The pattern of usage of the various referential forms for each subject group is shown in Figures 4.13–4.14 as a proportion of the total references used by each group for this referential category. Tables in appendix H show the total number of further references without an intervening reference used for each referential form for each character in each condition. It is clear from figures 4.13–4.14 that children from all subject groups recognised that a reduced form is sufficient for continued reference to a character. This is most clearly seen for the main character. For reference to the peripheral character more reduced than full references were used. The proportion of full references used for the peripheral character is greater than that for the main character. This may be because there are often two or more characters in the story when continued referencing occurs for the peripheral character and the child may assume the need for increased clarity in this case.

Analysis of Variance was performed on the data for further references to a character in the absence of an intervening reference to another character. Full analysis of variance summary tables and tables of means are given in appendix I. Referential forms were again amalgamated into the summary categories of full and reduced references. The use of a high proportion of full references indicates that the child considers it necessary to use an unambiguous reference for the character to which they are referring. As children are continuing reference to the main character who has been previously established, a predominance of reduced references was expected, with full references being used for the peripheral character—in accordance with the thematic subject strategy identified by Clibbens (1992).

In order to compare the proportion of full references used as a continuing reference for the main and peripheral characters in each condition, by each subject group, a 4 (subject group) x 2 (character type) x 2 (position of listener) x 2 (video type) analysis of variance was performed on the percentage of full references used in each condition (dependent variable) by each child as a further reference to a character in the absence of a reference to another character.

This analysis is summarised in Table 4.2, and indicates that there were significant main effects for the subject group, the character type and the video type. There is also a significant interaction between the subject group and the character type. Figure 4.15 clearly displays the nature of the effects identified in the ANOVA both for

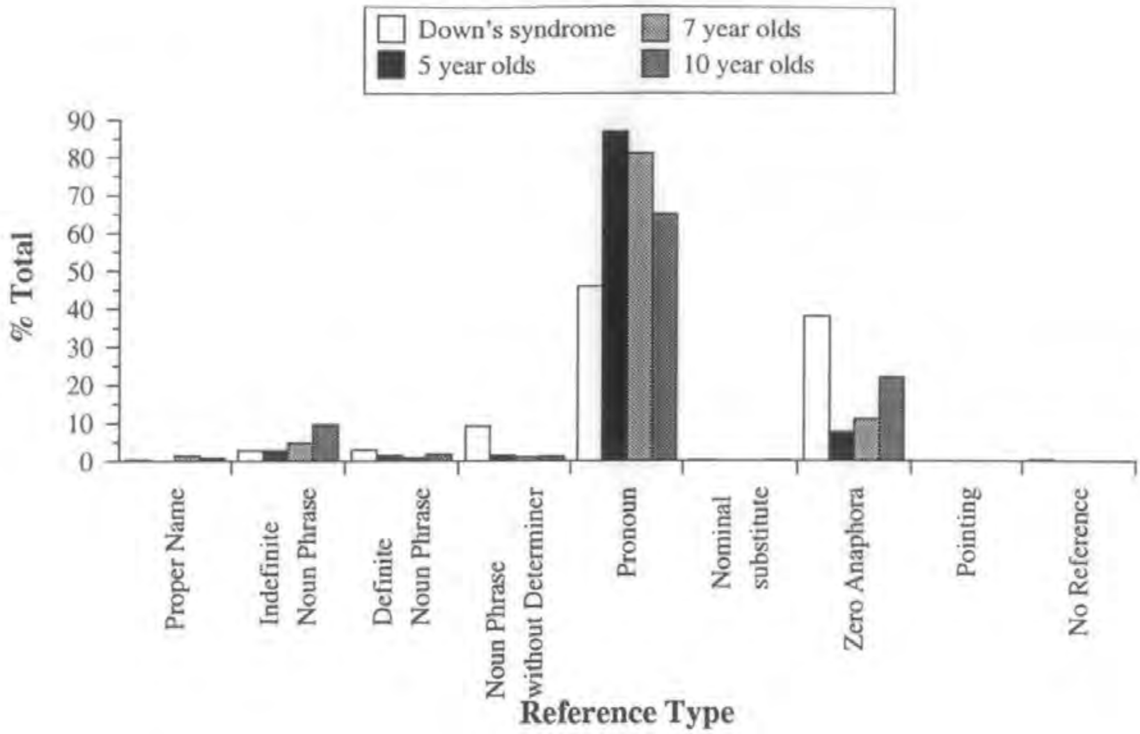


Figure 4.13: *Percentage of reference types used for the main character by each subject group, when making a further reference without an intervening reference to another character*

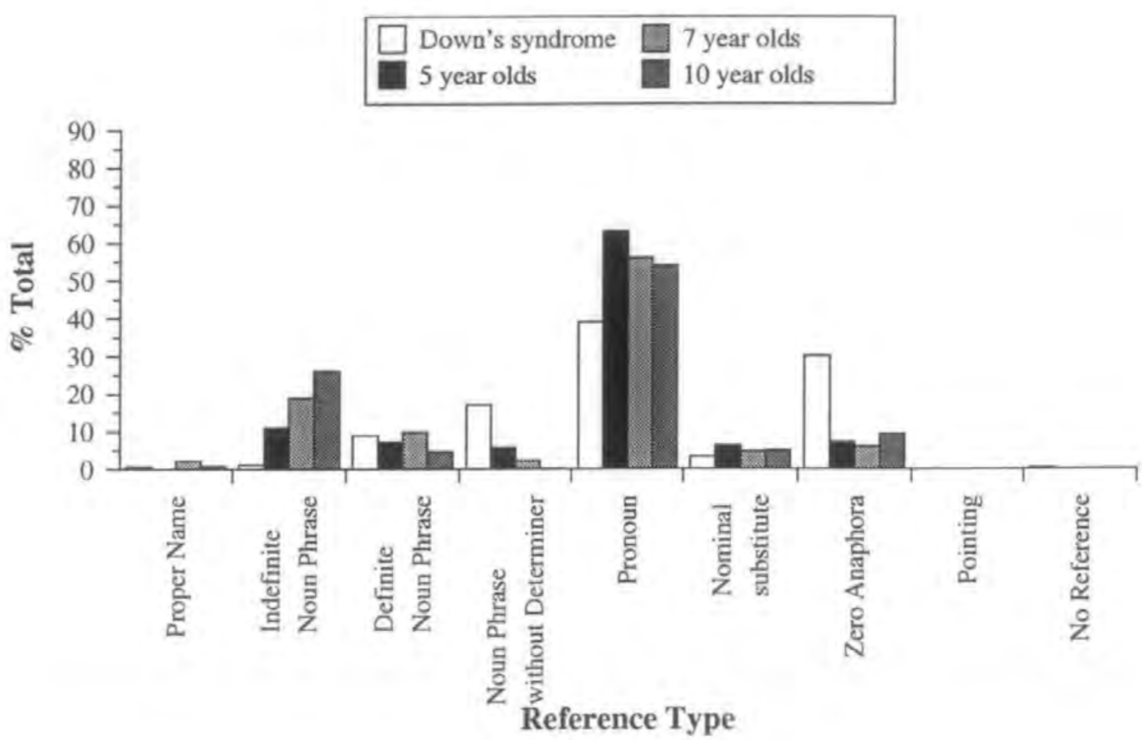


Figure 4.14: *Percentage of reference types used for the peripheral character by each subject group, when making a further reference without an intervening reference to another character*

Effect	df effect	df error	F	p
1. Subject Group	3	81	4.9	0.003
2. Character	1	81	71.1	0.00001
3. Position of Listener	1	81	1.2	0.2
4. Video Type	1	81	4.3	0.04
1*2	3	81	8.1	0.0001

Table 4.2: *ANOVA findings for Further References without an intervening reference used by All Subject Groups*

typically developing children and children with Down's syndrome. Significantly more full references were used in still than in moving videos. A clear increase in the use of full references with age can be seen. Each subject group used more references for the peripheral characters than for the main character, the degree to which this distinction was made varied with subject group—as indicated by the significant interaction. Children with Down's syndrome do not display differences in full references used for each character or each video type as clearly as the typically developing children.

As with the initial references, the significant main effects were further investigated using post hoc Newman-Keuls tests. First, the proportion of full references used by each subject group for each character was further assessed. More full references were used for the peripheral characters than for the main character in both moving and still videos. Post hoc tests show that this was significant for seven-year olds (moving: $p = 0.001$; still: $p = 0.005$) and ten-year-olds (moving: $p = 0.01$; still: $p = 0.002$) but not for five-year-olds (moving: $p = 0.6$; still $p = 0.2$) children with Down's syndrome (moving: $p = 0.8$; still: $p = 0.6$). Clearly, the interaction occurs as a consequence of the older typically developing children distinguishing between the two characters, while five-year-olds and children with Down's syndrome did not. In moving videos it can be seen from Figure 4.15 that children with Down's syndrome did not distinguish between

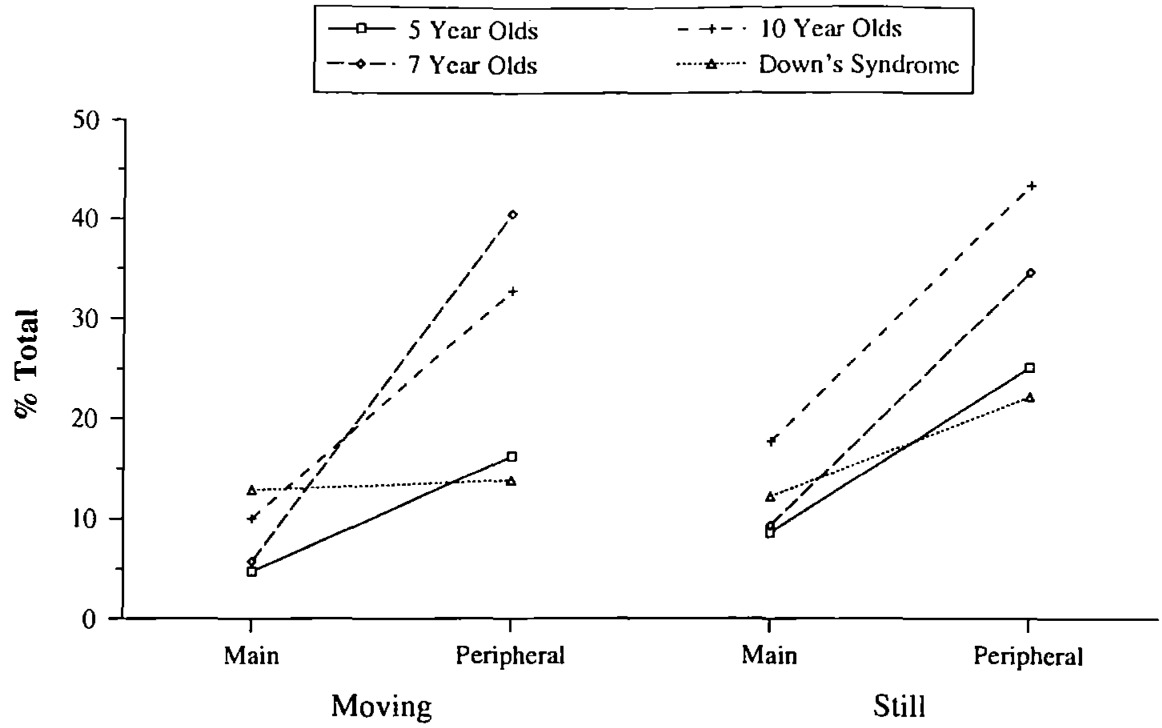


Figure 4.15: *Effects of character type and video type on the percentage of full references used when making a further reference without an intervening reference to another character*

the characters at all, while in still videos, a similar proportion of full references was used as used by five-year-olds for each character. Analysis showed that when referring to the peripheral character, children with Down's syndrome used significantly fewer full references than either seven-year-olds ($p = 0.0001$) or ten-year-olds ($p = 0.0001$). Five-year-olds were also found to use fewer full references when referring to the peripheral character than seven-year-olds ($p = 0.001$) and ten-year-olds ($p = 0.001$). Significant differences were not found for references used for the main character between subject groups.

The main effect of video type was assessed, this indicated that while there was an overall effect whereby more full references were used in the still videos than in the moving videos, no individual groups showed significant differences—as detected by Newman-Keuls analysis. However, when comparing the proportion of full references used on each video type by each subject group, Newman-Keuls post hoc analysis showed that children with Down's syndrome used significantly fewer full references than ten-year-olds when the video was still ($p = 0.01$). No significant differences were found for moving videos.

The significant main effect of subject group was assessed, and showed that overall, children with Down's syndrome used significantly fewer full references than seven-year-olds ($p = 0.03$) and ten-year-olds ($p = 0.006$). Five-year-olds were also found to use significantly fewer full references than ten-year-olds ($p = 0.01$) and approaching significance when compared with seven-year-olds ($p = 0.08$). From Figure 4.15 it can clearly be seen that the older typically developing children mark the difference between characters in both video types, five-year-olds indicate some differences between characters, but children with Down's syndrome seem to differentiate between characters in a limited way only in still videos.

Summary Of Findings

Further References without an Intervening Reference

- All subject groups used more reduced references (pronouns and zero anaphora) than full references.
- More full references were used for the peripheral characters than for the main character by older typically developing children.
- Children with Down's syndrome differentiate between characters in a limited way in still videos.
- Children with Down's syndrome and five-year-olds used significantly fewer full references than seven- and ten-year-olds for references to the peripheral characters.
- Children with Down's syndrome used significantly fewer full references than ten-year-olds when the video was still.
- There was no main effect of listener position.
- A significant main effect of video type was not seen to be the result of individual subject group distinctions.

4.5.6 Further Reference to the Main and Peripheral Characters following an Intervening Reference to Another Character

As has been noted in the introduction, the use of this type of reference can indicate whether or not children are able to distinguish linguistically between the roles of the characters. In order to distinguish between them the child must, first, have some form of representation of the differing roles of the characters; and second, have knowledge of the referential strategy by which that differentiation may be signalled, by manipulating linguistic forms to overtly mark the characters' roles.

As with the previously analysed reference types, the use of each individual referential form can be seen in Figures 4.16–4.17, where each referential form is displayed as a percentage of the total references used by each subject group. Tables in appendix H show the total number of further references after an intervening reference used for each referential form for each character in each condition. It is interesting to note that in all subject groups a wide range of reference types has been recorded indicating that the children have the ability to use the linguistic forms. In re-establishing reference to a character, the speaker can use referential forms to distinguish the status of each character—usually a full reference for peripheral characters and a reduced reference for the main character. Given that all children have shown that they are capable of using a wide range of referential forms, a purely linguistic cause for any difficulty in manipulating referential forms in order to distinguish between the characters seems unlikely.

The following analysis therefore assesses children's understanding of, and ability to use consistently, the linguistic forms identified in figures 4.16–4.17 in accordance with a referential strategy. The lack of evidence of a strategy to distinguish between

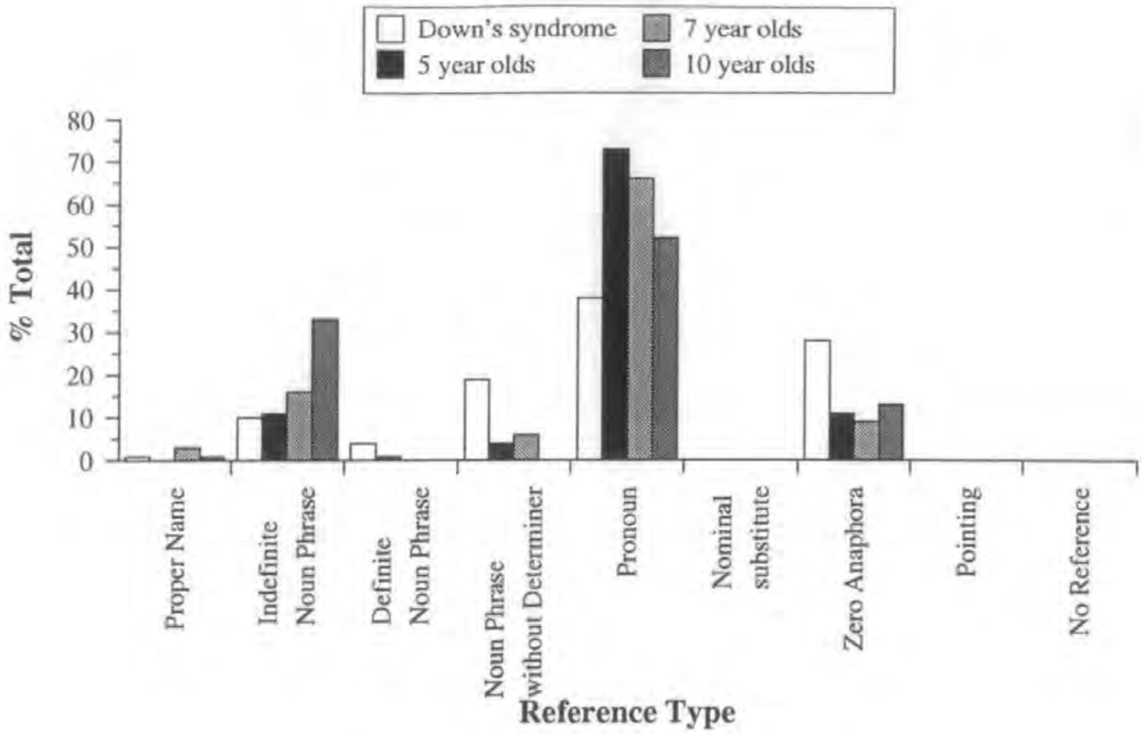


Figure 4.16: *Percentage of reference types used by each subject group for the main character after an intervening reference to another character*

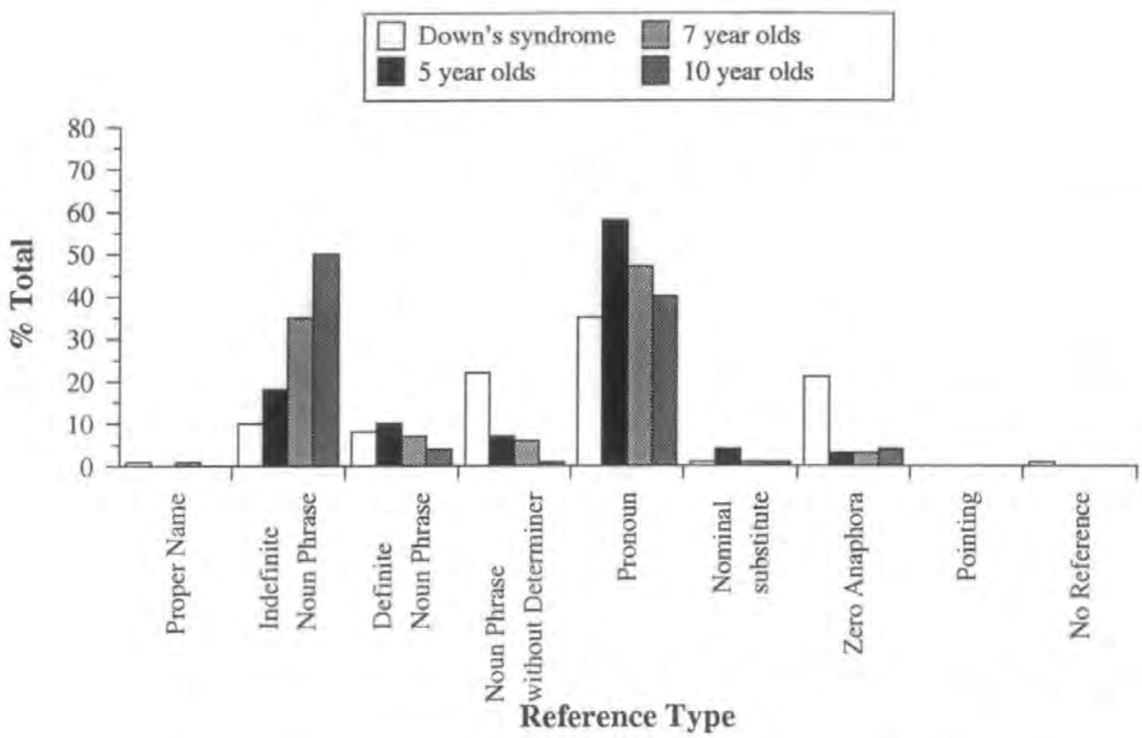


Figure 4.17: *Percentage of reference types used by each subject group for the peripheral character after an intervening reference to another character*

the status of characters may indicate either that knowledge and understanding of a referential strategy is absent, or that distinguishing internal representations of the characters are not being formed or not being maintained.

Analysis of Variance

Analysis of Variance was performed on the data for further references to a character following an intervening reference to another character. Full analysis of variance summary tables and tables of means are given in appendix I. Referential forms were again amalgamated into the summary categories of full and reduced references. The use of a high proportion of full references indicates that the child considers it necessary to use an unambiguous reference for the character to which they are referring. Clibbens and Karmiloff-Smith have noted that the use of full references is more likely to occur for the peripheral character than for the main character. In order to compare the proportion of full references used as a re-establishing reference for the main and peripheral characters in each condition, a 4 (subject group) x 2 (character type) x 2 (position of listener) x 2 (video type) analysis of variance was performed on the percentage of full references used in each condition by each child as a further reference to a character after an intervening reference to another character. Thus the dependent variable was the proportion of full references used by each subject group in each condition, while the independent variable was the subject group to which the child belonged.

Table 4.3 shows the results of the main effects and any significant interactions. Table 4.3 indicates significant main effects for all variables except for the listener position, as well as a significant interaction between subject group and character type. Figure 4.18 also highlights the full references used for each character in both video types by each subject group.

Effect	df effect	df error	F	p
1. Subject Group	3	81	3.6	0.01
2. Character	1	81	31.8	0.00001
3. Position of Listener	1	81	2.4	0.08
4. Video Type	1	81	38.7	0.00001
1*2	3	81	5.7	0.001

Table 4.3: *ANOVA findings for Further References after an intervening reference used by All Subject Groups*

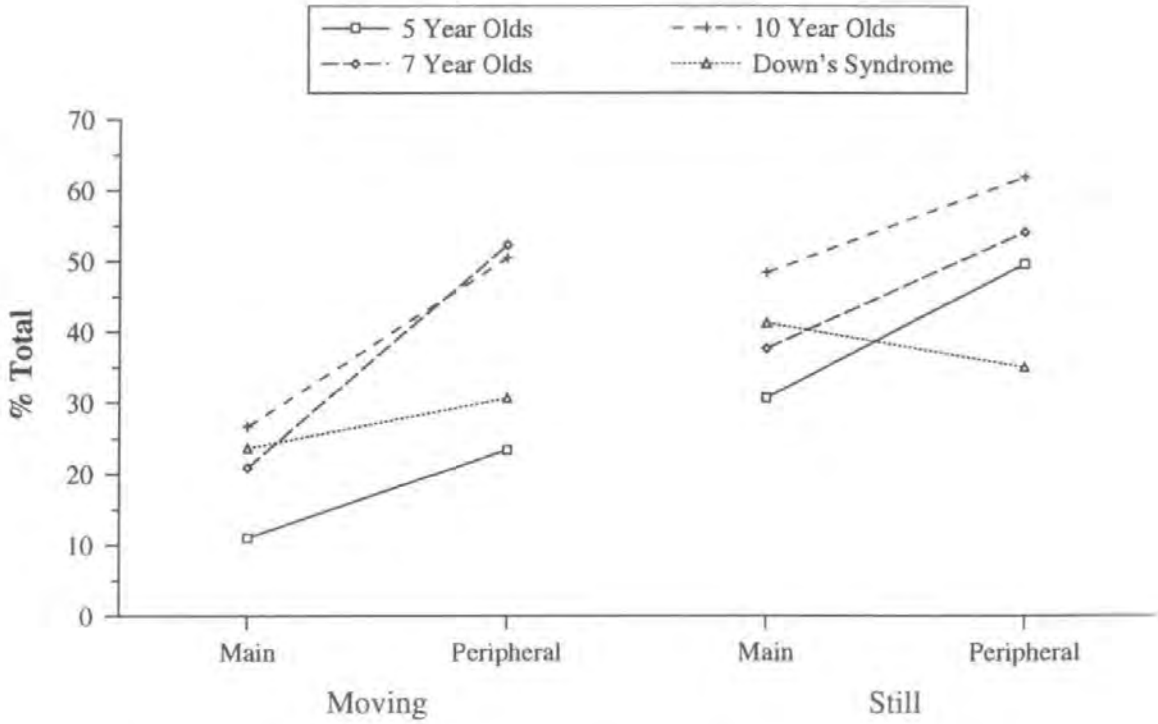


Figure 4.18: *Effects of character type and video type on the percentage of full references used as a further reference to characters after an intervening reference to another character*

Planned Orthogonal Comparisons

Planned Orthogonal comparisons were performed on the data for further full references after an intervening reference to another character. The findings from the comparisons which were performed are summarised in Table 4.4 The results showed that when assessing the proportion of full references used for the main character, significantly more full references were used when the video was still than when it was moving: this was true for all subject groups. For full references used for the peripheral character only five-year-olds used a significantly different proportion of references for each video type.

As can be seen from Figure 4.18, for typically developing children, significantly more full references were made to the peripheral character than to the main character, both when the video was moving and when it was still. Although significant differences occurred in both video types, it can be seen from the significance levels and Figure 4.18 while five-year-olds increased the distinction made between characters in the still videos, the older age-groups made less of a distinction. Children with Down's syndrome did not use significantly different proportions of full references for the main and peripheral characters. However, in moving videos more full references were used for the peripheral characters than for the main character, while in still videos more full references were used for the main character than for the peripheral characters—the opposite pattern from that used by typically developing children. The significant result obtained for references to the main character when comparing references used in moving and still videos occurs as a consequence of this change in referential strategy by children with Down's syndrome.

Post hoc Newman-Keuls analysis was performed in order to compare each subject group, the results of the follow-up tests are illustrated in Figure 4.18. Results showed that overall ten-year-old children used significantly more full references than children

Subject Group	Refs to MC Moving v Still	Refs to PC Moving v Still	Moving Videos MC v PC	Still Videos MC v PC
5 year olds	13.99***	17.33***	4.19*	11***
7 year olds	10.35***	0.08	27.52***	8.29*
10 year olds	17.33***	3.31	15.81***	5.6*
Down's syndrome	15.29**	0.6	1.8	1.2

* indicates significance at ($P < 0.05$)
** indicates significance at ($P < 0.01$)
*** indicates significance at ($P < 0.001$)

Table 4.4: *F values for Planned Orthogonal Comparisons for All Subject Groups*

with Down's syndrome (p = 0.02) and five-year-olds (p = 0.03).

The use of full references for each character by each subject group was further assessed using Newman-Keuls analysis. Children with Down's syndrome used significantly more full references than five-year-olds when referring to the main character (p = 0.04), and significantly fewer full references than seven-year-olds (p = 0.0003) and ten-year-olds (p = 0.0001) when referring to the peripheral character. Five-year-olds were found to use fewer full references than ten-year-olds when referring to the main character (p = 0.05), and fewer full references than both seven-year-olds (p = 0.01) and ten-year-olds (p = 0.004) when referring to the peripheral character.

For each subject group, the proportion of full references used for each character in each condition was assessed using Newman-Keuls analysis. Interestingly, all subject groups used similar proportions of full references for the main character, but significant differences were found for references to the peripheral character between the subject groups. As can be seen in Figure 4.18 the older typically developing children distinguished between the two character types more clearly than the other subject groups. For reference to the peripheral character when the video was either moving or still, children with Down's syndrome used significantly fewer full references than seven-year-olds, (moving: p = 0.01; still: p = 0.03) and ten-year-olds (moving: p = 0.02; still: p = 0.001). Five-year-olds also used fewer full reference than seven- and ten-year-olds when referring to the peripheral character and the video was moving (p = 0.01).

Summary Of Findings

Further References after an Intervening Reference

- Children with Down's syndrome used more reduced references (pronouns and zero anaphora)than full references for both main and peripheral characters.
- Typically developing children used more reduced (pronouns) for the main character, while for the peripheral character a similar proportion of full and reduced references was used.
- Children with Down's syndrome and five-year-olds used fewer full references than seven- and ten-year-olds in both video types, for both main and peripheral characters.
- More full references were used by all subject groups in still videos than in moving videos.

Correlation Matrix Data

From the analysis above a clear picture can be gained of the performance by each subject group on the narration task, specifically relating to the use of full references for each of the characters in each of the conditions. Following this analysis, correlations were performed in order to assess any relationship between the scores obtained on the standardised tests and the use of full references on the narration task. One would expect that a higher score on the standardised tests would indicate higher verbal and non-verbal ability. In order to maintain a referential strategy such as the ones outlined by either Karmiloff-Smith or by Clibbens, it is expected that both linguistic and cognitive skills are necessary. It was therefore expected that scores on tests of language ability and cognitive ability should correlate with performance on the narrative task. Such a correlation depends on which cognitive and language skills are tested when compared with those which are necessary for the narrative task. It was interesting to examine whether the abilities tested did correlate with performance on the narrative task—therefore indicating that they were skills related to such a task.

The correlation matrix which compared the proportion of full references used for each character and the test scores achieved for each subject group showed that for all subject groups very few reference types correlated significantly with test scores. Most notably, there was no relationship between references used and standardised test scores for seven- and ten-year-olds. For children with Down's syndrome the only significant correlation shown was that between the score obtained on Raven's progressive matrices and references used for the peripheral character in stories which were still and where the listener was not watching. For five-year-olds chronological age correlated significantly in still-video conditions where the listener was not watching for references to the main charater (r=0.63) and to the peripheral character (r=0.56). Significant correlations were found between TROG in still-video conditions where the listener was not watching and references to the main charater (r=0.54) and to the peripheral character (r=0.52). Scores obtained on TROG also correlated significantly in moving-video conditions where the listener was not watching for references to the main charater (r=0.81) and to the peripheral character (r=0.62).

	CA	BPVS	TROG	Ravens
CA	1.00			
BPVS	0.16	1.00		
TROG	0.17	0.56*	1.00	
Ravens	-0.05	0.52*	0.74*	1.00

* indicates significance at ($P < 0.0001$)

Table 4.5: *Correlation Between Standardised Test Scores for Ten-Year-Olds*

	CA	BPVS	TROG	Ravens
CA	1.00			
BPVS	0.40*	1.00		
TROG	0.60*	0.58*	1.00	
Ravens	0.34*	0.56*	0.57*	1.00

* indicates significance at ($P < 0.05$)

Table 4.6: *Correlation Between Standardised Test Scores for Children with Down's syndrome*

Table 4.6 provides details of the correlations performed between test scores for children with Down's syndrome, indicating that all test scores correlated significantly with each other. This was also found for ten-year-olds, although no significant correlation was found for CA and test scores (see table 4.5). No significant correlations were found for five-year-olds, while for seven-year-olds BPVS and CA correlated significantly (r=0.57), as did BPVS and TROG (r=0.68).

These results indicate that while serving as a guide to the level of ability on specific language and cognitive measures for each subject group, they do not reflect the ability to represent, integrate and maintain such information, which is necessary for the use of referential strategies in a narrative task.

Summary Of Findings

Full References used to Re-establish Reference and Test Scores

- For children with Down's syndrome, test scores correlated significantly with each other, but did not correlate significantly with the proportion of full references used for either character.
- For ten-year-olds, but not for five- and seven-year-olds, test scores correlated significantly with each other.
- For seven- and ten-year-olds, full references used did not correlate significantly with test scores and CA.
- For five-year-olds, full references used in conditions where the listener was not watching correlated significantly with TROG and CA.

4.6 Discussion

It is possible not only to compare the findings presented above with those of other studies which have examined the use of referential forms but also to assess the ability of both subject groups to use a referential strategy similar to the one put forward by Clibbens (1992) or that of Karmiloff-Smith (1985).

The precise findings of Karmiloff-Smith have not been replicated in this study since it can be seen from the results concerning each type of reference that all age groups of children are able to use the initial slot of an utterance for both characters, rather than, as Karmiloff-Smith found, children of approximately seven years old being constrained to reserve it for the main character only. The other finding which conflicts with the assumptions of Karmiloff-Smith is that even children as young as five years old are able to distinguish between the characters and are capable of using full reference types to do so. These findings are in direct agreement with those of Clibbens, thus supporting hypothesis 1a. It may be argued that this was to be expected since the presentation of the stories was more similar to that of Clibbens than that of Karmiloff-Smith. This suggests that presenting a story on video may result in a different style of narration from that which results when the story is presented as a story book (as in the study by Karmiloff-Smith). The referential strategy found by Clibbens therefore may be a result of presenting the story on video rather than as a result of the fact that using moving pictures reduces the amount of cognitive processing involved in narrating the stories. However, there are a number of other possible reasons for the differences. For example a difference in the subject population, for this reason the cause of differences in the narratives produced remains unclear.

It has been possible to compare the use of nominal reference by children with Down's syndrome with that of typically developing children, resulting in the overall finding that children with Down's syndrome are functioning similarly to typically developing five-year-olds, and significantly differently from seven- and ten-year-olds. The precise way in which the references are used is discussed below.

4.6.1 Initial References to Characters

All age groups used a large proportion of full references for both characters. This may be because the act of entering the story is more noticeable to the child and therefore the strategy used—namely using a full reference for introduction (as seen with objects, see chapter 6)—more easily applied. Whether or not it is rigidly applied may be more affected by the position of the listener for this type of reference since it marks the first mention and appearance of each character. If the listener cannot see the screen the child may be more careful to introduce the character clearly, but for subsequent references to that character the child may assume the listener understands to whom they are referring.

The use of initial references demands only the consideration of information at a relatively local level in the discourse, while other reference types may need to consider the story or discourse more globally. Perhaps it is for this reason that children with Down's syndrome indicate that they are able to mark the different status of each of the characters at this local level of the story (at a level which approaches significance).

In general there is no distinction between main and peripheral characters for older subject groups, indicating that children with Down' syndrome used referential forms in a similar way to that of typically developing children when introducing the characters.

4.6.2 Further References in the Absence of an Intervening Reference to Another Character

This reference type gives some indication of the strategy being used to mark the status of each of the characters at a local level. As discussed for initial references, it can also be seen for references of this type, that the child need only consider events and references which occur immediately prior to the reference which they are about to use in order to continue reference to the character which is currently the focus of the story. For this reference type the position of the listener did not significantly affect the proportion of full references used. The method of presentation—whether moving or still—did not dramatically affect the referential forms used by any subject group.

For typically developing children more full references were used to refer to the peripheral character than to the main character for both moving and still videos, and thus a referential thematic subject strategy similar to the one noted by Clibbens has been identified for older typically developing children. For children with Down's syndrome a distinction between characters was only noticeable when the video was still, however more full references were used for the main character than for the peripheral character. This suggests that integrating information about the status of the character was found easier by children with Down's syndrome in still videos.

4.6.3 Further References after an Intervening Reference to Another Character

This reference type occurs at points in the story which demand that the child must re-establish reference to a character who has re-entered the focus of attention. The use of this reference type therefore requires the child to access information about the events in the story, information about the character, and information about which referential forms have previously been used for this character. Thus it can be seen that, unlike the previous reference types considered above, this reference type demands that numerous sources of information about the story be accessed at a global level. Typically developing children appear to be using a referential strategy to mark the thematic status of the characters, but children with Down's syndrome seem not to use the same strategy, thus supporting hypothesis 2.

Position of Listener

The position of the listener did not affect the way in which the child used the referential expressions for either character, therefore hypothesis 4 (which predicted that more full references would be used when the listener could not see the story) cannot be supported. It would therefore appear that the child does not alter the referential strategy to take account of the listener's ability to see the presentation of the story, contrary to predictions by Stevenson (1988). This does not create a problem for the older children since they use more full NPs to refer to each character in both conditions, so that ambiguity is avoided. But the five-year-olds use more reduced references than full references, and do so in a largely deictic manner. They may be applying a strategy, but too inflexibly to take account of the listener's current awareness of the story.

Subject Group Differences

The age differences apparent in this study do not map exactly onto the findings of the previous studies. The older the age group the more full references were being used to refer to both the main character and the peripheral character. Both seven- and ten-year-olds marked the distinction between the characters more clearly than the five-year-olds, thus supporting hypothesis 1c (which predicted that success with which referential strategies are applied increases with age). However, this is contrary to the findings of Clibbens (1992), the results obtained in moving videos for five- and seven-year-olds more closely resemble the findings by Karmiloff-Smith. The fact that older children, as well as five-year-olds, are using a thematic subject strategy in both video types is contrary to findings of both Clibbens (1992) and Karmiloff-Smith (1985). This may indicate the influence of using both different stimulus material, and different subject groups.

Children with Down's syndrome did not distinguish between characters in moving videos. In still videos the distinction made between characters was less than for any age group, and indeed in the opposite direction.

Character

A very striking thematic subject strategy is evident in the data obtained in this study for both moving and still presentations for typically developing children. Children with Down's syndrome showed that are able to form some mental representation of the story, but the way in which the character status is represented may be different from the way in which typically developing children represent status of characters, since they used more full references for the main character than for the peripheral character.

The type of thematic subject strategy seen in this study may occur because the main character is "in focus" (Garrod and Sanford, 1988) for more of the time than the peripheral character and thus the child does not find it necessary to refer to it fully since it is still the shared focus of attention between speaker and listener. The peripheral character, on the other hand, must be re-established as a focus of attention more often by using full references. The greater use by five-year-olds of full references for the main character than would be predicted by the Karmiloff-Smith study may be due to the peripheral character occupying a less restricted role, creating the need to re-establish reference to the main character more often, as found by Clibbens (1992).

Children with Down's syndrome may experience an inability to amalgamate different sources of information. It would seem that representations of character status may be impaired or at least different from typically developing children. This may be a result of the inability to hold in working memory all the information necessary to form and maintain a representation of each character's status.

Video Type

Clearly the way in which the story is presented affects the use of reference types. In this study all age groups used more full references in still videos. This may be explained by the fact that the still videos presented the story in a more traditional story-book manner, leading the child to apply previous experience of story telling to this task. Still videos also provided more time to address the salient points of the story by forming a well structured sentence taking into account all that is portrayed in the scene. Having separate pictures may lead the child to believe that the characters must be re-established more often—thus increasing the use of full references in the still condition.

Presenting the events of the story in a moving format may have reduced the cognitive burden of the children who were asked to narrate it. Therefore, in the moving stories, older children were able to concentrate on applying an effective thematic subject strategy by using different linguistic markers to distinguish the status of each of the characters, thus supporting hypothesis 3 (which predicted that a referential strategy would be used in moving rather than still stories).

The use of video presentation increased the complexity and length of the task as well as preventing the use of spatial deixis by the child; the child could not rely on pointing and was forced to use more full references to establish and maintain reference to each character in the video task. The greater length and complexity of the story may have imposed a greater cognitive demand for the five-year-old children, resulting in the limited use of a referential strategy by the five-year-olds in the moving videos. For seven- and ten-year-olds a very striking thematic subject strategy is seen in the moving videos, showing that the cognitive load has been lifted sufficiently to enable the successful use of a referential strategy to differentiate the status of the characters.

Central Findings for Further References without Intervening References

There are significant subject group differences, where typically developing children are using a thematic subject strategy to distinguish between main and peripheral characters in both video types. Children with Down's syndrome are not using a thematic subject strategy, where some distinction is made it is in the opposite direction to that used by typically developing children. Older age-groups also mark more of a distinction between characters than five-year-olds and children with Down's syndrome, especially in moving videos.

Presentation of information clearly influenced reference types used. In the moving videos younger children and children with Down's syndrome may be unable to encode and integrate into their overall mental representation of the story each new item of information because the information is constantly changing—an efficient system is needed to represent all new information. Children with Down's syndrome and five-year-olds do not have an efficient system to deal with so much incoming information, they therefore use fewer full references overall in moving than in still videos, and do not distinguish between the characters. From these results it would seem that for the subjects in this study moving videos created more of a processing burden resulting in the use of referential forms appropriate to an earlier phase in development than that predicted by their age in relation to previous studies. However, age-appropriate strategies were seen in performance in still videos, indicating that typically developing children were able to focus on and encode each item of information, and then integrate this into the overall representation of the story in order to aid decisions about the appropriate referential form to be used for each character.

4.7 Conclusions

Overall, it can be seen that children as young as five, as well as those of seven and ten years of age, use a thematic subject strategy when using anaphoric reference, but the extent to which this is successfully performed depends upon the organisation of their knowledge of referential forms and, to a certain extent, upon the type of task. Analysis of narratives produced by children with Down's syndrome suggests that no such strategy is being applied since they do not distinguish referentially between characters. This may perhaps indicate that children with Down's syndrome do not integrate information which is necessary for the use of a referential strategy such as the thematic subject strategy identified by Clibbens (1992). It has been argued (see chapter 1) that mental representations offer a plausible mechanism by which the integration of information can occur. It follows, therefore, that children with Down's syndrome may not be using mental representations effectively in discourse. Whether difficulty is experienced in the formation or the use and maintenance of mental representations is unclear. Further uncertainty remains as to the cause of the unsuccessful integration of the relevant information. Possible causes could be inefficient initial encoding of relevant information, the inaccessibility of the information thus preventing recall, or simply being unaware of which information may be relevant to the comprehension and production of discourse. Indeed, even for typically developing children as young as five years old some tentative form of thematic referential strategy is evident, indicating that they are able to take account of linguistic and cognitive information in order to maintain coherent discourse. Mental representations are used with increasing efficiency by typically developing children, while for children with Down's syndrome mental representations may not be used effectively to integrate linguistic and cognitive information in order to successfully use a referential strategy to maintain coherent discourse.

It is not until linguistic and cognitive information can be systematically organised that a successful referential strategy can be implemented, through the use of a mental representation of the discourse. It may be argued that underlying causes for the inability of individuals with Down's syndrome to exhibit referential strategies may involve the lack of organisation of information preventing its integration within a mental representation of discourse. Interesting evidence at the neural level supports this idea (Johnson, 1988)(discussed further in chapter 7), and may also explain other general processing constraints which have been identified for individuals with Down's syndrome.

The comparison of moving and still videos was useful in establishing that, for this subject population, moving videos proved more difficult, perhaps due to the volume of rapidly changing information which was needed to be represented internally. Children with Down's syndrome indicated that in less demanding situations some form of distinction between characters was possible, suggesting that character status can be represented in a limited way, but the use of this information is affected by any increase in information which must be integrated. This in turn suggests that the difficulty may lie in the maintenance of items in working memory. Difficulty is experienced with representing multiple items of information in a narrative task most closely resembling natural discourse—that is moving videos. Moving rather than still videos will be used in the next experiment. Additional manipulations of the stimulus will also be carried out to investigate whether the volume of information or the way in which information about the status of the characters is different in children with Down's syndrome. In the next chapter the aim is to explore reasons for the difference apparent in children with Down's syndrome in their ability to use referential devices to maintain coherent discourse. This could be due to a number of factors such as: no distinction between characters at the representational level; an inability to use the necessary linguistic forms to mark the distinction; a lack of understanding of what the listener needs to know. Further investigation to examine the understanding of the characters' status and the role of the listener have been performed in the next chapter.

Chapter 5

Experiment 3: The Importance of Thematic Status

5.1 Introduction

In the last chapter it became clear from the performance of the typically developing children that they were able to develop strategies for referring to characters in a story. This may be something of which they become increasingly aware during their school life; indeed story telling skills develop gradually throughout childhood (e.g. Klecan-Aker et al, 1987), and stories of personal experience have been noted to occur in children of as young as 20 months (e.g. Miller and Sperry, 1988). Successful use of referential strategies appears to be something for which linguistic development is necessary, for example it has been suggested that narrative ability is related more to language ability than to chronological age (Kontos et al, 1986). Successful use of referential strategies is also something for which the development of representational abilities is necessary: children's narratives can be used to assess how children perceive and encode information about a story stimulus (Loveland et al, 1991). Whatever the necessary skills needed, it has been demonstrated that a referential strategy can be utilised in an increasingly effective manner as the typically developing child increases in age. However, children with Down's syndrome, whilst being able to demonstrate the use of a wide range of linguistic forms, seemed unable to mark the status of the characters in the same way as was predicted by typically developing children, based on the use of certain referential strategies.

The production of narratives is clearly guided by cognitive schemas or scripts which children develop and which dictate story-telling context, structure and linguistic conventions. It can be seen that they influence the language produced, but as with normal discourse, narration is dependent on the integration of linguistic, cognitive, social and pragmatic knowledge. The ability to achieve this integration to produce a successful narrative increases with age, alongside the accumulation of linguistic, cognitive and social knowledge as well as the maturation of both linguistic and cognitive systems.

Although limited in number, various studies have investigated the narrative abilities of children with learning and specific language disabilities (e.g. Feagans and Short, 1984; Roth and Spekman, 1986; Sleight and Prinz, 1989). Whilst language difficulties were not identified using conventional language measures, difficulties were experienced with the narrative tasks by the subjects in these studies. Narrative tasks appear to be sensitive to discourse difficulties since they require similar integration of knowledge sources. Linguistic limitations resulted in shorter stories which contained fewer complex sentences and more non-referential pronouns, while conventions of story telling were violated by a less complete plot structure and the lack of use of conventional story "scripts". For these studies cognitive organisation has been seen to be comparable to that of age-matched controls; this parallels findings in the previous chapter in which cognitive measures were seen to predict narrative performance. These findings were similar to the ones found by Karmiloff-Smith for children functioning at the first of three phases in the development of referential use.

Interestingly, in experiment 2 it was shown that, for both typically developing children and children with Down's syndrome, the position of the experimenter seemed to make no difference to the referential strategies employed by the children. This finding is something which needs to be investigated further, since research has shown that children as young as the age of three or four are aware of the necessity to be more specific in their references when the listener cannot see to what the child is referring (Emslie and Stevenson, 1981). Possible reasons for this finding have already been discussed.

The study reported here was carried out in order to examine further possible underlying reasons why children with Down's syndrome did not appear to use a referential strategy. The failure, by both typically developing children and children with Down's syndrome, to alter the referential strategy when the position of the listener was altered was also examined further. Although the methodology was similar to that used in experiment 2, some modifications were made and are outlined below.

In the experiment reported here children's use of referential strategies in narrative was assessed using stories presented using video tape. The stories were designed to maximise the difference in the thematic status of the characters in the stories. This was done by varying the number of peripheral characters in each. In two stories there was one main character and one peripheral character, in order to clearly indicate that while one character (the main character) was necessary for most events in the story, another character (the peripheral character) contributed very little to the story. In the other two stories seen by each child there was one main character and two peripheral characters, and the importance of the actions of the peripheral characters thereby increased, thus creating less of a distinction between the status of the main and peripheral characters. If the child's representation of the characters is reflected by the type of reference used for each character, and the status of the characters is one element of the representations formed by the child, then altering the status of those characters should result in changes in the type of reference used by the child. Whilst, in experiment 2, the status of the main and peripheral characters tended to converge at some points in the story, in this experiment this has been prevented from happening in two of the four stories which each child narrates. In order to clearly distinguish the difference in status of each character in the story the greater part of the action must be performed by one character. This clearly identifies this character as the main character. The status of the peripheral characters was varied, this was achieved by having only one peripheral character in two of the four stories, who played a much more exaggeratedly peripheral role by performing very few actions. The more prominent status of the peripheral character was maintained in the stories where two peripheral characters performed a considerable number of actions.

Whether children were able to change the referential strategy used when the position of the listener was varied was re-examined. The knowledge about the story which both the speaker and listener shared should influence the type of referential form used (Stevenson, 1988). The listener was, in this experiment, a child rather than the experimenter. This modification reflects the consideration that the lack of change in referential strategy observed in the previous experiment may have been because the narrating child had assumed the experimenter to be familiar with the events of the stories. By asking a child to listen to the story the narrating child could not make such assumptions. Familiarity with the listening child might also encourage narration which more closely reflected normal discourse than the task of telling a story to an adult.

In addition to the narrative task, questions were devised in order to assess further the narrating child's perception and representation of the status of each of the characters in the story. Questions have been used to assess this issue further following the performance of children with Down's syndrome in experiment 2. They demonstrated that they were not representing the thematic status of the characters differently, or at least not able to reflect this difference in their use of referential forms. Questions were therefore used to assess whether or not children with Down's syndrome had represented features about the status of each of the characters. It was expected that if questions were answered correctly but no thematic subject strategy was used, this would indicate that the difficulty is more likely to be linguistically based. The questions served a number of purposes. First, and most importantly, they were designed to elicit information about character status as perceived by each child. It was expected that the child's answer to the first question ("Who is the story about?") would reflect who they thought the main character was. The question was constructed in such a way that it did not directly ask the child to identify the main character, but it was expected that the response would reflect whoever the child had represented as the main character. Subsequent questions assessed whether this had in fact been the case, since they overtly required the child to identify who they believed to be the main character. Other questions were asked to assess whether or not the child could remember other less prominent characters in the story.

In the previous experiment it was clearly established that the way in which the stories were presented, either by using moving characters or still characters, influenced the proportion of full references used to refer to the characters in the stories. This variable was therefore not repeated in this experiment so that for every video which the child narrated the characters were moving. Instead the status of the characters in the story was the main focus of attention.

In this experiment focus was given mainly to the references which fall into the category of further reference to a character following an intervening reference to another character. The successful use of this referential category enables the narrator to re-establish reference to characters who have not been the most recent focus of attention by the narrator and therefore by the listener. The differing roles or status of the characters in the story will be reflected in the referential strategy used to re-establish reference.

5.2 Hypotheses

As a result of the changes to the design of the experiment, outlined above, the following hypotheses were proposed, the first three focusing on the performance of typically developing children:

1. There will be a significant difference in the referential strategies used for stories which contain one peripheral character when compared with those containing two peripheral characters.

   (a) Where there is only one peripheral character in the story more full references will be used to refer to the peripheral character than to the main character because the status of each character is more distinct when there is only one peripheral character.

   (b) Where there are two peripheral characters in the story, although a referential strategy similar to the one suggested above may be observed it will not be as pronounced as for the one-character condition.

2. There will be a significant difference in the referential strategies used when the listener can see the story compared with when they cannot see the screen.

   (a) When narrating stories for which the listener can also see the screen fewer full references will be used, since clarifying the identity of the referent in narrative is less essential when the listener also has visual reference to characters.

(b) When the listener cannot see the screen, ambiguity by the narrator will be prevented by full reference to characters, this will be more pronounced for reference to peripheral characters.

3. (a) The main character of the story will be identified accurately when asked the set of questions following the story, thus indicating that the status of the characters has been internally represented accurately by the narrating child.

   (b) The ability to identify the main character correctly will be significantly correlated with the ability to use a referential strategy, since, in order to successfully use a referential strategy the status of each character must first be identified by the narrating child.

4. (a) Following the performance of children with Down's syndrome in experiment 2, the independent variables will not affect the proportion of full references used by children with Down's syndrome.

   (b) Children with Down's syndrome will not be able to answer the questions about character status correctly.

5.3 Method

5.3.1 Design

A repeated measures design was used, with two variables, each with two levels. The type of video shown comprised one variable—one or two peripheral characters. The other variable involved the position of the listener—watching or not watching the story presentation with the child. Typically developing children and children with Down's syndrome were asked to narrate a story which they were watching on a monitor. There were either one or two peripheral characters in the stories. All subjects performed under each condition, seeing four videos in total. Two "one-peripheral-character" and two "two-peripheral-character" videos were seen, one in which the listener watched the story with the child, for the other the listener was unable to see the screen. The stories were recorded on video-tape, each story had a one-peripheral-character and a two-peripheral-character version. Each videoed story was of very similar theme and construction, differing only in the characters and the objects (see appendix F for an exact description of each video). For each age group of typically developing children, as for children with Down's syndrome, the conditions were counter-balanced, so that each video was seen in each listener-position an equal number of times.

Six questions were asked after video (see Materials section for the complete list). The first question was always asked before the others, while the order for questions three, five and six was randomly allocated, after each of these a "Who else?" question was asked. Photographs of the characters were provided as a prompt for questions two–six, these were designed for use by children with Down's syndrome and the five-year-old typically developing children, although they were provided for all children.

5.3.2 Participants

A new subject population was used for this experiment since it was thought that familiarity with the methodology might favour the performance by typically developing children, although possibly being of little benefit to children with Down's syndrome. Again, two subject groups were used. The first group consisted of forty children with Down's syndrome, whose ages ranged from six to eighteen with a mean age of eleven years. Forty-five typically developing children, fifteen from each of three age groups (five-, seven- and ten years) comprised the second group.

5.3.3 Materials

The same set of standardised tests were used as in experiment 2. They were used mainly to confirm that the typically developing children were performing at a level consistent with a normal population of their age group, as predicted by the test. They were also a useful measure of the performance of the children with Down's syndrome simply in order to locate their level of achievement on the abilities tested, namely a selection of vocabulary (BPVS), grammar (TROG) and non-verbal cognitive tasks (Raven's Progressive Matrices).

Four stories, each with similar themes, were constructed using glove puppets and recorded onto video tape. The themes and puppets were similar or identical to those from the previous experiment. Each story had two versions: in one there was one main character and two peripheral characters, as in the previous experiment; in the other there was again one main character but this time only one peripheral character. The reason for this was in order to maximise the difference in the status of the characters.

After narrating each video, the child was asked a series of questions about the characters in the story. The purpose of these was to assess the child's understanding of the characters' status. The following questions were asked:

1. Who was the story about?
2. Who else was in the story?
3. Who was the main person in the story?
4. Who else was in the story?
5. Who was the most important person in the story?
6. Who was in the story for the longest time?

The first question on the above list was always asked before the others, while the order for questions 3, 5 and 6 was randomly allocated, after each of these a "Who else?" question was asked.

In the set of photographs–which was used as a prompt—shown to each subject were the relevant characters and a picture of an equivalent character type (i.e. the main character in each of the stories was a cloth-bodied glove puppet with a wooden, painted face; the peripheral characters were glove puppets constructed from a fluffy material) but who did not appear in any of the stories seen by the child (see appendix J for the set of photographs used).

5.4 Procedure

The tasks were carried out in a randomised order, in a quiet and familiar room, in pairs—where one child was the listener and the other was the narrator. Each child was assessed at two separate times. For the typically developing child each session lasted for approximately 15–20 minutes, while for children with Down's syndrome the sessions were slightly longer (30 minutes). Presentation order of each video counter-balanced, and the order for seeing videos and completing the standardised tests was randomly assigned. A typical session would involve two or three videos and one or two standardised tests.

Within each pair of children, one was allocated the task of the listener and the other the narrator. One child from each pair was selected from a registration list, the second child was selected by the teacher as being a friend of the first child. It was explained that the narrating child would see four videos which did not have any sound or narration accompanying them. The narrating child was asked to tell the story to their friend. It was also explained that for two of the videos the listening child would be able to see the screen, while in the other two videos they would be unable to see the story. The child then narrated the story while it was being shown and this was recorded using a video camera. After the story had been shown the narrating child was asked to answer the questions listed above: it was explained that they could use the photographs to help them decide on the answer. The standardised tests were interspersed with the videos in a randomised order: instructions for these can be found in the manual for each of the tests.

As with experiment 2, the video-recorded narration provided by each participant was transcribed. Each referential form was then coded as one of seven types. The character being referred to and the point in the narration at which the reference occurred was also coded. Coding was possible by simultaneous investigation of both the video recording and the transcription.

5.5 Results

The data collected from typically developing children was again compared with that relating to the performance by children with Down's syndrome. A sample of transcriptions of the narratives provided by all subject groups can be found in appendix K. The variation in the complexity and length of the narratives produced by each subject group can be seen in this appendix, with children with Down's syndrome and five-year-olds requiring more prompting to narrate each point in the story. The findings of most interest in this chapter are those which focus on references made to both the main and peripheral characters which occur after the child has referred to another character in the story—in chapter 4 this type of reference was termed "a further reference to a character after an intervening reference to another character". For this type of reference the child must re-establish reference to the character. The form of reference used is dependent upon the status which the narrator assigns to the character, and it is this process which is considered in more detail in this section.

5.5.1 Reference Types

The procedure for assessing the narration produced by each child was identical to that followed in the previous experiment, where the categories of reference type remained the same:

1. full references—which included proper names, definite noun phrases, indefinite NPs, and NPs without determiners;

2. reduced references—including pronouns, nominal substitutes and zero anaphora.

Summary of Reference Types Used

In order to use a referential strategy the child must have acquired knowledge about the use of referential devices, from both a linguistic perspective and a communicative one. The use of individual reference types for reference to each character by each subject group was assessed. This was done in order to establish the ability to use referential forms by each subject group. A brief summary of the proportions of references used by each subject group is shown in figure 5.1. Tables in appendix L show the total number of references used for each referential form for each character in each condition.

As in the previous experiment, children with Down's syndrome showed that they were capable of using all of the reference types, except for nominal substitutes—which were not used by any subject group. It is equally apparent that the frequency of usage is very different from that of the typically developing children, perhaps suggesting that referential strategies are either different for the two groups or that children with Down's syndrome are not able to use a referential strategy. Similar patterns of use can also be seen for each of the typically developing age groups: initially, at five-years-old, the dominant reference type is that of pronouns; in subsequent years there is an increased usage of fuller referential types which replace the use of the pronoun, possibly

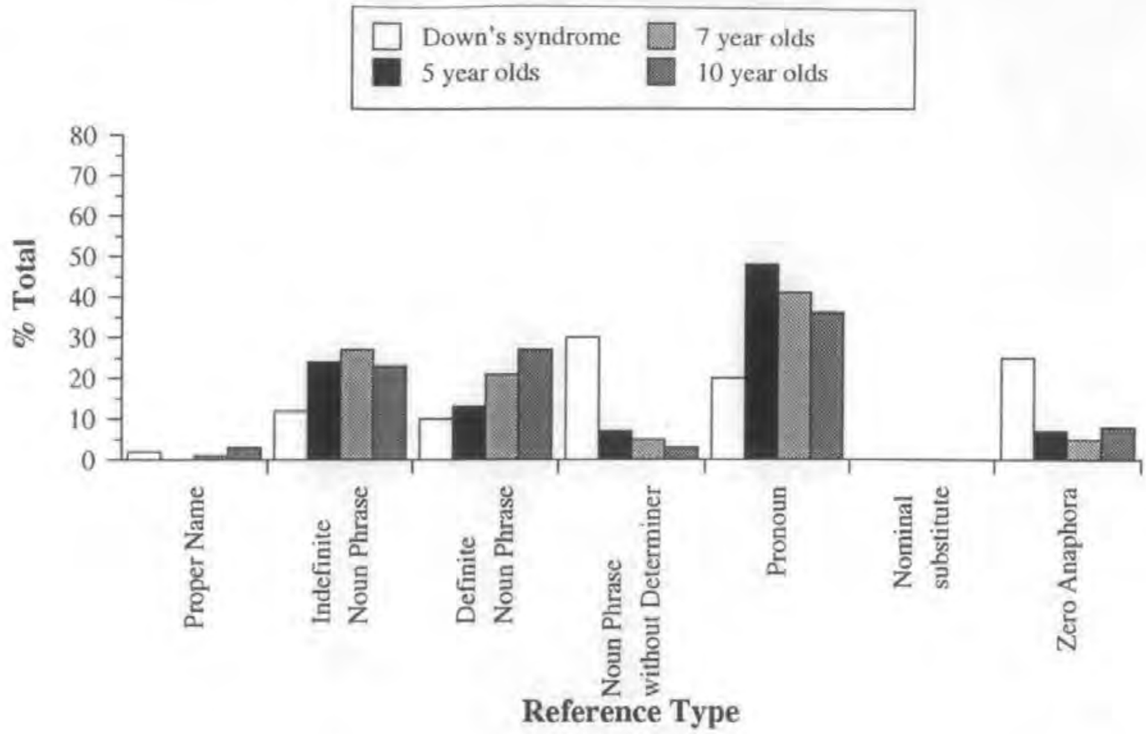


***Figure 5.1:** Percentage of reference types used by each subject group for both the main character and the peripheral character*

in order to avoid ambiguity, and as the child becomes more aware of certain referential strategies.

Having established the main pattern of reference use for the individual referential forms, the analysis concentrated largely on data pertaining to the summary reference categories of Full and Reduced reference. Analysis focused on the proportion of full references used for either the Main Character or the Peripheral Characters.

5.5.2 Initial References to Characters

Figures 5.2–5.3 show the references used as an initial reference to each character for all subject groups. Both the main and peripheral characters were introduced by children of all age groups and children with Down's syndrome using a full reference type, with Indefinite Noun Phrases being the most frequent category used. Figures 5.2–5.3 also

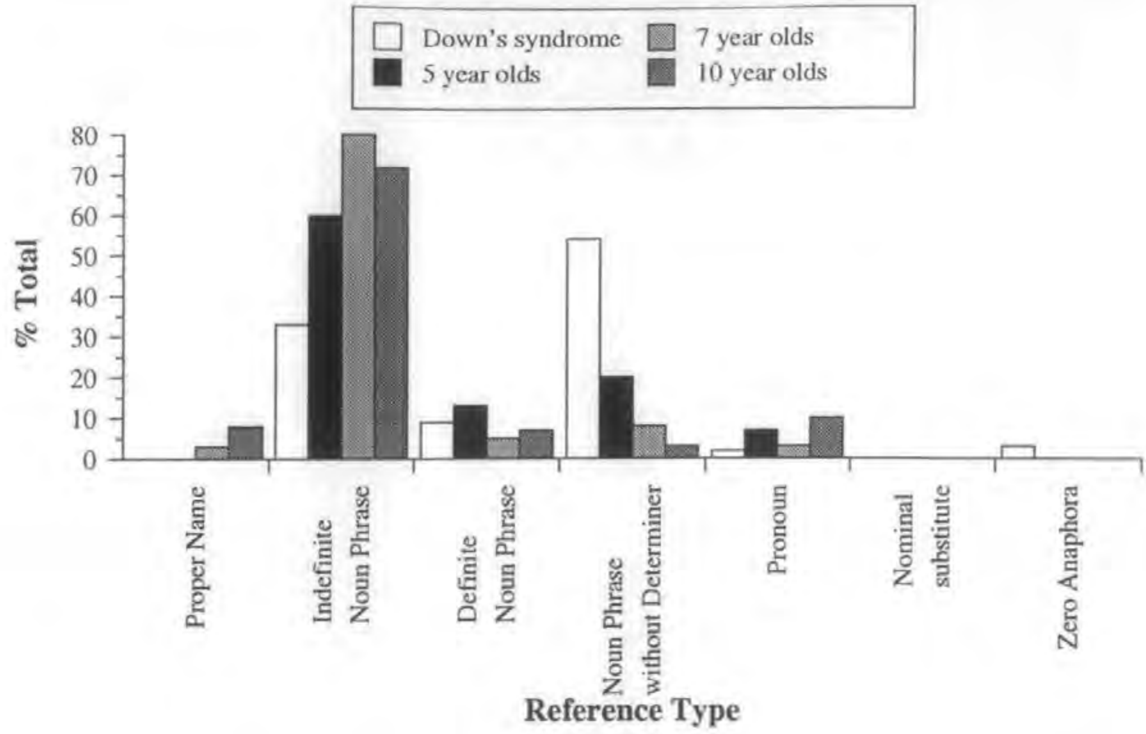


Figure 5.2: *Percentage of reference types used by each subject group for initial references to the main character*

show that children with Down's syndrome used significantly more Noun Phrases which did not contain a determiner than the typically developing children. Tables in appendix L show the total number of initial references used for each referential form for each character in each condition.

Analysis of Variance was performed on the data concerning initial references to the characters, a full summary table and table of means can be found in appendix M. For this analysis the reference types used were amalgamated into the two summary categories: full and reduced. For this analysis only the proportion of full references which were used by each child in each condition was assessed.

In order to compare the proportion of full references used for the main and peripheral characters in each condition, and in order to compare the performance of each subject group, a 4 (subject group) x 2 (character type) x 2 (position of listener) x 2

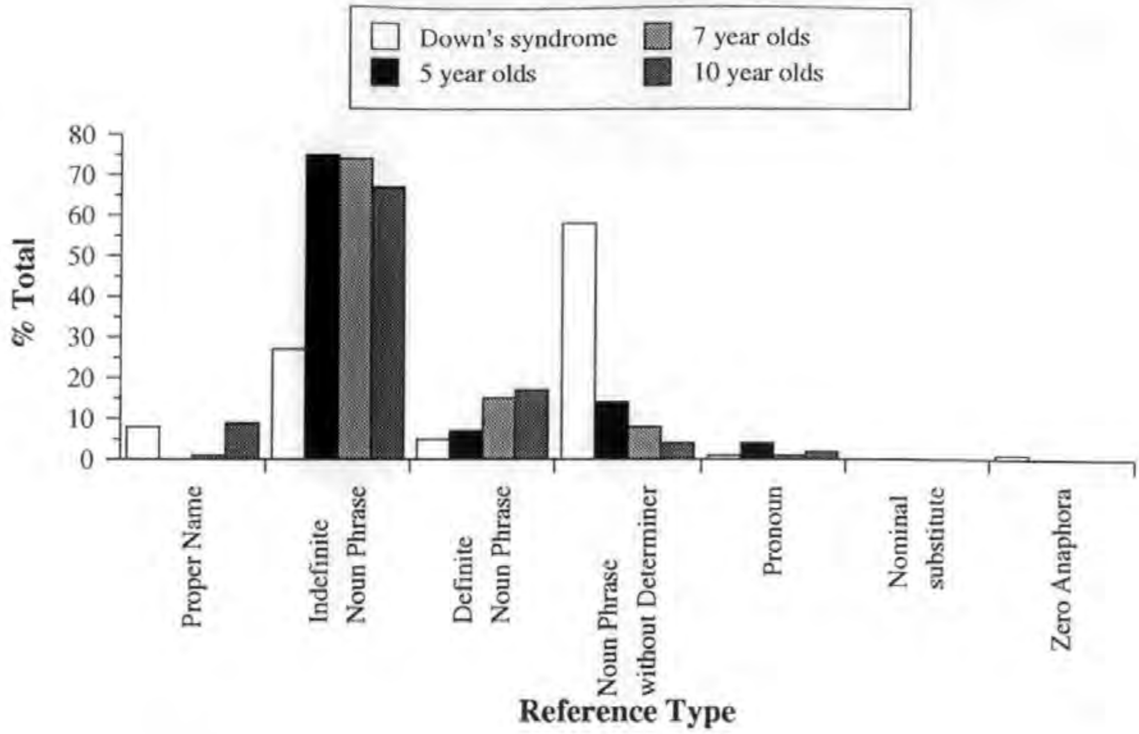


Figure 5.3: *Percentage of reference types used by each subject group for initial references to the peripheral character*

(number of peripheral characters) analysis of variance was performed on the percentage of full references used by each child as an initial reference (dependent variable) in each condition. The details of the main effects can be seen in Table 5.1. No significant main effects or significant interactions were found. It indicates that children with Down's syndrome are not performing significantly differently from typically developing children in their initial reference to characters.

Figures 5.4–5.5 are also included to show the use of full references for the initial reference to each character for each condition. They clearly show that there were no significant main effects of the subject group, the character to whom they were referring, the number of peripheral characters in the story, or whether or not the listener could seen the screen. It must be noted that each subject group used very high levels of full references for both characters, perhaps explaining the absence of any significant main effects in reference types used.

However, although no significant differences were identified, on inspection figures 5.4–5.5 show some interesting differences between the subject groups, as well as in their individual differences for each condition. Children with Down's syndrome used more full references for the main than for the peripheral characters in stories containing one peripheral character—the opposite was true for stories containing two peripheral characters. More of a distinction was made between characters in the two-peripheral-character stories by children with Down's syndrome.

Typically developing five-year-olds made no distinction between characters for any condition, except when the listener was watching in two-peripheral-character stories. In conditions where the listener was not watching ten-year-olds distinguished between the characters, seven-year-olds also made this distinction in one-peripheral-character stories. Interestingly this was not repeated for watching conditions. As with children with Down's syndrome, typically developing children also used more full references for the main character than for the peripheral characters in one-peripheral-character stories, although this was true only in watching conditions for typically developing children.

What is also interesting to note is that in experiment 2 initial references produced significant main effects for all conditions, however these proved to be as a consequence of the distinction made between characters on the still-watching condition by typically developing five-year-olds. This could not be compared with performance in this study since there was no still condition—perhaps explaining the difference in findings between experiments. The two-peripheral-character stories while the listener was watching was the closest comparison which can be made and it is the only condition in which five-year-olds made a (non-significant) distinction between characters, while in all other conditions no distinction was made.

Effect	df effect	df error	F	p
1. Subject Group	3	81	0.2	0.8
2. Character	1	81	2.2	0.1
3. Number of PCs	1	81	2.0	0.2
4. Position of Listener	1	81	0.09	0.8

Table 5.1: *ANOVA findings for Initial References used by All Subject Groups*

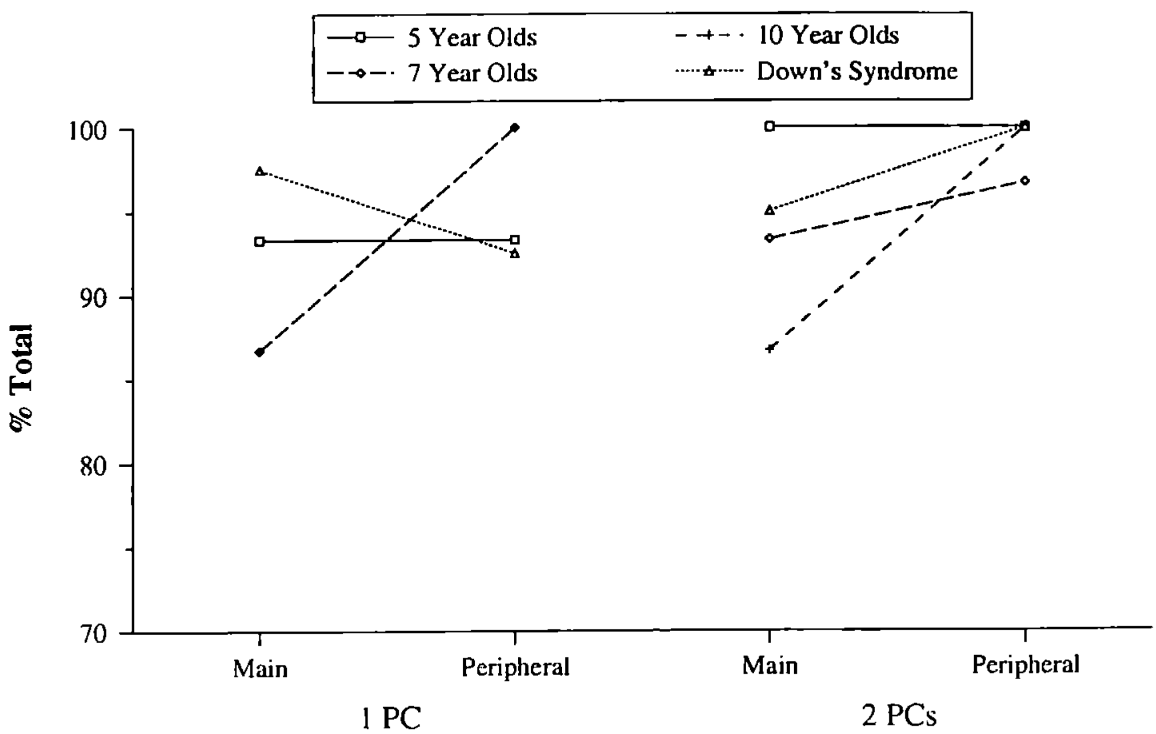


Figure 5.4: *The effects of the number of peripheral characters and the character type on the percentage of full references used for initial references to characters when the listener is not watching*

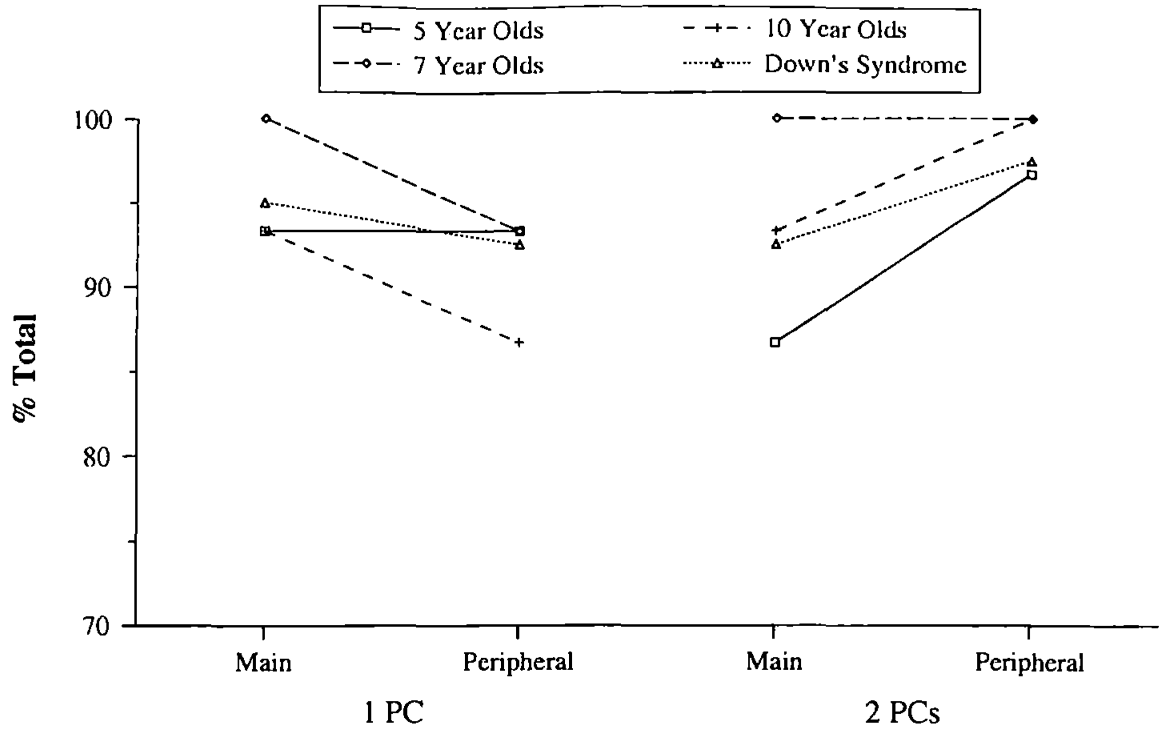


Figure 5.5: *The effects of the number of peripheral characters and the character type on the percentage of full references used for initial references to characters when the listener is watching*

Summary Of Findings

Initial References

- No significant main effects or interactions were found for initial references.
- No significant differences were found between performances by children with Down's syndrome and typically developing children.

5.5.3 Further Reference to Characters Without an Intervening Reference to Another Character

The references in this category are those which are used when the child has continued to refer only to one character without any mention of any other character. The continuing reference to one character limits the need of the speaker to refer to the character using a full reference. When referring to a character who has previously been introduced in the discourse, the speaker must take account of additional sources of linguistic and non-linguistic information when deciding what form of reference to use for that character. For example, the speaker must consider when the character was last referred to, the status of the character, and what contextual information the listener has about the character. Such considerations are not necessary for an initial reference to a character, but are relevant for the type of references considered below and contribute both to the formation and use of a mental representation of the discourse and to the successful use of a thematic subject strategy.

A summary of the types of references used by each subject group can be seen in Figures 5.6–5.7. These figures clearly show that all children recognised that a reduced form was sufficient for continued reference to a character, and that pronouns were most likely to be used. This pattern is more evident for references to the main character (Figure 5.6) than for those for the peripheral characters (Figure 5.7). Children tended to use full references as well as reduced ones for the peripheral characters: this may be because there are often two or more characters in the story when continued referencing occurs for the peripheral character, and the child may assume the need for increased clarity in this case; however, this is further investigated in the analysis which follows. Children with Down's syndrome preferred to use a reduced reference but instead of using a pronoun were more likely to use zero anaphora. They also used more full references for the peripheral characters than for the main character in this category of referencing. Tables in appendix L show the total number of further references without an intervening reference used for each referential form for each character in each condition.

Analysis of Variance was performed on the data concerning continuing references to the characters, a full summary table and table of means can be found in appendix M. For this analysis the reference types used were amalgamated into the two summary categories: full and reduced.

In order to compare the proportion of full references used for the main and peripheral characters in each condition, and in order to compare the performance of each subject group, a 4 (subject) x 2 (character type) x 2 (position of listener) x 2 (number of peripheral characters) analysis of variance was performed on the percentage of full references used by each child as a continuing reference (dependent variable) in each condition. Table 5.2 indicates the results for the main effects and any significant interactions resulting from this analysis. The results indicated that a significantly different proportion of full references was used for each character. The number of peripheral characters also significantly affected the proportion of full references used. There was also a significant interaction between subject group and character type. There was no significant main effect of listener position. Figures 5.8–5.9 display the effects identified in the ANOVA for typically developing children and for children with Down's syndrome. The figures show that each subject group used more full references for the peripheral character than for the main character. Children with Down's syndrome made less of a distinction between characters, since they used more full references for the main character than the typically developing children. There was one significant interaction between subject and character type. These findings are almost identical to those found in experiment 2, except that in experiment 2 there was also a significant main effect of subject group. Further analysis was performed to examine the differences

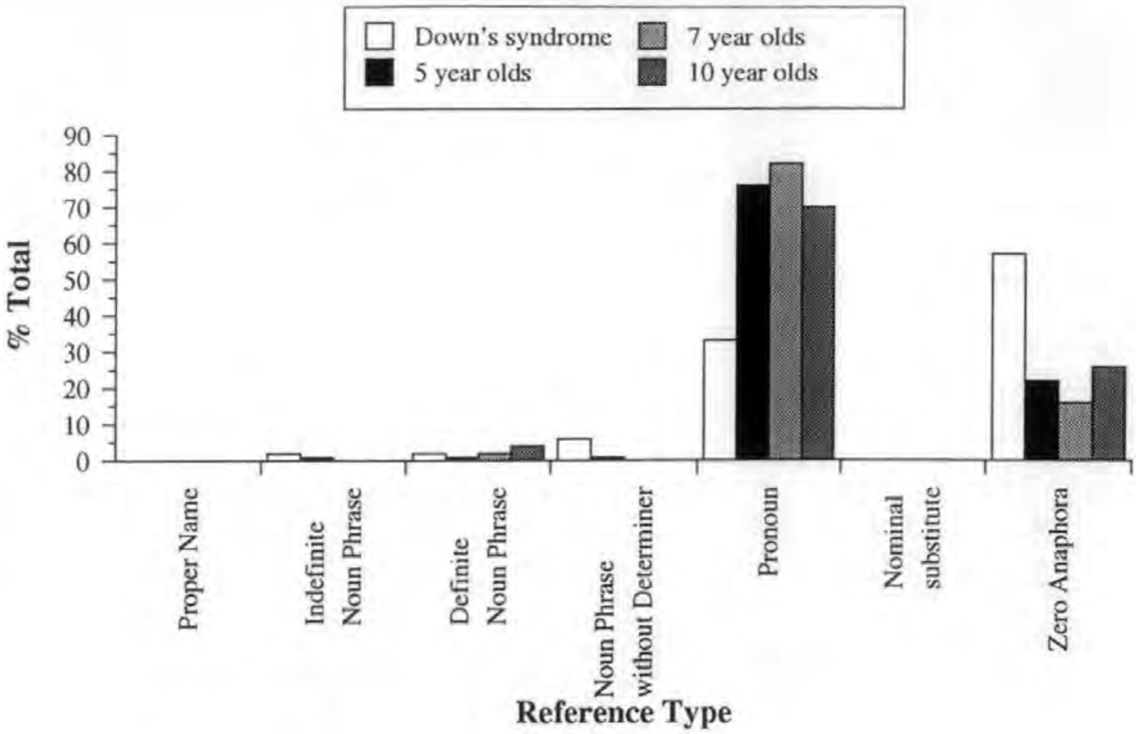


Figure 5.6: *The percentage of reference types used as a further reference to the main character without an intervening reference to another character by each subject group*

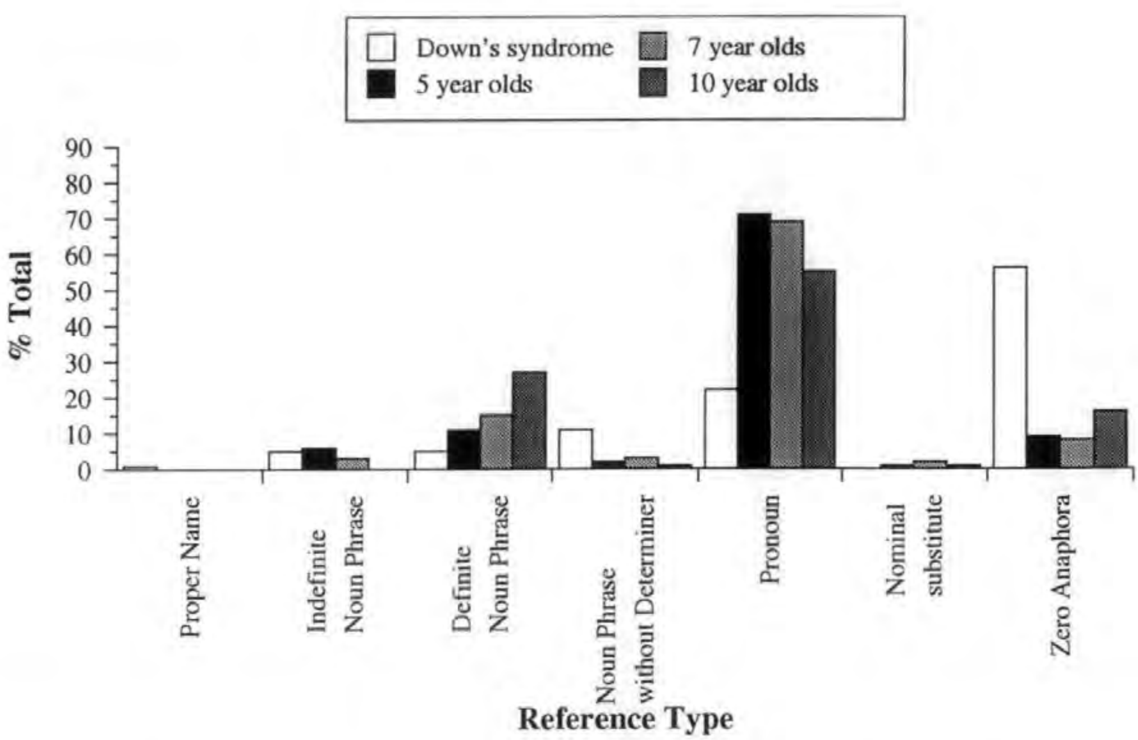


Figure 5.7: *the percentage of reference types used as a further reference to the peripheral character without an intervening reference to another character*

between groups and between conditions. It must be noted that there was an overall low proportion of full references used as further references without an intervening reference to another character by all subject groups.

Post hoc analysis, using Newman-Keuls test, compared the proportion of full references used for each character overall. This showed that five- ($p = 0.003$), seven- ($p = 0.0001$) and ten-year-olds ($p = 0.0001$) used significantly more full references for the peripheral characters than for the main character. This distinction was also made by children with Down's syndrome, which approached significance ($p = 0.07$). However, further analysis showed that while each subject group used more full references for the peripheral character than for the main character, only ten-year-olds showed a significant distinction, for both listener positions but only in two-peripheral-character stories (Watching: $p = 0.04$; Not Watching: $p = 0.01$). The success with which this distinction is made is clearly age-related, where ten-year-olds make the largest distinction and five-year-olds the least—except in "watching one-peripheral-character" stories. Children with Down's syndrome generally made less of a distinction than any other subject group, using more full references for the main character than other groups, and fewer full references than seven- or ten-year-olds for the peripheral characters. However, for each condition children with Down's syndrome showed that they were able to distinguish between characters in the same way as typically developing children—but in a more limited way.

Post hoc analysis using Newman-Keuls test compared the proportion of full references used for each character by each subject group. This revealed that when referring to the main character children with Down's syndrome used more full references than ten-year-olds at a level approaching significance ($p = 0.07$). There were no significant differences in the proportion of full references used by each group of typically developing children for the main character. Significant differences were not found for

Effect	df effect	df error	F	p
1. Subject Group	3	81	0.7	0.6
2. Character	1	81	74.9	0.00001
3. Number of PCs	1	81	8.4	0.005
4. Position of Listener	1	81	0.2	0.6
1*2	3	81	3.9	0.01

Table 5.2: *ANOVA findings for Further References without an intervening reference used by All Subject Groups*

references to the peripheral character, although the proportion of full references used by five-year-olds when compared with ten-year-olds for peripheral characters approached significance ($p = 0.06$). The interaction between character type and subject group occurs as a consequence of ten-year-olds greater distinction between characters than the other groups and the more limited distinction made by children with Down's syndrome.

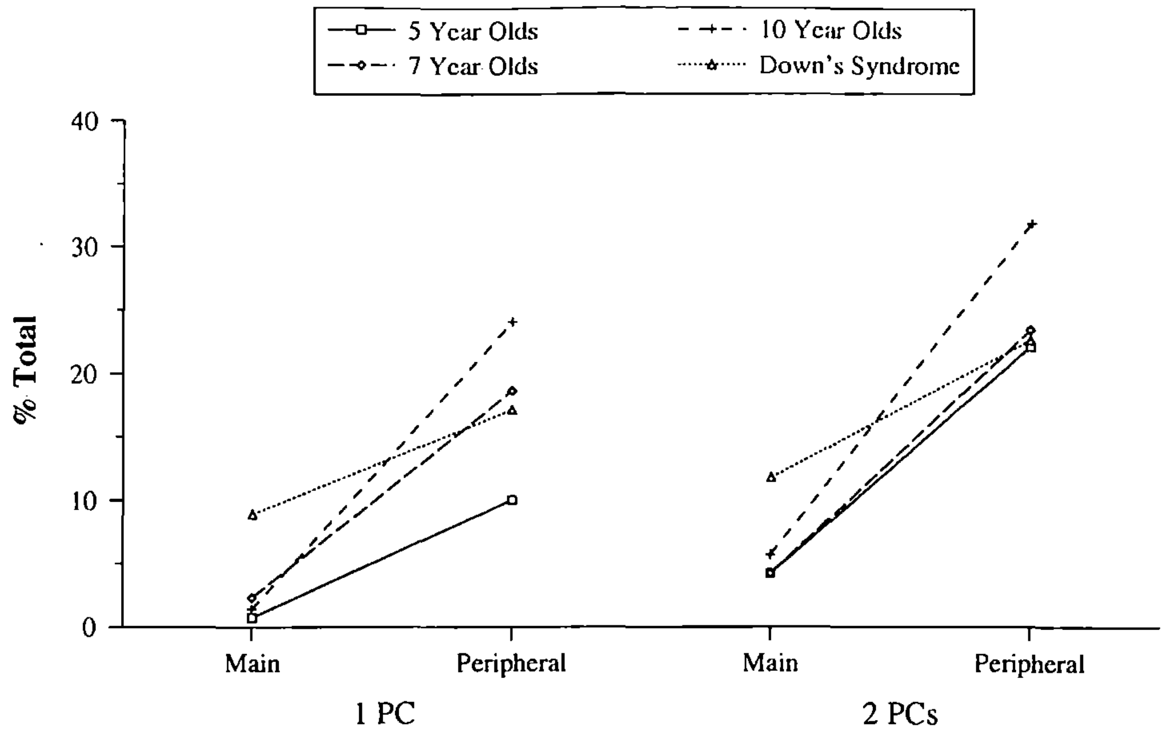


Figure 5.8: *The effect of character type and number of peripheral characters on the percentage of full references used when the reference is a further reference with no intervening reference to another character, in cases where the listener is not watching*

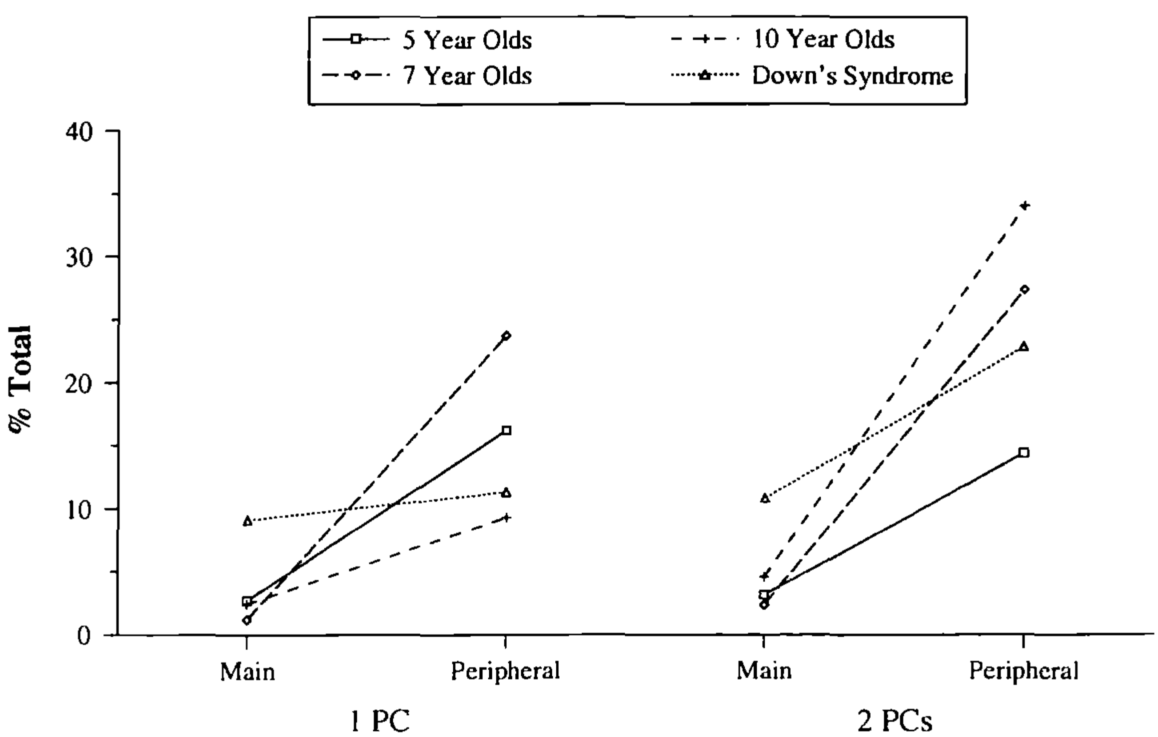


Figure 5.9: *The effect of character type and number of peripheral characters on the percentage of full references used when the reference is a further reference with no intervening reference to another character, in cases where the listener is watching*

Summary Of Findings

Further References without an Intervening Reference

- Significant main effect of character for children with Down's syndrome and typically developing children, more full references were used for the peripheral character than for the main character.
- Significant main effect of the number of peripheral characters in the story for children with Down's syndrome and typically developing children, more full references were used for stories with two peripheral characters than for those with one.
- There was a significant interaction between subject group and character type.
- Children with Down's syndrome used more full references for the main character than ten-year-olds.

5.5.4 Further Reference to the Main and Peripheral Characters Following an Intervening Reference to Another Character

For all subject groups a wide range of referential forms was used for the purpose of re-establishing reference to a character. The results of this initial assessment can be seen in Figures 5.10–5.11. They indicate that the children have the ability to use the linguistic forms. The most frequently used referential forms used as a further reference following an intervening reference were definite Noun Phrases and pronouns. In addition to these referential forms children with Down's syndrome frequently used noun phrases containing no determiner and zero anaphora (see figures 5.10–5.11). Tables in appendix L show the total number of further references following an intervening reference to another character used for each referential form for each character in each condition.

Analysis of Variance

Analysis of Variance was performed on the data concerning re-establishing references to the characters, a full summary table and table of means can be found in appendix M. For this analysis the reference types used were amalgamated into the two summary categories: full and reduced.

In order to compare the proportion of full references used for the main and peripheral characters in each condition by each subject group, a 4 (subject group) x 2 (character type) x 2 (position of listener) x 2 (number of peripheral characters) analysis of variance was performed on the percentage of full references used by each child as a re-establishing reference (dependent variable) in each condition.

Table 5.3 indicates the results for the main effects and any significant interactions resulting from this analysis. The results indicate that a significantly different proportion of full references was used by each subject group. The number of peripheral characters also significantly affected the proportion of full references used. There were two significant interactions between subject and character type, and between subject, character type and listener-position. Figures 5.12–5.13 also show the direction of the effects indicated by ANOVA.

Planned Orthogonal Comparisons

Planned orthogonal comparisons were performed on the data which related to further references to a character after an intervening reference to another character in order to

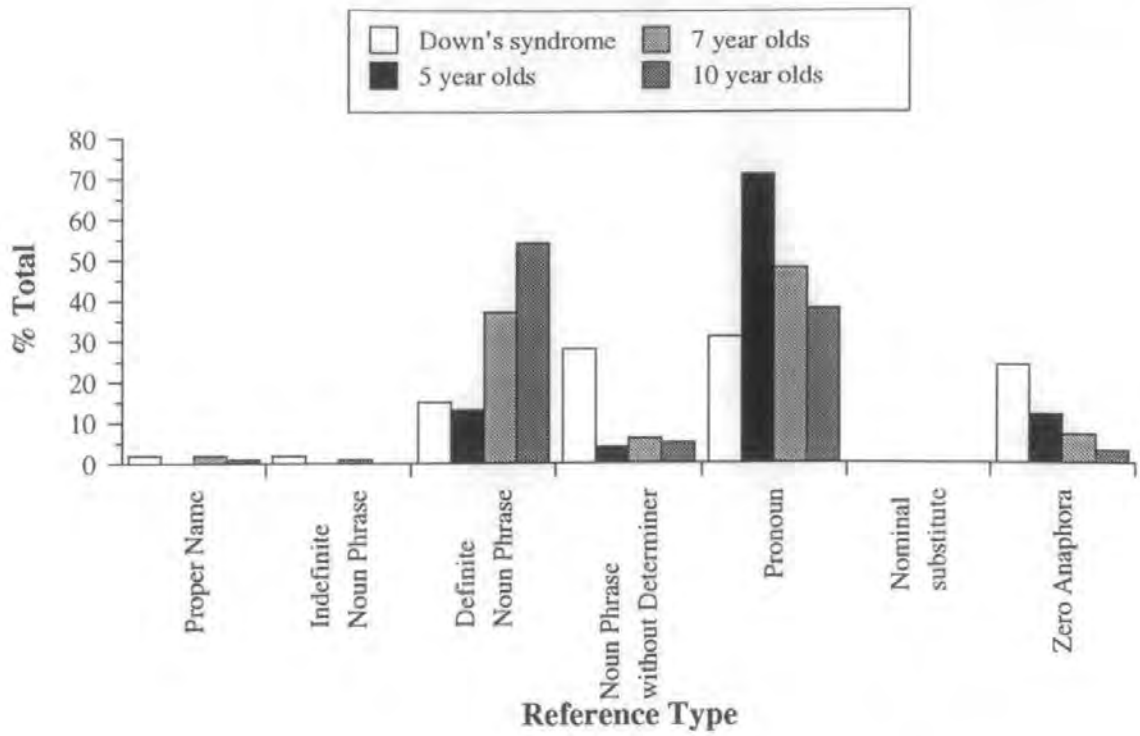


Figure 5.10: *The percentage of reference types used to refer to the main character after an intervening reference to another character by each subject group*

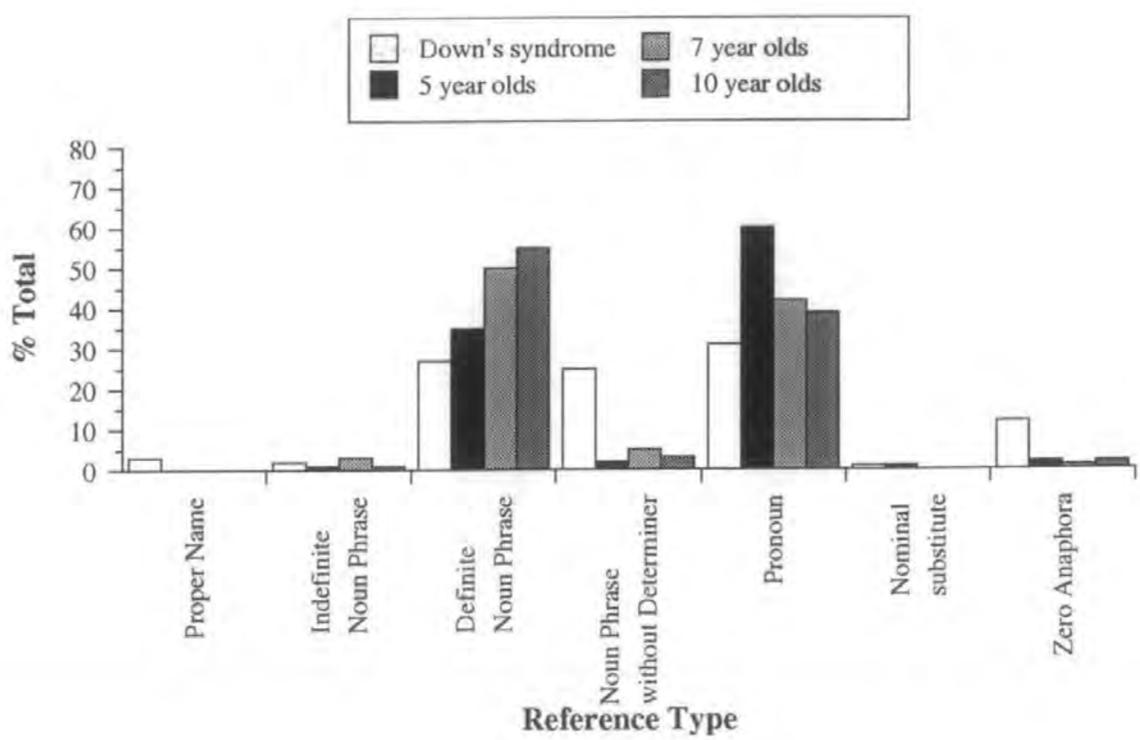


Figure 5.11: *The percentage of reference types used to refer to the peripheral character after an intervening reference to another character by each subject group*

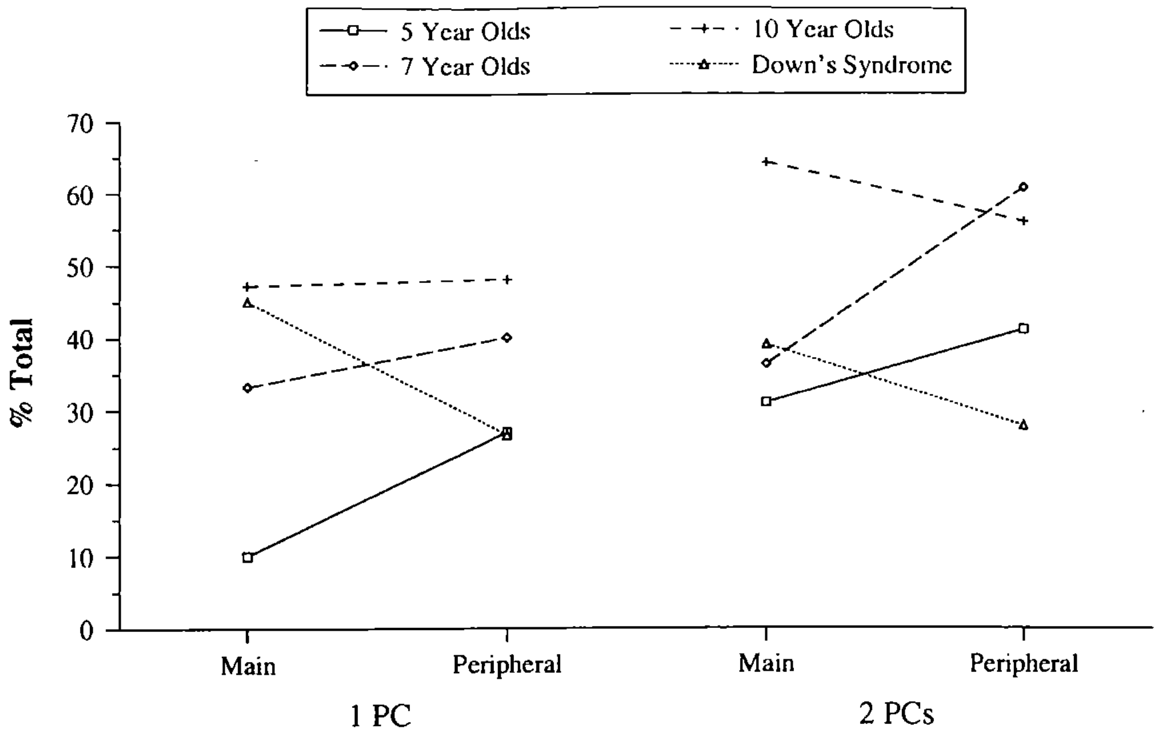


Figure 5.12: *The effect of character type and number of peripheral characters on the percentage of full references used when the reference is a further reference following an intervening reference to another character, in cases where the listener is not watching*

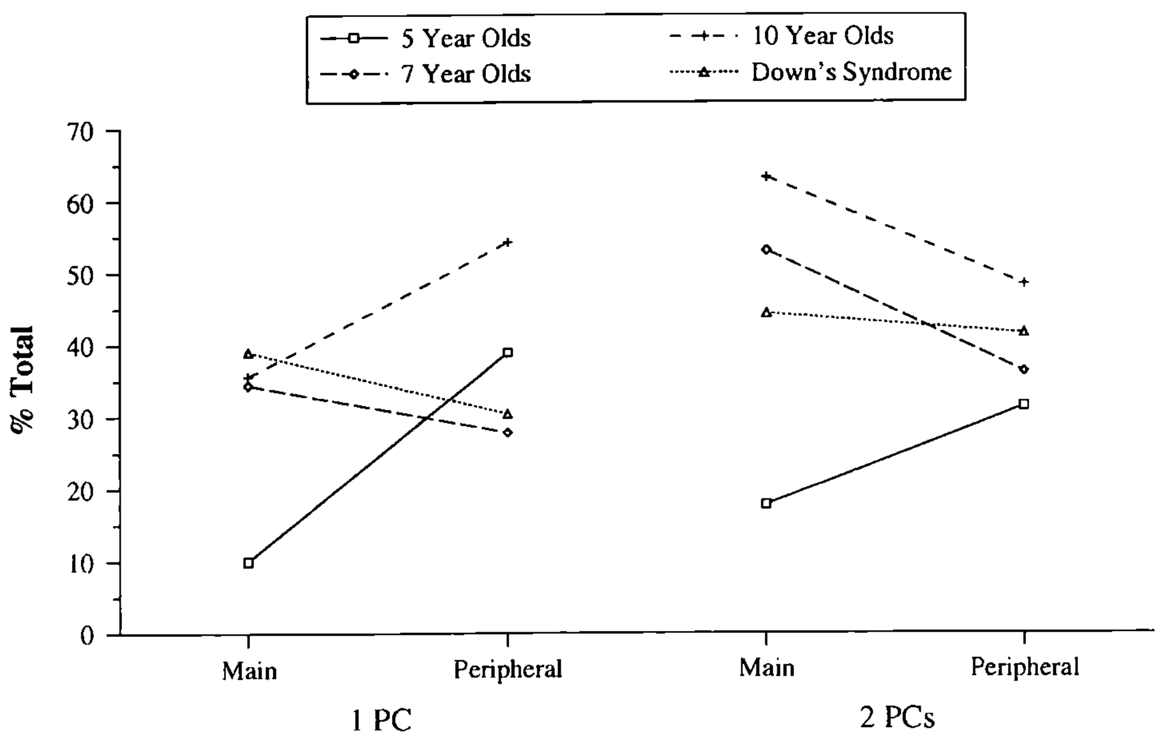


Figure 5.13: *The effect of character type and number of peripheral characters on the percentage of full references used when the reference is a further reference following an intervening reference to another character, in cases where the listener is watching*

Effect	df effect	df error	F	p
1. Subject Group	3	81	4.05	0.01
2. Character	1	81	0.4	0.5
3. Number of Pcs	1	81	6.8	0.01
4. Position of Listener	1	81	0.3	0.6
1*2	3	81	3.6	0.02
1*2*4	3	81	3.03	0.03

Table 5.3: *ANOVA findings for Further References after an intervening reference used by All Subject Groups*

indicate more clearly the reason for significant main effects and significant interactions.

Planned orthogonal comparisons showed that significantly more full references were used for references to the main character when there were two peripheral characters in the story than when there was only one peripheral character in the story (df = 1, 42; F = 15.22; p = 0.0003). Significantly fewer full references for the main character than for the peripheral characters were used by five-year-olds (df = 1, 42; F = 9.41, p = 0.003), while for seven- and ten-year-olds there was very little difference in the proportion of full references used for each character.

Five-Year-Olds When the story contained one peripheral character and when the listener was watching significantly more full references were used for the peripheral character than for the main character (df = 1, 42; F = 7.4; p = 0.009).

When the listener was not watching significantly more full references were used to refer to the main character when there were two peripheral characters in the story than when there was one peripheral character in the story (df = 1, 42; F = 4.24; p = 0.04). Five-year-olds were able to distinguish between the characters only in the one-peripheral character story, when the listener was watching. They also altered their referential strategy when the position of the listener was changed. That five-year-olds distinguished between the characters replicates the finding of Clibbens (1992) and the findings of experiment 2. However, they do so in the condition unlike that used by Clibbens—the one-peripheral-character stories rather than the two-peripheral-character stories.

Seven-Year-Olds When narrating stories where the listener could not see the story and the story contained two peripheral characters, seven-year-olds used significantly more full references for the peripheral characters than for the main character (df = 1, 42; F = 5.5; p = 0.02). When referring to the peripheral characters, in stories containing two peripheral characters, significantly more full references were used when the listener could not see the story than when they could see the story (df = 1, 42; F = 9.08; p = 0.004). This analysis, therefore, showed that while no overall significant effect of character type was found, seven-year-olds used a thematic referential strategy when narrating videos which contain two peripheral characters. An opposite distinction between characters was made for each listener position, this result largely contributes to the interaction between position of listener, character type and subject group. That a thematic referential strategy was used by seven-year-olds supports the finding by Karmiloff-Smith but not Clibbens.

Ten-Year-Olds For ten-year-olds when referring to the main character, and when the listener was watching, significantly more full references were used when there were two peripheral characters in the story than when there was one (df = 1, 42; F = 10.01; p = 0.002). As can be seen for Figure 5.13 this is due to the fact that ten-year-olds used a non-significant thematic subject strategy as identified by Clibbens (1992)—more full references for the main character than for the peripheral character—in one-peripheral character stories, but this was reversed for two-peripheral-character stories. No distinction was made between the main and peripheral characters but these results indicated that ten-year-olds appear to be using different referential forms according to the position of the listener in conjunction with the number of peripheral characters in the story—contributing to the significant interaction between these three variables.

Children with Down's syndrome Overall more full references were used for the main character than for the peripheral character, this difference approached significance (df = 1, 39; F = 3.7; p = 0.06). This difference was only significant in stories where there was one peripheral character and the listener could not see the story (df 1, 39; F = 4.6; p = 0.04). All other conditions produced non-significant results. The distinction between characters does not correspond to, and is in fact opposite to the thematic subject strategy identified by Karmiloff-Smith or Clibbens. However, it does indicate that under certain circumstances children with Down's syndrome are able to differentiate linguistically between characters in a story. It suggests that by minimising the number of peripheral character in the story and thereby maximising the difference in status, children with Down's syndrome are able to distinguish the status of each character. This result also indicates that children with Down's syndrome recognise the need to re-establish reference to a character more clearly when the listener cannot see the screen and are able to do this, as well as linguistically marking the status of the characters when the difference between the status of the characters is maximised. But the way they choose to do this is opposite to the way in which Clibbens (1992) and Karmiloff-Smith (1985) have observed it occurring in typically developing children. That this type of distinction occurs only for children with Down's syndrome (at a significant level) suggests that the way in which character status is represented may be different from typically developing children.

Post Hoc Analysis

Post hoc analysis was carried out using Newman-Keuls test, in order to compare the differences in performance of each subject group. Children with Down's syndrome used significantly fewer full references than ten-year-olds ($p = 0.04$), and approaching significantly more full references than five-year-olds ($p = 0.09$). Further Newman-Keuls follow-up analysis was used to compare the proportion of full references used for each character by each subject group. This revealed that when referring to the main character children with Down's syndrome used significantly more full references than five-year-olds ($p = 0.001$). When referring to the peripheral character, children with Down's syndrome used significantly fewer full references than ten-year-olds ($p = 0.01$). Five-year-olds were found to use significantly fewer full references than seven-year-olds ($p = 0.01$) and ten-year-olds ($p = 0.001$) when referring to the main character. There were no significant differences in the proportion of full references used by each group of typically developing children for the peripheral character. What is also interesting to note from Figures 5.12–5.13 is that children with Down's syndrome performed very similarly to seven-year-olds in "watching" videos, while in "not watching" videos children with Down's syndrome performed differently from all typically developing children.

Newman-Keuls analysis was also used to assess the differences identified by the analysis of variance in the interaction between the subject group, character type, and position of the listener. When referring to the peripheral character while the listener could not see the screen, children with Down's syndrome used significantly fewer full references than seven-year-olds ($p = 0.02$) and ten-year-olds ($p = 0.01$). When referring to the main character, children with Down's syndrome used significantly more full references than five-year-olds, both when the listener could see the screen ($p = 0.001$) and when they could not ($p = 0.01$). Five-year-olds also showed that when referring to the main character when the listener could see the screen, they used significantly fewer full references than seven-year-olds ($p = 0.01$) and ten-year-olds (0.001). When referring to the main character when the listener could not see the screen they used significantly fewer full reference than ten-year-olds only ($p = 0.001$). No significant differences were found for references to the peripheral character by typically developing children.

Summary Of Findings

Further References after an Intervening Reference

- Significant main effects of subject group and number of peripheral characters in the story—more full references were used in two-peripheral-character stories than in one-peripheral-character stories.

- Significant interactions between subject and character; and subject, character and listener position, largely explained by the references used by seven-year-olds.

- For children with Down's syndrome, the effect of character was found to be significant only for one-peripheral-character stories, in cases where the listener could not see the screen—more full references were used for the main character than the peripheral character.

- Children with Down's syndrome used fewer full references than ten-year-olds for references to the peripheral character, and significantly more full references than five-year-olds for the main character.

5.5.5 Re-establishing Reference to the Peripheral Characters

The strategy for referring to the peripheral characters was further assessed, focusing particularly on the types of references which were used to re-establish reference to the peripheral characters for stories in which there were two peripheral characters. From this analysis it is possible to assess whether or not the child perceives a difference in status of the two peripheral characters in the story. This analysis was carried out in order to highlight possible reasons why children with Down's syndrome find it difficult to apply a referential strategy in narrations of videos containing two peripheral characters. Previous analysis of variance and planned orthogonal comparisons assessed the ability to re-establish reference to peripheral characters by comparing referential strategies for videos which contained only one peripheral character with that for videos which contained two peripheral characters. Analysis in this section assessed the references used for the first peripheral character to appear in the story compared with the references used for the second peripheral character to appear in the story. The proportion of full references used to refer to each of the peripheral characters is displayed in Figure 5.14. It can clearly be seen that, for each subject group, a similar number of full references were used for the first and second peripheral characters. Figure 5.15 shows the proportion of each type of reference which was used for each peripheral character, by each subject group. Both figures show that there was very little difference in the type of reference used, especially the proportion of full references used for each peripheral character.

Analysis of Variance

The proportion of full references used to re-establish reference to each peripheral character was found to be similar for each of the subject groups. Since analysis which assessed the proportion of full references used for each character would have yielded

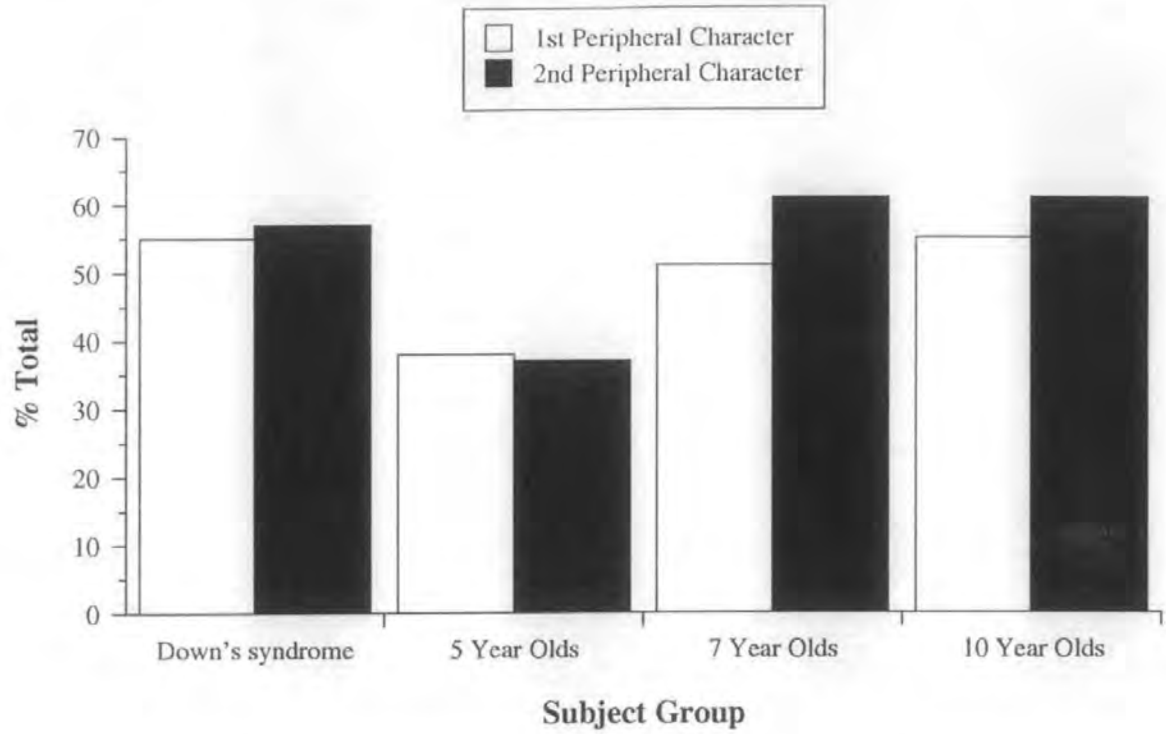


Figure 5.14: *The percentage of full references used by each subject group to refer to each peripheral character*

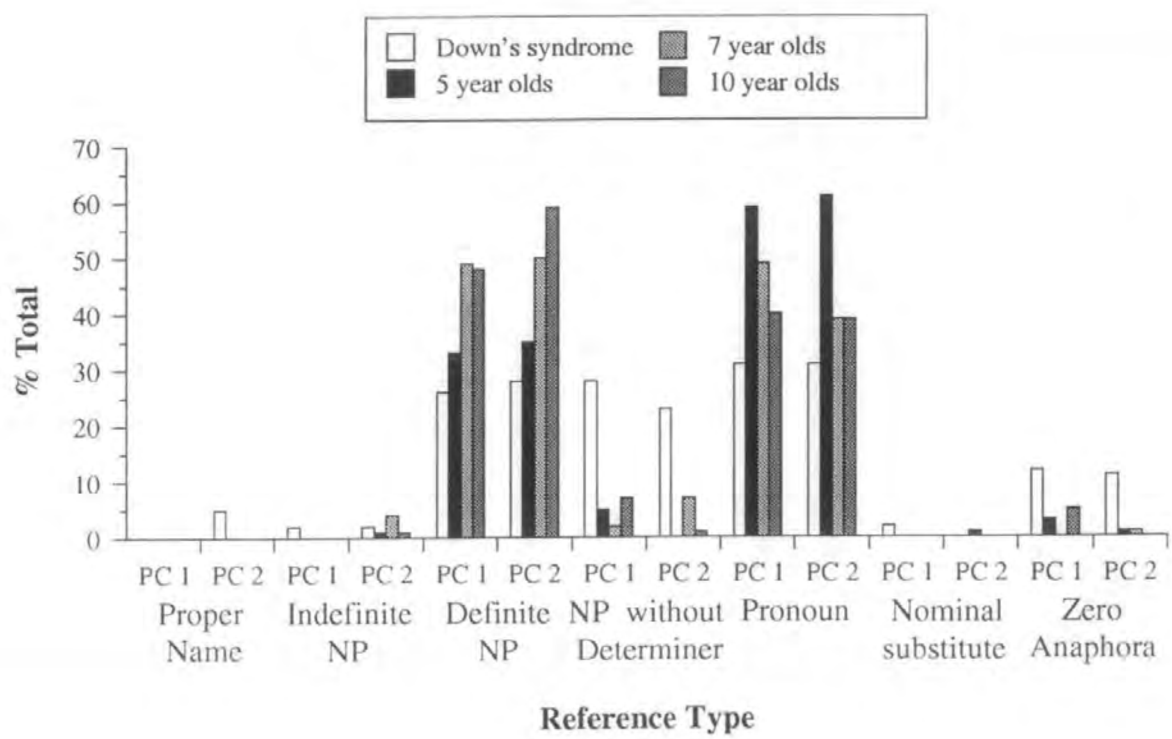


Figure 5.15: *The percentage of references used by each subject group for each peripheral character*

no differences, the specific type of full reference which was used for each peripheral character was assessed. Three reference types were assessed, the first two categories are similar to those used in previous analysis, while the third category was added for clarity. The first category contained those references which were indefinite, for example "another bunny"; the second group were those which were definite, for example "the other bunny"; and the third group were those which relied on a description of the character, for example "teddy with a bobble hat on".

The proportion of full references used to refer to the first and second peripheral characters, when having to re-establish reference, was assessed using Analysis of Variance. In order to compare the proportion of each reference type used for each of the peripheral characters, a 3 (age) x 3 (reference type) x 2 (character) analysis of variance was performed on the percentage of references used by each child as a re-establishing reference (dependent variable) for typically developing children. For children with Down's syndrome a 3 (reference type) x 2 (character) analysis of variance was performed. The details of the main effects and any significant interactions can be seen in Table 5.4 for typically developing children and children with Down's syndrome.

For typically developing children, the significant main effects which were found included the age of the child, the reference type used, and the character to whom they were referring. There were also significant interactions of the age of the child and the character type, as well as between character type and reference type.

For children with Down's syndrome, there was no significant main effect of reference type used, indicating that no reference type was used in a significantly different proportion from the rest. There was a significant main effect for the character being referred to, indicating that different reference types were used for each character. There was also a significant interaction between the reference type used and the character being referred to. These results indicate that both children with Down's syndrome

	Normally Developing Children				Children With Down's Syndrome			
Effect	df effect	df error	F	p	df effect	df error	F	p
1. Age of Child	2	42	5.79	0.006				
2. Reference Type	1	42	12.69	0.001	1	39	0.97	0.38
3. Character	1	42	21.04	0.001	1	39	21.3	0.001
1*2	2	42	2.03	0.09				
1*3	2	42	7.17	0.002				
2*3	1	42	8.38	0.001	1	39	10.26	0.001
1*2*3	2	42	0.47	0.75				

Table 5.4: *ANOVA findings for References used to Distinguish between the Two Peripheral Characters for Both Subject Groups*

and typically developing children were able to distinguish between the two peripheral characters using linguistic forms when re-establishing reference.

Planned Orthogonal Comparisons

Further analysis of these results using Planned Orthogonal Comparisons indicated more clearly the reason for the significant results. This analysis is outlined below.

Typically Developing Children For typically developing children the planned comparisons showed that significantly more indefinite references were used for the second peripheral character than for the first peripheral character (df = 1, 42; F = 19.2; p = 0.0001), while the use of the other reference types did not differ significantly.

Distinction between First and Second Peripheral Character Five-year-olds made a significant distinction overall between the first and second peripheral character (df = 1, 42; F = 32.2; p = 0.0001), whereas the other age groups did not.

References to the First Peripheral Character When referring to the first peripheral character, the only significant difference identified was that for seven-year-olds, significantly fewer definite than descriptive references were used (df = 1, 42; F = 6.32; p = 0.01).

References to the Second Peripheral Character For the second peripheral character five-year-olds used significantly more indefinite references than descriptive references (df = 1, 42; F = 6.5; p = 0.01). When seven-year-olds referred to the second peripheral character significantly more indefinite references were used than either definite (df = 1, 42; F = 17.15; p = 0.0001) or descriptive references (df = 1, 42; F = 7.7; p = 0.01). Seven-year-olds also used significantly more definite references than descriptive ones (df = 1, 42; F = 4.04; p = 0.05). Ten-year-olds used significantly more indefinite references to re-establish reference to the second peripheral character than either definite (df = 1, 42; F = 12.4; p = 0.001) or descriptive (df = 1, 42; F = 8.2; p = 0.01) references.

Children with Down's syndrome

Distinction Between Reference Types For children with Down's syndrome significantly more definite references (df = 1, 39; F = 22.4; p = 0.001) and indefinite references (df = 1, 39; F = 6.02; p = 0.01) were used to refer to the second peripheral character than to the first peripheral character.

Distinction between First and Second Peripheral Characters For the first peripheral character significantly more descriptive references were used than either definite references (df = 1, 39; F = 8.27; p = 0.006) or than indefinite references (df = 1, 39; F = 4.9; p = 0.03). However when referring to the second peripheral character significantly more definite than descriptive references were used (df = 1, 39; F = 5.08; p = 0.03).

Summary Of Findings

Re-establishing Reference to Peripheral Characters

- For typically developing children there were significant main effects of age, reference type, and character. There were also significant interactions between age and character, and character and reference type.

- For both typically developing children and children with Down's syndrome a referential hierarchy was identified—where descriptive noun phrases were used for the first peripheral character, and indefinite or definite noun phrases were used for the second peripheral character.

- For children with Down's syndrome, there was a significant main effect of character, and a significant interaction between character and reference type.

5.5.6 Identifying the Main and Peripheral Characters

Each child was asked a series of questions immediately after they narrated each story. The questions were accompanied by photographs of characters which were in the story as well as photographs of "dummy" characters. These photographs were used in order to alleviate cognitive overload or memory difficulties which might have hindered the performance of children with Down's syndrome and younger-aged children. Only data obtained from children with Down's syndrome was examined since typically developing children of all age groups correctly identified the main character for all questions. Table 5.5 shows the responses made by children with Down's syndrome to each of the questions, where the "correct" answer should be to identify the main character. Table

Question	Main Character	Peripheral Character	Other	No Answer
Who?	74	70	16	0
Main?	53	60	14	33
Important?	42	36	0	82
Longest?	36	29	5	90

Table 5.5: *Total Responses to Questions by Children with Down's syndrome*

Question	Main Character	Peripheral Character	Other
Who?	46	44	1
Main?	42	47	11
Important?	54	46	0
Longest?	51	41	7

Table 5.6: *Proportion of Responses to Questions by Children with Down's syndrome*

5.6 shows the total responses given as a proportion of the total responses made on each question. The tables indicate that most responses were made to the first two questions, while the second two were found to be more difficult. It can also be seen that the main character and the peripheral character were identified in similar proportions as being the correct response to each of the questions.

Correlations

The number of correct responses to each question was examined using a Pearson's product-moment correlation. It was expected that the ability to identify the main character in the first question would be followed by correct responses to the other questions which asked who the main or most important character was. Consistency of correct responses would indicate that the status of the characters had been internally

	Refs to MC	Refs to PC	Who?	Main?	Important?	Longest?
Refs to MC	1					
Refs to PC	0.18	1				
Who?	-0.22	-0.21	1			
Main?	-0.01	-0.02	0.33*	1		
Important?	-0.17	0.37*	0.24	0.62*	1	
Longest?	0.03	0.42*	0.41*	0.54*	0.49*	1

* indicates significance at ($P < 0.05$)

Table 5.7: *Correlation between the Responses to the Questions and the Percentage of Full References Used for Each Character by Children with Down's syndrome*

represented. Table 5.7 indicates the findings. The results showed that when the child correctly identified the main character in the first question they continued to do so for the other questions—indicating that they had internally represented the status of the characters. It was expected that if the child had internally represented the status of the characters this would enable them to correctly identify the main character in answer to the questions and also use a referential strategy to mark the status of the characters in the narration task. Therefore, the responses to questions was correlated with the proportion of full references made to each of the characters, showing some positive correlations between answers given and the peripheral character, but not for the main character.

Summary Of Findings

Response to Questions by Children with Down's syndrome

- Significant correlations were identified between the proportion of full references used to re-establish reference to the peripheral characters and the question responses.
- Significant correlations were identified between each question response.
- No significant difference in the number of times "main character" and "peripheral character" were given in response to each question for which "main character" was the correct answer.

5.5.7 Performance on Standardised Tests

The chronological age of each child, as well as their performance on each of the standardised tests used has been recorded and used to assess any possible relationships between performance on the tests, age, and referential strategy. For each subject group both the chronological age and the age-equivalents obtained on each of the standardised tests can be seen in figure 5.16.

This clearly shows that, while children with Down's syndrome are functioning at a level noticeably below that of the five-year-old group for each of the tests, the other groups are achieving age-equivalent scores of approximately their chronological age. For the BPVS, seven- and ten-year-olds seem to be functioning at a level identical to their chronological age, while for five-year-olds the average achievement is almost two years above the expected performance. For both the Raven's Progressive Matrices and the TROG, the age equivalent is slightly below the chronological age of seven- and

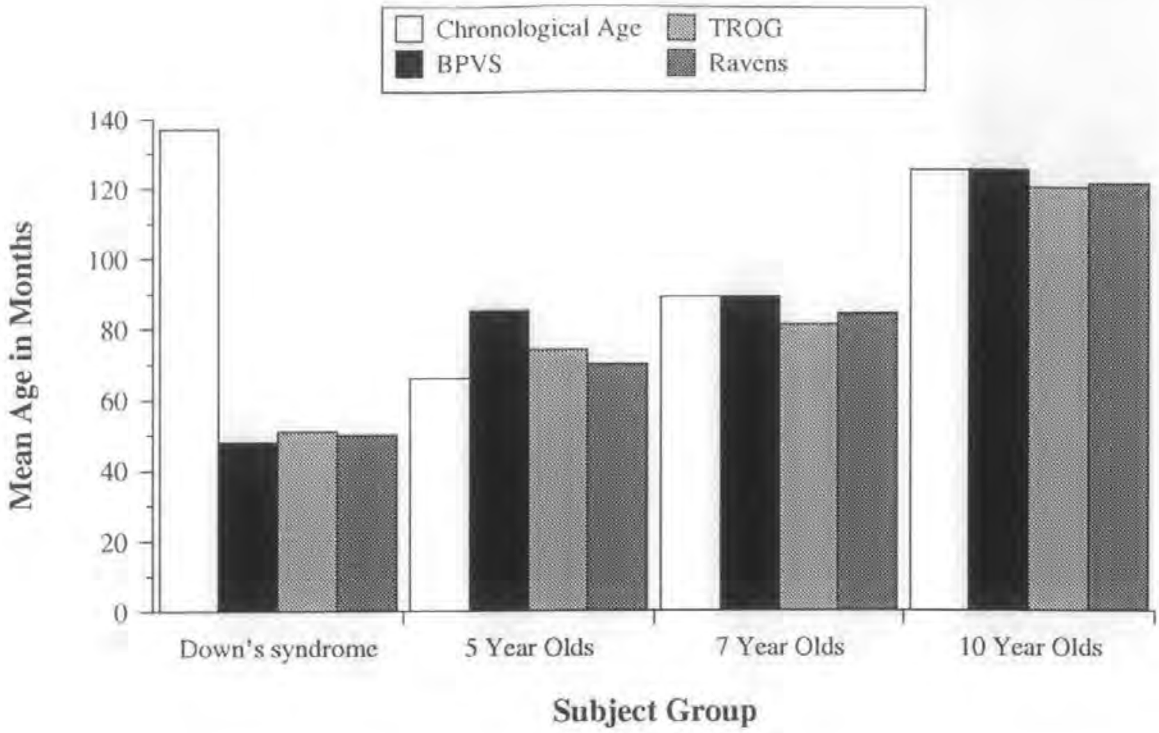


Figure 5.16: *Mean chronological age and standardised test age-equivalents for each subject group*

ten-year-olds, while for five-year-olds performance is slightly above their chronological age. All typically developing children found Ravens and TROG more difficult than the BPVS. Children with Down's syndrome performed almost identically on all tests although a slightly higher age-equivalent was obtained for TROG while BPVS proved most difficult.

Figures 5.17–5.20 indicate the mean age equivalent scores, together with standard deviations, achieved on each of the tests and the mean chronological age for both the typically developing children and children with Down's syndrome. What seems most apparent from these figures is the variability in performance of all subject groups.

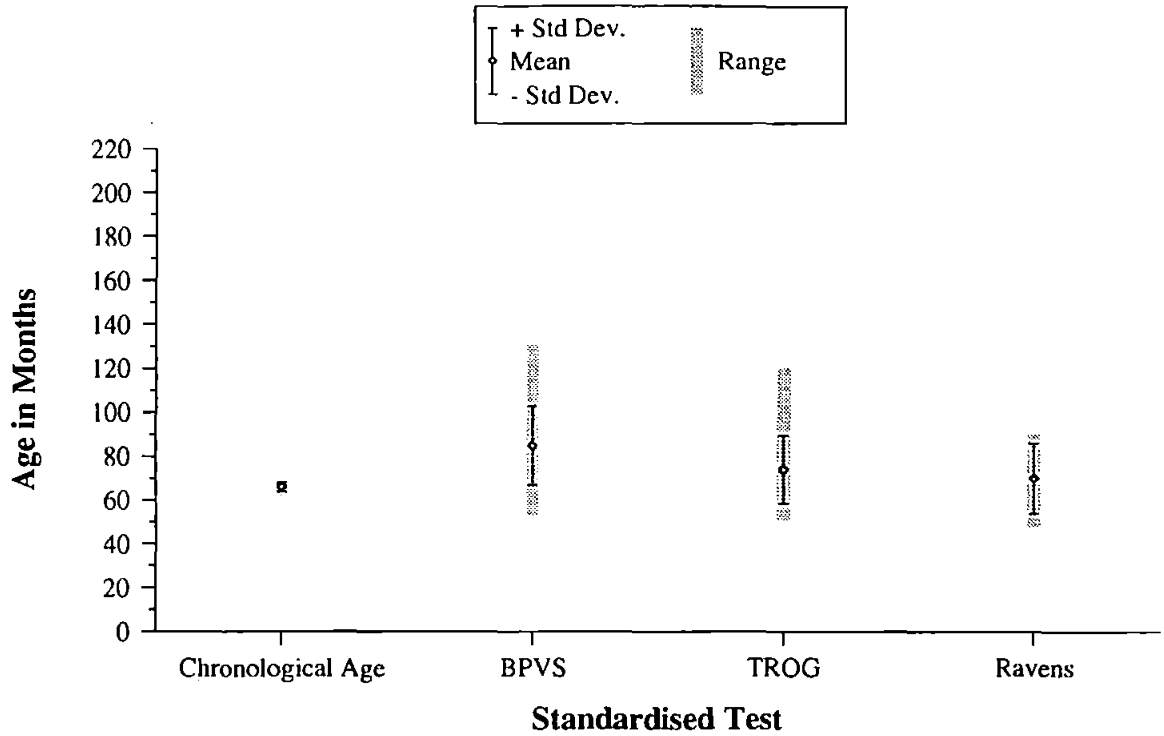


Figure 5.17: *Distribution of chronological, cognitive and language age for typically developing five-year-olds*

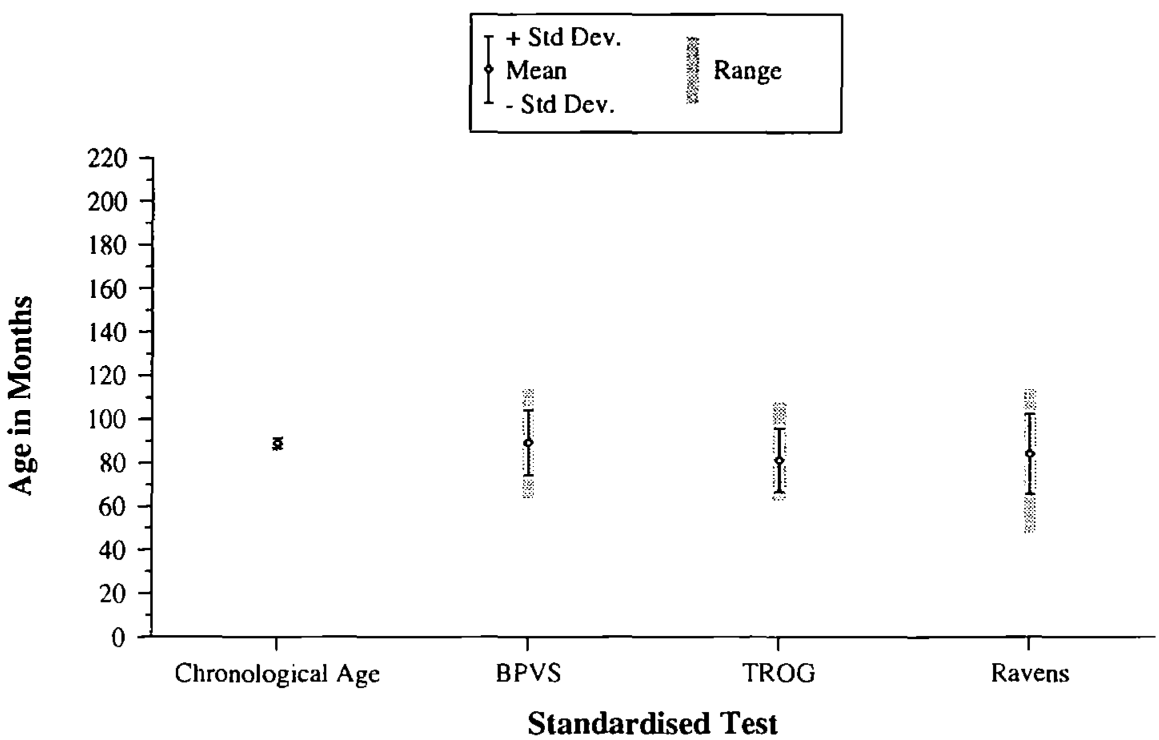


Figure 5.18: *Distribution of chronological, cognitive and language age for typically developing seven-year-olds*

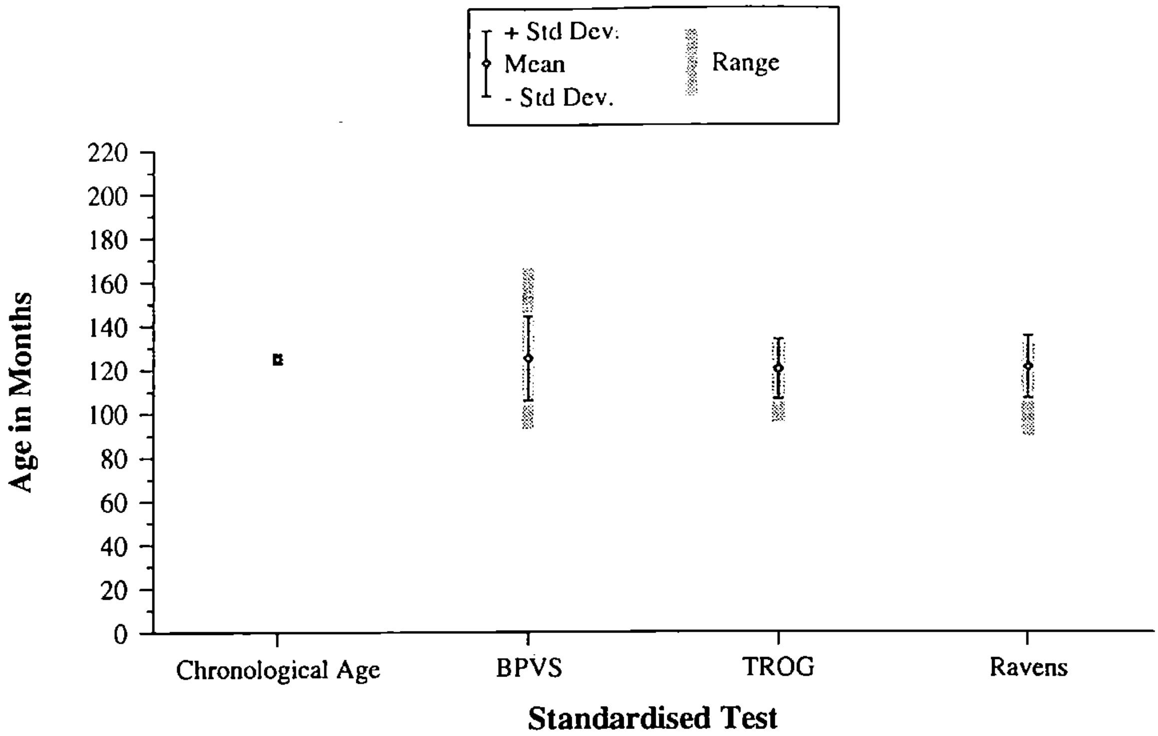


Figure 5.19: *Distribution of chronological, cognitive and language age for typically developing ten-year-olds*

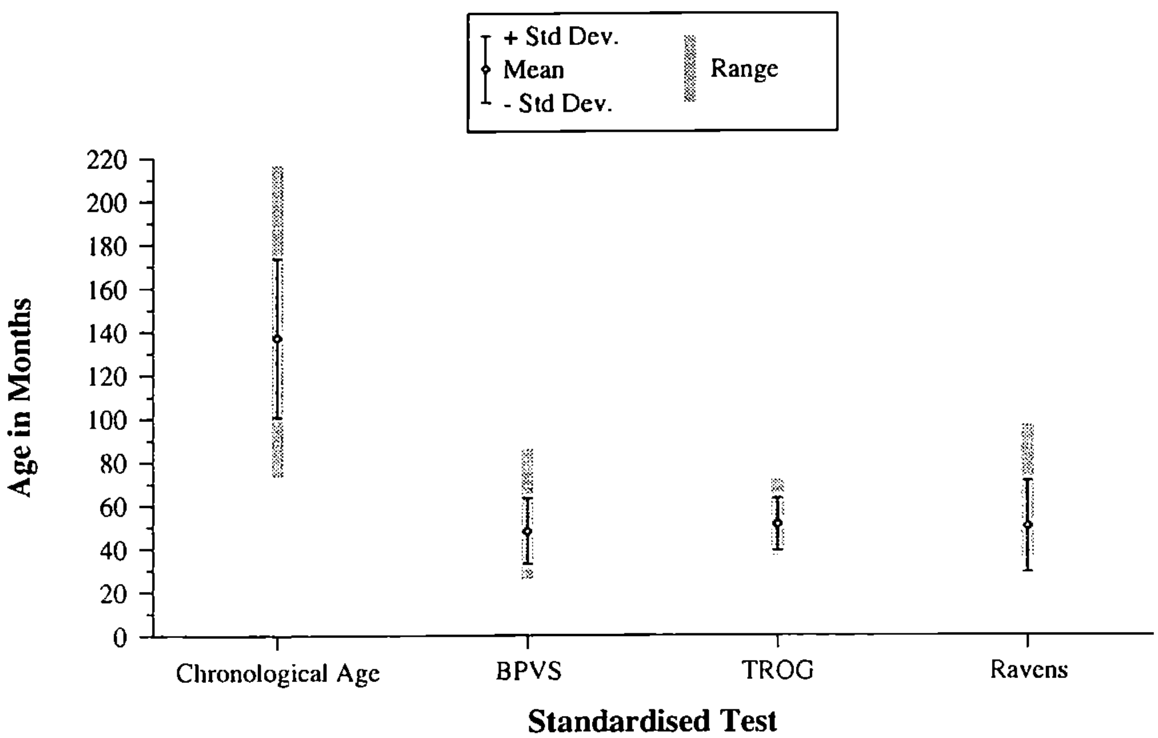


Figure 5.20: *Distribution of chronological, cognitive and language age for children with Down's syndrome*

Correlation Matrix Data

Correlations have been performed to assess the relationship between the references used to refer to each character, the test scores achieved on each of the standardised tests, and the chronological age of each of the children. Table 5.8 shows the results for children with Down's syndrome, while results for typically developing children are described separately. For children with Down's syndrome, performance on standardised tests correlated significantly with references used for the main character in videos where there was one peripheral character and the listener was not watching. For references to the peripheral character, significant correlations were identified between standardised test scores and references used in videos containing two peripheral characters when the listener was not watching.

When the performance on standardised tests was compared with the references used by typically developing children in each experimental condition for both characters, no clear pattern emerged. For five-year-olds chronological age, but no standardised test scores, correlated with references used for the main character in stories where the listener was not watching and there was one peripheral character (r=0.54). CA also correlated significantly with references used for the peripheral character both when the listener was not watching and there were two peripheral characters (r=0.53), and when the listener was watching in one-peripheral-character stories (r=0.54).

For seven-year-olds CA did not correlate significantly, but each standardised test score correlated significantly with a different condition. References to the peripheral character in stories where the listener was watching and there were two peripheral characters correlated with BPVS (r=0.54), and Raven's (r=0.52). TROG correlated significantly with references to the main character in stories where the listener was not watching and there were two peripheral characters (r=0.55).

For ten-year-olds only references to the main character correlated with language

	Main Character				Peripheral Character			
	Listener Not Watching		Listener Watching		Listener Not Watching		Listener Watching	
	1 PC	2 PCs	1 PC	2 PCs	1 PC	2PCs	1 PC	2 PCs
CA	-0.31	0.06	-0.15	0.03	-0.09	0.08	-0.04	-0.01
BPVS	0.49*	0.01	0.09	-0.01	0.17	0.47*	0.18	0.24
Ravens	-0.53*	-0.2	-0.16	0.01	0.22	0.31*	0.23	0.3
TROG	-0.39*	0.18	0.02	0.05	0.31*	0.54*	0.27	0.37*

* indicates significance at ($P < 0.05$)

Table 5.8: *Correlation between the Standardised Test Scores and the Percentage of Full References Used for Each Character by Children with Down's syndrome*

measures in conditions were the listener was watching. BPVS correlated only in the two-peripheral-character condition (r=0.54), while TROG correlated in both the one- (r=0.55), and two-perpheral-character conditions (r=0.54).

Correlations between the scores on each of the standardised tests have also been performed in order to establish whether for each child the performance on each of the tasks is similar. Scores on standardised tests correlated significantly with each other for children with Down's syndrome, five- and seven-year-olds (see tables 5.9, 5.10, and 5.11). For ten-year-olds only TROG and BPVS correlated significantly (r=0.92). There were no significant correlations between standardised test scores and chronological age. Correlations were performed on the proportion of full references used for each character in each condition, in order to assess whether there was a relationship between the proportion used in one condition relative to another condition. For children with Down's syndrome only two significant results were found. First when referring to the peripheral character in one-peripheral-character stories a significant correlation occurred between references used when the listener was watching and was not watching (r=0.43). Second, in two-peripheral-characters stories a significant correlation occurred between references used when the listener was watching and was not watching (r=0.37)

	CA	BPVS	Ravens	TROG
CA	1			
BPVS	-0.30	1		
Ravens	-0.22	0.68*	1	
TROG	-0.02	0.85*	0.55*	1

* indicates significance at ($P < 0.05$)

Table 5.9: *Correlation between Standardised Test Scores for Five-Year-Olds*

	CA	BPVS	Ravens	TROG
CA	1			
BPVS	-0.16	1		
Ravens	-0.26	0.87*	1	
TROG	-0.21	0.94*	0.80*	1

* indicates significance at ($P < 0.05$)

Table 5.10: *Correlation between Standardised Test Scores for Seven-Year-Olds*

	CA	BPVS	Ravens	TROG
CA	1			
BPVS	0.51	1		
Ravens	0.59	0.74*	1	
TROG	0.43	0.81*	0.8*	1

* indicates significance at ($P < 0.05$)

Table 5.11: *Correlation between Standardised Test Scores for Children with Down's syndrome*

	CA	BPVS	Raven's	TROG
Who?	0.15	0.14	0.25	0.24
Main?	0.05	0.29	0.43*	0.43*
Important?	0.29	0.41*	0.56*	0.55*
Longest?	0.25	0.44*	0.59*	0.56*

* indicates significance at ($P < 0.05$)

Table 5.12: *Correlation between the Responses to the Questions, Chronological Age, and the Scores Obtained on Each Standardised Test by Children with Down's syndrome*

For typically developing children very few significant correlations were found. For five-year-olds significant correlations were found only for references to the peripheral character, when comparing the listener position in the one-peripheral-character condition (r=0.53), an in the two-peripheral-character condition (r=0.76). For seven-year-olds significant correlations occurred only in conditions where the listener was not watching. First, in the one-peripheral-character condition when comparing references to the main and peripheral characters (r=0.86). Second, comparing references to the main character in the one-PC condition with references to the peripheral character in the two-PC condition (r=0.62). Third, comparing references to the main character in the two-PC condition with references to the peripheral character in one-PC condition (r=0.60). For ten-year-olds only references to the main character in conditions were the listener was not watching correlated significantly with other references to the main and peripheral characters: for the main character, when comparing the number of peripheral characters (r=0.80); and when comparing references to the main and peripheral characters in two-PC conditions (r=0.64).

Correlations were also performed in order to compare chronological age, the performance on standardised tests, and the responses to questions for children with Down's syndrome. Table 5.12 indicates the findings. No significant correlation was found be-

	BPVS		TROG		Raven's		CA	
	F	p	F	p	F	p	F	p
Down's Syndrome	3.8	0.06	2.5	0.1	3.7	0.06	5.6	0.02
5 year-olds	3.3	0.09	1.1	0.3	0.3	0.6	0.4	0.5
7 year-olds	1.7	0.2	0.1	0.7	0.5	0.4	0.04	0.8
10 year-olds	0.5	0.5	9.8	0.007	3.1	0.1	0.9	0.4

Table 5.13: *Performance on Standardised Tests compared between Experiments for Each Subject Group*

tween the response given to the initial "Who" question and standardised test scores and the standardised test scores. No significant correlation was found between chronological age and the responses given to any of the questions. However, significant correlations were found between the remaining questions and the test scores.

Finally analysis of variance was performed on the age-equivalent scores of each age group on the standardised tests, comparing performance of subjects from experiment 2 with that of subjects in experiment 3. This was carried out in order to test whether or not the equivalent subject groups were performing significantly differently from each other. Table 5.13 indicates that the mean age equivalent scores for BPVS and Raven's approached significant difference between the two groups of children with Down's syndrome. Mean chronological age of the children with Down's syndrome in both subject groups was found to be significantly different. The typically developing children did not perform significantly differently between experiments, except for ten-year-olds on TROG.

Summary Of Findings

Standardised Test Scores

- Children with Down's syndrome performed below five-year-olds on all standardised tests.
- Typically developing children performed at approximately the level expected for their age.
- Significant correlations occurred between all test scores, but not CA for children with Down's syndrome and typically developing five-, and seven-year-olds. Only language measures correlated significantly for ten-year-olds.
- For typically developing children, there were no clear patterns to the few significant correlations found between test scores and the proportion of full references used in each condition.
- For children with Down's syndrome there were significant correlations between test scores and references used for i.) the main character in "watching" one-peripheral-character stories, and ii.) the peripheral characters in "not-watching" two-peripheral-character stories.
- For children with Down's syndrome significant correlations were found between all questions (except the initial "who" question) and the test scores.

5.6 Discussion

The results of this experiment, like those of the previous experiment clearly show that both typically developing children and children with Down's syndrome were able to use the full range of referential forms being investigated, although different patterns of use emerged between the typically developing children and children with Down's syndrome. It appears that children with Down's syndrome are a able to mark the status of characters linguistically in certain circumstances. In experiment 2 children with Down's syndrome did not differentiate between the characters linguistically. However, in this experiment, where the status of the characters was made maximally distinct, children with Down's syndrome did show a referential strategy, where more full references were used for the main character than for the peripheral character. Children with Down's syndrome are able to mark the status of characters at a local level in the discourse but not at a more global level. In other words, when attention is continuously focused upon one character children with Down's syndrome are able to represent and recall the status of that character—marking that status linguistically. However, when the focus of attention is changed and the child needs to re-establish reference to a character—thus having to draw upon information about the previous events in the story, children with Down's syndrome seem unable to call upon that knowledge in order to use an appropriate referential strategy to mark the status of the characters, except in cases where the status is maximally different. The ability to maintain the status of each character over the course of the story depends upon the ability to represent such information in an easily accessible form. The way in which the subject groups performed on each type of reference will now be examined with further discussion of the implications of such findings.

5.6.1 Initial References to Characters

Most initial references to characters of both status were full references. This pattern indicated that children as young as five years old are aware that introducing a character usually requires the use of a full reference: this was significantly affected by the number of characters in the story or whether the listener could seen the story.

It is possible that the reference type used for introducing a character is one of the first rules to be acquired in narrative strategy, or perhaps it is more likely that, rather than being acquired within a narrative framework, this strategy is learned as a successful communicative strategy for directing attention to the relevant stimulus and is therefore robust enough to be maintained in any discourse setting its successful use therefore need not take account of contextual changes. An increase in the number of peripheral characters alerts children with Down's syndrome to the possibility of ambiguity, resulting in the use of more full references for all characters. Children with Down's syndrome did not perform significantly differently from typically developing children when introducing characters in a story.

It is interesting to note that the use of initial references in experiment 2 produced significant main effects for all variables. However, this occurred as a consequence of the proportion of full referential forms used by five-year-olds for the main character in still-watching videos. These results were therefore not replicated since experiment 3 has no "still" condition. Findings suggest that the older children were sensitive to the requirements of the listener when they could not see the screen, as well as the usefulness of a referential strategy to distinguish between characters in such a situation. Younger children seem less sensitive to the usefulness of such a strategy.

5.6.2 Further Reference to Characters Without an Intervening Reference to Another Character

The status of the character can clearly be marked using linguistic devices which are dependent upon knowledge about story-telling and/or discourse conventions which are shared by the narrator and listener. In instances where the narrator continuously refers to one character only, using reduced references, the listener must assume that the most relevant interpretation of this sort of utterance must be one in which the referent is the same character because no full references are used to indicate reference to another character. Both the narrator and listener must be aware of this strategy in order for the story to be understood and to avoid ambiguity. However, if a child has represented a certain character as being peripheral the child will continue to use full references to indicate that the peripheral character is the relevant referent, regardless of the fact that no other character has been referenced. This is likely to occur because reduced references are the more acceptable reference type for main characters.

Overall the dominant referential strategy seems to be one in which full references are used for reference to the peripheral character regardless of the lack of intervening references to other characters. This may indicate that when processing constraints are being imposed on the child, they are more likely to use full references for less important characters in a story, while more important characters will be referred to using reduced references.

Since it is usual in discourse for there to be a central theme which is being maintained for the duration of the discourse, it would seem particularly necessary that where processing becomes more complex (such as in a task which requires simultaneous viewing and narration of a story) the linguistic strategies used to maintain coherent discourse can function automatically, with the main objective being that where possible ambiguity is prevented. Since the status of characters is less important when continuing to refer to the same character, status may be disregarded if this strategy is adopted, especially in cases where the amount of information (e.g. when two peripheral characters appear in the story) outweighs the available processing resources or abilities.

All typically developing children mark the status of the characters, with a level of success which increases with age. The findings are similar to those found in experiment 2, indicating that, for further references without intervening references to another character, the same type of task produced similar results regardless of the additional contextual manipulations.

That children with Down's syndrome are able to use referential forms to distinguish the status of each character appears to indicate that, at a local level in a story, they are sensitive to the status of characters and therefore able to internally represent this. They are only required to represent and access a limited amount of information about the story and characters since the same character remains the current focus of attention. It may be the case that for references which do not occur following an intervening reference status is not the important factor which determines the use of referential forms, but as seen above, is more determined by the processing resources available. When it is necessary to consider other pragmatic cues—such as considering the story as a whole, as well as manipulating linguistic information this increases the processing load so that maintenance of coherent discourse using referential strategies is beyond resources available. It must also be noted that children with Down's syndrome used a higher proportion of full references for the main character than typically developing children, which resulted in less of a distinction being made between characters. This suggests that while able to mark the status of characters, children with Down's syndrome do so less distinctly than typically developing children.

5.6.3 Further Reference to Characters Following an Intervening Reference to Another Character

Where status of the characters is maximised a linguistic distinction between the characters can be made by children with Down's syndrome. An increase in the number of characters prevents the child with Down's syndrome from clearly identifying which might be a main character and which a peripheral character. Without the ability to identify and represent the status of the character it is impossible to use a referential strategy which marks the status of each character. For successful use of this type of reference, it is important to represent status mentally: status can then be marked linguistically using different referential forms for each character. Other contextual information must also be accessed in order to refer to a character using a specific referential form consistently. Children with Down's syndrome have demonstrated that they are able to mark the status of the characters at a local level within a single event in a story, where one character is continually referenced. But where referencing must extend across event-boundaries in a story, status marking using distinct referential forms seems more difficult. This may indicate that the child is able to hold in memory information about the status of the character while it is the focus of the story. However, when reference to that character must be re-established the child must consider the global structure and content of the story. In order to access such information the story must be represented in an easily accessible form which clearly marks the status of the characters. It is therefore possible that children with Down's syndrome are unable to maintain a representation of the whole story, which requires the integration of numerous pieces of information including the status of the characters.

The overall finding seems to indicate that older children did not mark the status of the characters by varying the referential type, since they were more likely to use fuller references throughout. However on closer inspection the way in which the references were used was sensitive to the particular context of the narration: the status of the characters was not the only discourse constraint being considered.

The proportion of full references used for the main character seemed to be increased when there were two peripheral characters, indicating the increased need to prevent ambiguity when more characters were included in the story. Five-year-olds clearly show that they are able to mark the status of the different characters linguistically (reflecting findings by Clibbens, 1992), but less consistently than seven-year-olds (reflecting findings by Karmiloff-Smith, 1985) and less flexibly than ten-year-olds. The older age groups are able to consider other discourse factors such as position of listener and number of characters in the story which also affect they referential strategy used.

5.6.4 Number of Peripheral Characters and Status

In the previous experiment, where each story contained two peripheral characters, it was assumed that the high proportion of reduced references which was used overall was due to the inability of the children to distinguish between the main and peripheral characters since the roles may have overlapped at certain times during the story. Stories with one peripheral character were designed to enhance the differing references used to distinguish the character status. This was successful for five-year-olds and children with Down's syndrome, who showed that they were able to differentiate between characters linguistically when there was only one peripheral character in the story. However, when compared with stories which clearly depict one very peripheral character, stories which contain two (less) peripheral characters have a higher proportion of full references both for the main character and for the peripheral characters. This may be explained by the fact that the children were aware that in some stories there were more characters than in others, so that where the number of characters increased more care was taken to re-establish reference using a full reference. The less distinct use (or absence) of a referential strategy to mark the status of the characters in stories with two peripheral characters, for both typically developing children and children with Down's syndrome, indicates that the status of the characters is less clear than in stories which contain only one peripheral character. The ability to consider the contexts of the stories in this way is clearly another example of the flexibility with which the older children used referential strategies.

5.6.5 Shared Knowledge of the Speaker and the Listener

By altering the position of the listener, and assessing referential strategies used by the child both when the listener can see the story and when the listener cannot see the story, any differences observed in reference types used should indicate the child's ability to alter the referential strategy to take account of the change in the shared knowledge of the listener and themselves as narrator.

It is possible that the importance of the position of the listener can only be seen when other factors influencing discourse coherence are also varied, namely the number of characters to be referred to, as well as the status of those characters. As with hypothesis 1, no clear support for hypothesis 2 can be shown because of the interaction of all variables which have been seen to influence the referential strategy used.

For children with Down's syndrome the position of the listener appeared to influence the proportion of full references used for the peripheral character when there were two peripheral characters in the story—when the listener could see the screen more full references were used for the peripheral character than when they could not see the screen. This indicates that the consequences of the listener's position on the referential strategy used was not well understood by children with Down's syndrome.

5.6.6 Re-establishing Reference to the Peripheral Character

There is evidence of a distinguishing referential strategy for each of the peripheral characters which is dependent on age. It is possible that this difference may also be explained in terms of status.

Results clearly indicate that the status hierarchy for characters is extended to include differences between peripheral characters. The second peripheral character, as marked by an indefinite reference, is seen to be the most peripheral of the characters. The finding of a status hierarchy which includes peripheral characters is interesting in the light of claims made by Garrod and Sanford's model of focus. They suggest that one character will clearly be maintained as the central focus, while other characters are "backgrounded"—that is disappear from focus. Results here show that rather than a bipolar approach to the way in which characters are represented in discourse, degrees of focus can be maintained for discourse. The claims made by Garrod and Sanford are made on the basis of comprehension tasks which are sentence-based, rather than a production task which is discourse-based. Therefore it may be argued that the focus model is task dependent and cannot be generalised to longer discourse.

Where greater distinction was expected in the one-peripheral character condition, in fact the reverse has happened for the older age groups because the status of the second peripheral character is seen to be represented as below that of the first peripheral character. It is for the older age groups that this flexibility in referential strategy is possible: first because they have reached greater mastery, and second because they have greater processing capacity which will allow them to internally represent such differences.

It was interesting to note that children with Down's syndrome appeared to mark the differing status of the peripheral characters using a less effective strategy for marking the decreasing status of the peripheral characters than that seen by typically developing children.

5.6.7 Identifying the Main and Peripheral Characters

A prerequisite for the successful use of a sensitive referential strategy is the ability to identify and store in a mental representation the main and peripheral characters in the story before embarking on reference to them. This representation must be readily accessible alongside the rules for a successful strategy for referring to that character. This issue has been assessed in this experiment by directly accessing the child's understanding of the status of the characters in the stories which they narrate. Each child was asked questions about the status of the characters in order to assess whether the application of any referential strategy—where observed—could be due to the child's representation of that character as having a distinguishing status. For typically developing children all main and peripheral characters were accurately identified, suggesting that they have internally represented the status of the characters to whom they were referring, thus supporting Hypothesis 3a.

However, for children with Down's syndrome the results were not as clear. It was suspected that the children with Down's syndrome may not have understood the questions. However, the significant correlations between responses to each question indicates that, while identifying the incorrect character as the main or peripheral character children with Down's syndrome did so consistently. Performance on the tests was related to the ability to answer the questions. It is possible that those children who were able to answer each of the questions successfully, were those who performed well on the standardised tasks and who used more full references for the peripheral character—thus signifying a thematic subject referential strategy.

The open-styled question was designed to detect the character which was seen by each child to be the main character in an implicit fashion, it was expected that it would therefore correlate with the proportion of full references used by each child. However, there was no significant correlation between response and references used to each of the characters. Where status was correctly identified correlation with reference type did not occur. This gives some indication that reference types may not have been influenced by the status of the characters, perhaps because the status of the characters was either not considered by the child, or not represented in such a way as to be accessible for responding to such a question or for forming a referential strategy.

A positive significant correlation between reference type used for the peripheral character and questions about the most important and the longest-appearing character indicated that those children may have successfully used a mental representation of the character's status both in order to identify the characters in response to the questions, and to use a consistent referential strategy for peripheral characters. That the correct response rate was low has indicated that any ability to mark and store information about the status of characters occurs in only a limited number of children with Down's syndrome.

5.6.8 Standardised Tests and Referential Strategies

Findings for both children with Down's syndrome and typically developing children indicate that may not be closely related to linguistic or cognitive ability tested by the standardised measures used since no subject group showed a consistent relationship between test scores and referential forms used.

What is also interesting to note is the variation between subjects within each subject group within experiments, but also when comparing experiments 2 and 3. Results have indicated that the two groups of children with Down's syndrome perform differently (although non-significant). Typically developing children overall did not perform significantly differently, but clear variability did occur. Differences between performance on the experimental tasks may be in part due to this variability, as well as to the additional manipulations of variables.

5.7 Conclusions

The results obtained on the various parts of this experiment have indicated that while varying referential strategies are used by different aged typically developing children, the overall strategy seems to be one in which peripheral characters are more likely to be marked by the use of a full reference. This is consistent with the findings from the previous experiment and from the study by Clibbens (1992). Referential strategies used by older children have also been shown to be flexible enough to take account of contextual variables such as the number of characters in the story and whether or not the listener is able to see the story. The referential strategies were only seen to change significantly when these variables most increased risks of ambiguity, for example when the listener could not see the story and when there were two peripheral characters in the story. That children were able to successfully use referential strategies which also considered other sources of information supports the claim that children can use mental representations of events and discourse to maintain coherent discourse.

Children with Down's syndrome were able to mark the status of the characters, by using a thematic subject referential strategy, when the status of each character in the story was maximally different. However, the strategy used is the opposite of that identified by Clibbens (1992) indicating that the way in which children with Down's syndrome represent information about the status of the characters may be different from typically developing children. Children with Down's syndrome were capable of using appropriate linguistic forms and were able to recognise the status of characters, but this was more successfully achieved at a local level within the discourse which did not need to take account of the story at a global level. The inability to globally represent the status of the characters was highlighted by the results of the question task, which showed an inability to recall the status of the characters. This result also emphasises the importance of working memory in the formation and maintenance of a representation of discourse, further investigation is necessary to establish the extent to which this affects the performance of children with Down's syndrome. The lack of an internal representation of the discourse was also indicated by the fact that no consideration was given to the position of the listener while the story was being narrated, as shown by the referential forms used.

In general, findings from this experiment have highlighted abilities of both typically developing children and children with Down's syndrome to use a thematic referential strategy. All typically developing children use a referential strategy to indicate the different status of each character, especially in further references without an intervening reference to another character. Children with Down's syndrome use this in a less distinct way. In cases where re-establishing references, older typically developing children used a referential strategy flexibly, also taking account of other contextual information. Children with Down's syndrome indicated that they are able to distinguish between characters only when the information load is limited and the status difference is maximally different.

Chapter 6

References to Objects

6.1 Introduction

It has been argued earlier that the maintenance of coherent discourse can be achieved only through the formation and use of a mental representation of that discourse. The maintenance of discourse depends upon the integration of linguistic (syntactic and semantic) and non-linguistic (contextual and world-knowledge) information; without the use of a mental representation such integration cannot occur. Fundamental to the success of the integration process must be the ability to store, and more importantly, to access both types of information. It is well documented that the ability of children and adults with Down's syndrome to maintain coherent discourse is impaired. Although there are numerous processes involved in the maintenance of discourse, difficulty in the comprehension and production of linguistic forms, provides a focus for some of the problems exhibited. Of current interest is the underlying cause of such a difficulty. Since the integration of information is necessary in order to understand and use of different linguistic forms, it has been suggested in the previous chapters that an inability to use mental representations successfully may be the underlying cause for the discourse difficulties experienced by individuals with Down's syndrome. The inability to relate separate pieces of information together has previously been noted in studies by Morss (1983, 1985), where such an inability has been shown to prevent children with Down's syndrome from building on previous experience. Such findings suggest that children with Down's syndrome may have difficulty internally representing information and then integrating it in order to benefit from it. This can also be seen in their use of referential forms in a narrative. It is possible that this reflects working memory limitations, since in order to construct and maintain a mental representation information must be held in working memory. Without this ability information cannot be integrated into the mental representation. There are several people currently addressing the relationship between working memory and discourse (e.g. Fletcher, 1995; Just, 1995; Gernsbacher, 1995). Gernsbacher suggests that certain items in the representation will be enhanced in memory, while other information is suppressed, in order to understand the on-going discourse. She has shown that suppression of irrelevant information seems to be a problem for poor comprehenders. Just (1995) and Fletcher (1995) have indicated that working memory is essential for constructing and maintaining representations. Fletcher suggests that the ability to construct representations of a discourse is limited by the capacity to maintain representations in working memory—as suggested by the findings of experiments 2 and 3 for children with Down's syndrome.

It has been shown, in experiments 2 and 3, that children with Down's syndrome are able to use a wide range of referential forms when referring to characters in a story, although their ability to use them within a referential strategy similar to that of typically developing children appears to be hindered in some contexts. It has been shown that children with Down's syndrome are better able to distinguish the status of the characters using appropriate nominal referential forms if the difference in status is maximised. These findings indicate that children with Down's syndrome are able to use nominal reference successfully under conditions which demand the integration of fewer items of information. Although able to construct a mental representation, children with Down's syndrome seem less able to successfully maintain information in a mental representation, perhaps hindered by the way in which information is stored or accessed.

Following such evidence from the use of nominal reference to characters in a story, evidence from nominal references used when referring to objects in a story is examined in this chapter in order to assess further the conclusions reached in experiment 1, in which it was established that adults with Down's syndrome have some difficulty understanding and using referential forms. Examining the references used for objects by children with Down's syndrome follows on from findings reported in chapters four and five where references used for characters was assessed. As with reference to characters, using nominal reference for objects involves the integration of numerous sources of information.

The child must first identify the class of objects to the listener using a full noun phrase (e.g. a proper name, an indefinite noun phrase, a definite noun phrase, or a noun phrase without a determiner)(see 1. below, for an example of a definite noun phrase). Further references to objects in that class may provide additional information regarding one specific example of that class of objects in order to indicate to the listener exactly which object is being focused upon. Such a reference may be used to re-establish reference to the class of objects, usually taking the form of a full nominal reference (see 2. below for an example of an indefinite noun phrase). Alternatively, the child may continue to refer to the specific object, and thus forgo the necessity to re-establish reference, using instead a reduced nominal reference to maintain focus upon the previously identified object (e.g. a pronoun, or a zero anaphor). Nominal substitutes can also be used to identify one object from a presupposed class of objects, rather than to maintain reference to an object. (see 3. below for an example of a nominal substitute).

1. The frog is piling up *the tins* in his shop.

2. The teddy wants to buy *a blue tin.*

3. The frog has got the tin, it's *a blue one.*

The way in which children use nominal references for objects provides an interesting comparison with the use of nominal reference to refer to characters. For the stories which have been used in experiments 2 and 3, an object, although having a specific identity within the class of objects to which it belongs (e.g. a blue tin), does not have an identifiable thematic status (e.g. main or peripheral). This is contrary to the identity of the characters in the stories, where there is a main character and one or two peripheral characters. For the narrating child in the current experiment, an object is either a referent which has been previously established or one which must be introduced. Therefore the child does not need to use referential strategies to mark the status of the object linguistically. The referential forms which are used are those which will provide the listener with the most relevant information about the object in order to allow the listener to be able to internally represent that object. This will enable the listener to identify that object in relation to previous or subsequent references to objects in the narration.

Since the element of thematic status is removed from this linguistic equation, the child's use of referential forms for objects is dependent only upon whether or not the child has previously referred to the object, and whether or not the child needs to re-establish reference to the object. When referring to objects non-linguistic information must be considered in order to maintain a coherent narrative for the listener. Reference to objects therefore provides insight into the way in which linguistic information can be stored and manipulated within a mental representation of a narrative. It is important to note that references to objects in the stories used in experiments 2 and 3 occur at a local level of discourse since the same objects are manipulated. The global details of the story need not be attended to by the narrator in order to use appropriate referential forms.

Interestingly, research which has investigated thematic status using comprehension tasks suggests that it is possible to manipulate the central focus by altering the prominence of the object in the discourse. The result of such a manipulation is to ensure that the narrator must re-establish reference to an object, and thereby more clearly taking account of global information—that is contextual and linguistic information relevant to the whole discourse (e.g. Garnham, 1987; Clibbens and Harris, in submission). This differs from the production task used in experiments 2 and 3, in which it was necessary to attend to local details of the context only, since the class of objects to which the child must refer remained similarly prominent throughout the story. In order to separate the linguistic element from the element of status, references to objects—which have no thematic status in the stories used in experiments 2 and 3—will be examined in this chapter.

Various studies have investigated the acquisition and development of referential terms for objects, suggesting various non-linguistic factors as being influential, such as maternal referential style, tone of voice, facial expression, and even absence of the object (e.g. Harris et al, 1986; Tomasello and Barton, 1994; Akhtar and Tomasello, 1996). One conclusion that can be drawn from this research is that children as young as two years old are able to integrate various non-linguistic cues in order to understand adults' referential intentions. Therefore, mental representations of ongoing discourse which allow for the integration of non-linguistic and linguistic information are necessary and can be used by children as young as two years old in the acquisition of terms for reference to objects. Interestingly, Moore et al (1977) found that the mean length of utterance produced by children with Down's syndrome between the age of three and five years old was related to their understanding of objects, and the way in which these objects relate to one another and to people, rather than to their chronological or mental age. This perhaps suggests that language may emerge out of the child's knowledge and understanding of objects.

Other research has investigated language development in relation to joint attention, specifically in children with Down's syndrome (e.g. Harris et al, 1996). It has been noted that receptive language development is enhanced by an increase in joint attention of care-giver and child, where maintaining attention to child-directed objects is most beneficial. Harris et al (1996) note that it is more difficult to shift the attentional focus of children with Down's syndrome. This finding may be related to the differences observed between typically developing children and children with Down's syndrome in their use of thematic subject referential strategies. Once the attention is focused on a character—or in this case an object—referential performance is similar to that of typically developing children. However, the ability to re-establish the focus of attention linguistically seems to be more difficult. It can therefore be seen that the limited attentional capacity may hinder referential ability, as well as influencing the receptive language ability of children with Down's syndrome.

From these studies it can be seen that children are able to use mental representations at an early age in discourse, in particular for references to objects. Studies have also shown that the development of object-words is similar for both children with Down's syndrome and typically developing children (Mervis, 1990). Therefore, any differences between referential forms used by children with Down's syndrome when compared to those of typically developing children may reflect a difference in understanding about the way in which grammatical markers can be used to re-establish reference or continue reference to an object. The results reported above may indicate that children with

Down's syndrome can construct and manipulate mental representations sufficiently for success on the particular tasks used. This would not be surprising in the light of findings from experiments 2 and 3 which suggest that they can construct and use mental representations to a limited extent. The above results may therefore indicate a difference in the ability to internally represent information about the story or object (e.g. whether it has been introduced) in such a way that it can be accessed in order to influence the choice of reference used for that object.

If the child with Down's syndrome is unable to manipulate referential forms to indicate whether or not the object has been previously referenced, this may suggest that the child has difficulty internally representing information which has been gained from explicitly linguistic sources (e.g. lexical, syntactic) rather than information which has been inferred through the context of the discourse or through world knowledge. If this were the case, it would therefore be expected that the type of referential forms used to re-establish the focus of attention onto the object when compared with those used when the object continues to be referenced in an uninterrupted string would be similar.

If, however, there is a distinction between continuing and re-establishing references to the object, this would indicate that children with Down's syndrome are able to internally represent events in the story, including information about whether or not a referent has been previously introduced. Such a result would also indicate that children with Down's syndrome are also able to manipulate referential forms sufficiently in order to mark which referent is the current focus of attention. Such a finding would indicate that children with Down's syndrome are able to use appropriate referential forms.

References to objects have been assessed to test the claim that children with Down's syndrome can use referential forms, but difficulty arises in the construction and use of a mental representation of the discourse in which the referential forms are manipulated and integrated with other non-linguistic information. This claim has been tested by assessing the proportion of full references used for objects as initial, continuing and re-establishing references by children with Down's syndrome and typically developing children. For each of these reference types different contextual and linguistic information must be considered and integrated into a mental representation of the on-going discourse, and will therefore influence the referential form used. An inability to use different referential forms in different contexts indicates that the child may be unable to internally represent the information of the story in order to vary the linguistic forms used. For example, introducing an object, as with the initial reference to a character, requires the use of a full reference—usually an indefinite noun phrase. A re-establishing reference also requires the use of a full reference—usually a definite noun phrase—in order to unambiguously signal a change in the focus of attention. A continuing reference need not use a full referential form, a reduced form (e.g. a pronoun) indicates that the focus of attention has not changed. This pattern of reference use has been shown by typically developing children, but not by children with Down's syndrome, for reference to characters. References to objects will now be assessed.

6.2 Hypotheses

1. Children with Down's syndrome will not vary the type of reference used for objects.

2. Typically developing children will continue to use full references for initial, and re-establishing references, and will use reduced references when the object remains in current focus and reference has already been re-established—continuing references.

6.3 Method

6.3.1 Design

See chapters 4 and 5 for a full description of the design. Data regarding references to objects have been taken from narratives from both experiments 2 and 3. Therefore, there were two groups of participants. One group saw and narrated four videos, the characters in two of the videos were moving, while in the other two videos they were still. The other group saw and narrated four videos, two of which contained two peripheral characters, while the other two videos contained one peripheral character. In both experiments the position of the listener was varied. The references to objects obtained from each experiment have been analysed separately and are clearly described below.

6.3.2 Participants, Materials and Procedure

The participants were the same as those in experiments 2 and 3. The materials and procedure used have been previously described in chapters 4 and 5.

6.4 Results

References used for objects were divided into two main groups:

1. Full references, e.g. proper names, indefinite noun phrases, definite noun phrases, and noun phrases without a determiner.

2. Reduced references, e.g. pronouns, nominal substitutes, zero anaphora.

These references were used by children to refer to the target object in each story. The target objects for each story were those which the peripheral characters purchased; for example, in the Frog story the target objects were the tins. References which were made to other objects in each story were not recorded, since they were not fundamental to the story and were not mentioned by the majority of children.

The references were used in several ways:

1. Initial references, where the child introduces the target object or group of objects (see example (1) in the Introduction).

2. Further references to the target object following an intervening reference, where the referent must be re-established, once the group of objects or that specific object has been previously introduced (see example (2) in the Introduction).

3. Further references without an intervening reference to a character or to another object, where the reference may provide additional—possibly descriptive—information about the object which continues to be the current focus of attention (see example (3) in the Introduction).

6.4.1 Initial References to the Target Object

When making an initial reference to an object, the child should ensure that the reference contains adequate information about the object and set of objects to which it belongs. It must not, therefore, be ambiguous, and must allow the listener to accurately represent it within a mental representation of the ongoing discourse. The use of a full reference (usually and indefinite noun phrase) usually signifies the introduction of a new referent, or the re-establishment of a previous referent which has subsequently disappeared from current focus. The types of referential forms which were used by each subject group can be seen in Figures 6.1–6.2 which indicate that all subject groups used a wide range of reference types in both experiments, although they were more likely to use full references. Such a reference provides the listener with an unambiguous referent which can be internally represented, which can then be accessed as a possible antecedent of reduced referential forms later in the discourse.

For data from experiment 2 (figure 6.1), typically developing children used indefinite or definite noun phrases. Seven-year-olds showed a very clear preference for indefinite noun phrases. Children with Down's syndrome showed that, while favouring a full reference, they were most likely to use a noun phrase without a determiner. A small proportion of reduced references was also used by children with Down's syndrome and typically developing five-year-olds.

For data from experiment 3 (figure 6.2), typically developing children again used definite or indefinite noun phrases—where more definite noun phrases were used, while children with Down's syndrome used more noun phrases without a determiner. This difference between subject groups emphasises the known difficulty which children with Down's syndrome encounter in using determiners. This difference does not affect later analysis of the use of reference types, since a noun phrase without a determiner is classed as a full noun phrase.

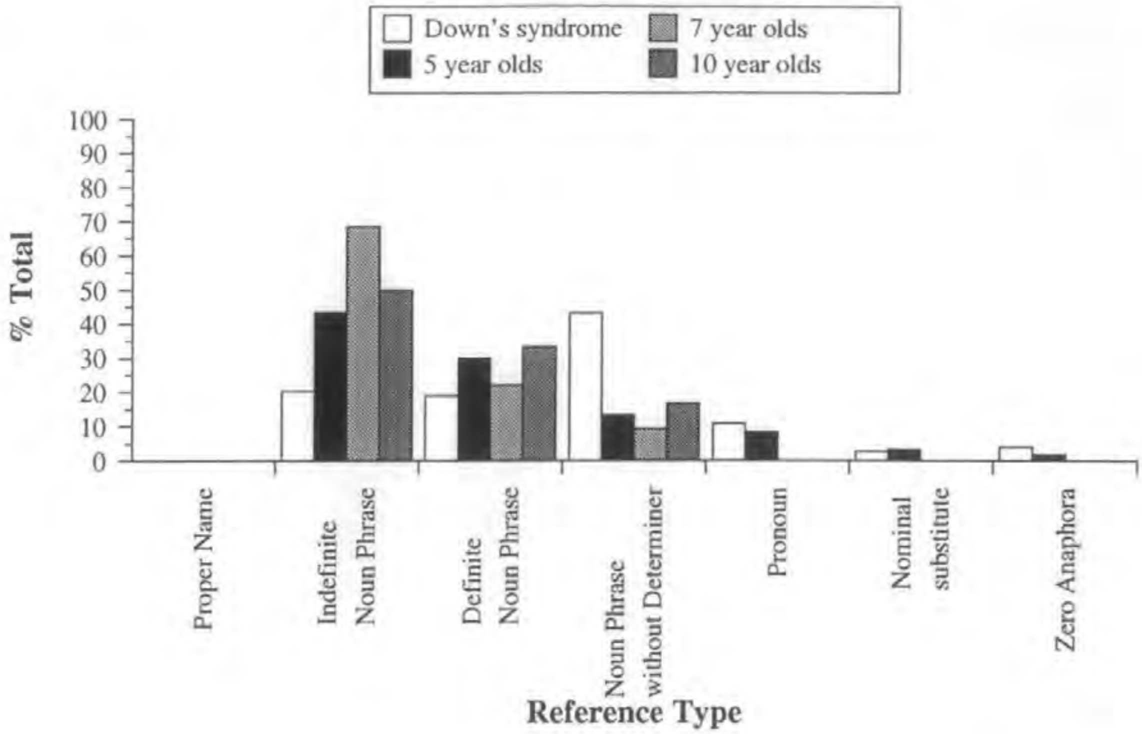


Figure 6.1: *Percentage of each reference type used for an initial reference to the target object by each subject group, from experiment 2*

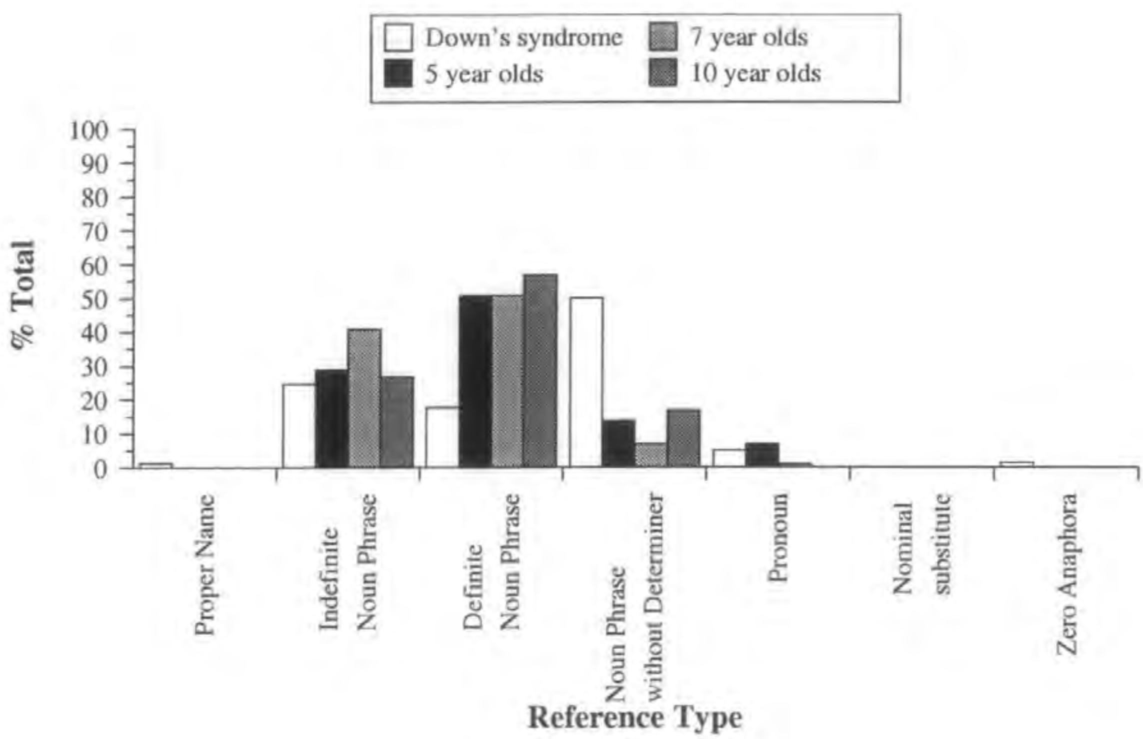


Figure 6.2: *Percentage of each reference type used for an initial reference to the target object by each subject group, from experiment 3*

6.4.2 References used to Re-establish Reference to the Object

Re-establishing reference to an object is necessary following a period of time in which that referent has not been the current focus of attention in the discourse. In the case of the stories which were produced in the two experiments presented in this chapter, this period of time is limited since the overall length of the story is also short. In order to understand the need to re-establish reference, the speaker must access non-linguistic information, for example the speaker must consider the knowledge of the listener about preceding events in the story, including the preceding context and focus of attention. Information about whether or not the referent has previously been established must also be considered. It is usual for full references to be used to re-establish reference to an object or character in order to clearly re-direct the listener to renew focus upon the specific referent.

Data from experiment 2 is presented in figure 6.3. This indicates that children with Down's syndrome again used noun phrases without a determiner. Typically developing children used more full than reduced references to re-establish reference to an object, with the exception of five-year-olds who used more pronouns.

Data from experiment 3 is presented in figure 6.4. Children with Down's syndrome used an approximately equal proportion of each of the full references, favouring overall the use of noun phrases without a determiner. Typically developing children used an approximately equal proportion of indefinite and definite noun phrases.

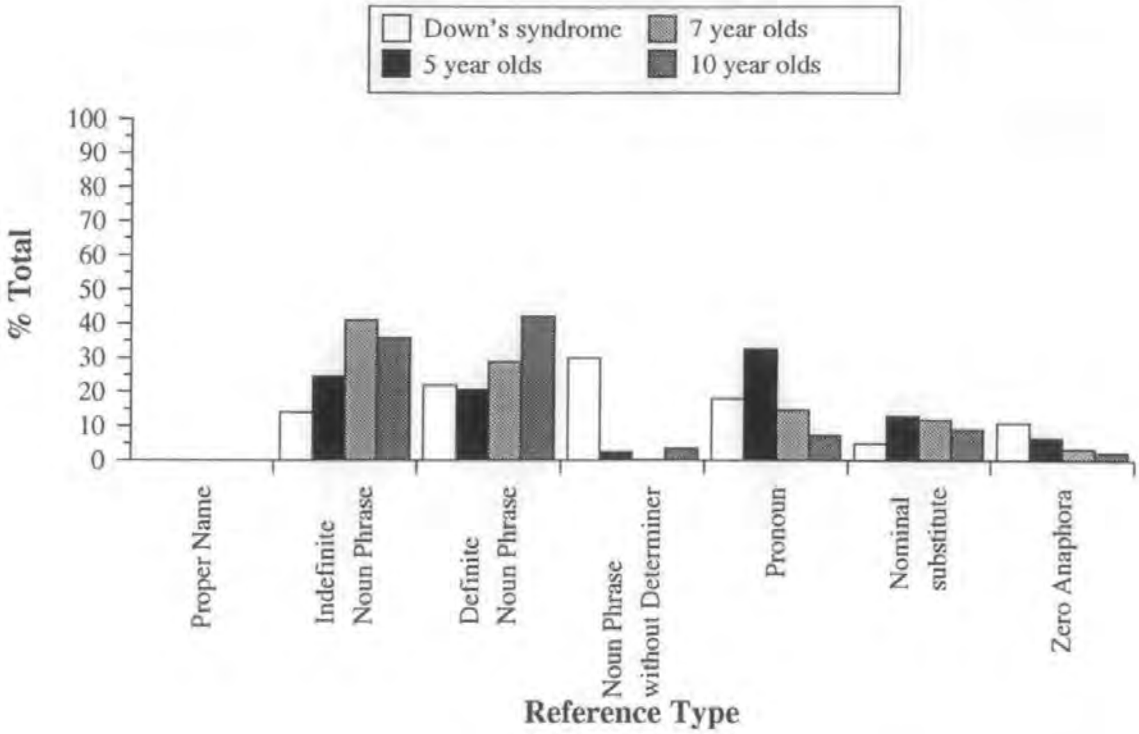


Figure 6.3: *Percentage of each reference type used by each subject group to re-establish reference to the target object, for experiment 2*

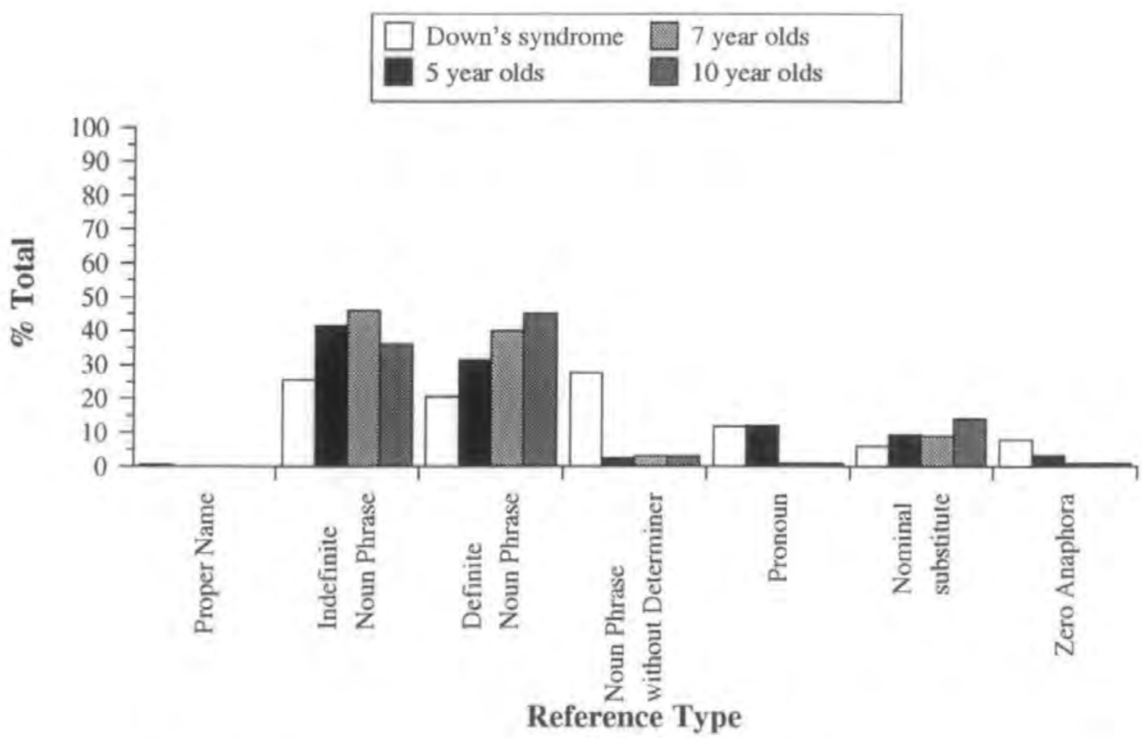


Figure 6.4: *Percentage of each reference type used by each subject group to re-establish reference to the target object, for experiment 3, for videos where the number of peripheral characters is varied*

6.4.3 Continuing References to Objects

When a specific referent (in this case a target object) remains as the focus of attention for a portion of the discourse, the speaker need not constantly re-establish reference to that object using a full reference. Therefore, using a reduced reference, the speaker signals linguistically to the listener that the focus of attention remains the same. The antecedent of the reduced reference can be assumed to be easily accessed from their mental representation of the preceding discourse (in accordance with the principle of relevance). Such a reference can also be used to provide additional information about the object, which is not apparent from the initial reference to that object (c.f. Clibbens, 1992). However, overall one would expect the predominant reference type to be reduced.

Data from experiment 2 is presented in figure 6.5. Typically developing children used mostly pronouns for continuing reference to an object, nominal substitutes were also used more than any of the full references. This pattern was also seen for data from experiment 3 (see figure 6.6). Typically developing children recognised that full references provide redundant information in contexts where the focus of attention has been maintained.

However, children with Down's syndrome show a less distinct preference for reduced references for continuing reference to an object. Data from experiment 2 indicates that the predominant reference type was noun phrases without a determiner. In experiment 3, the overall proportion of reduced references used is greater than that for full references. More full references were used by children with Down's syndrome in experiment 2 than in experiment 3—where many more pronouns were used.

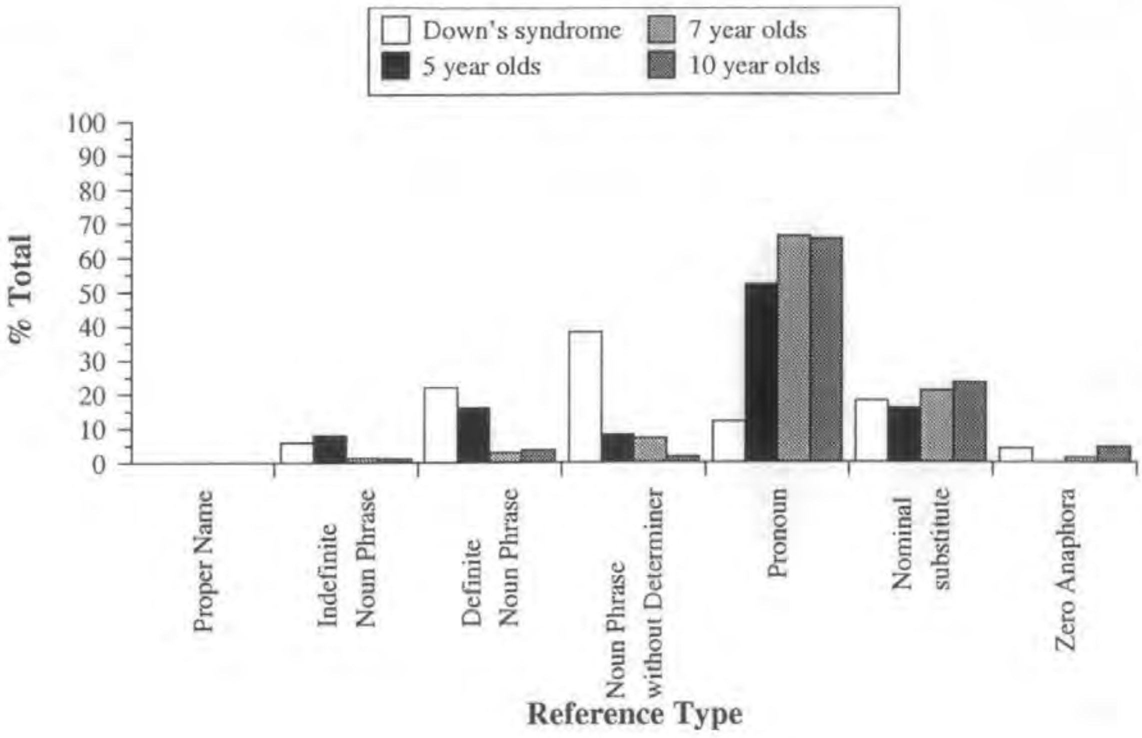


Figure 6.5: *Percentage of each reference type used by each subject group to continue reference to the target object, for experiment 2*

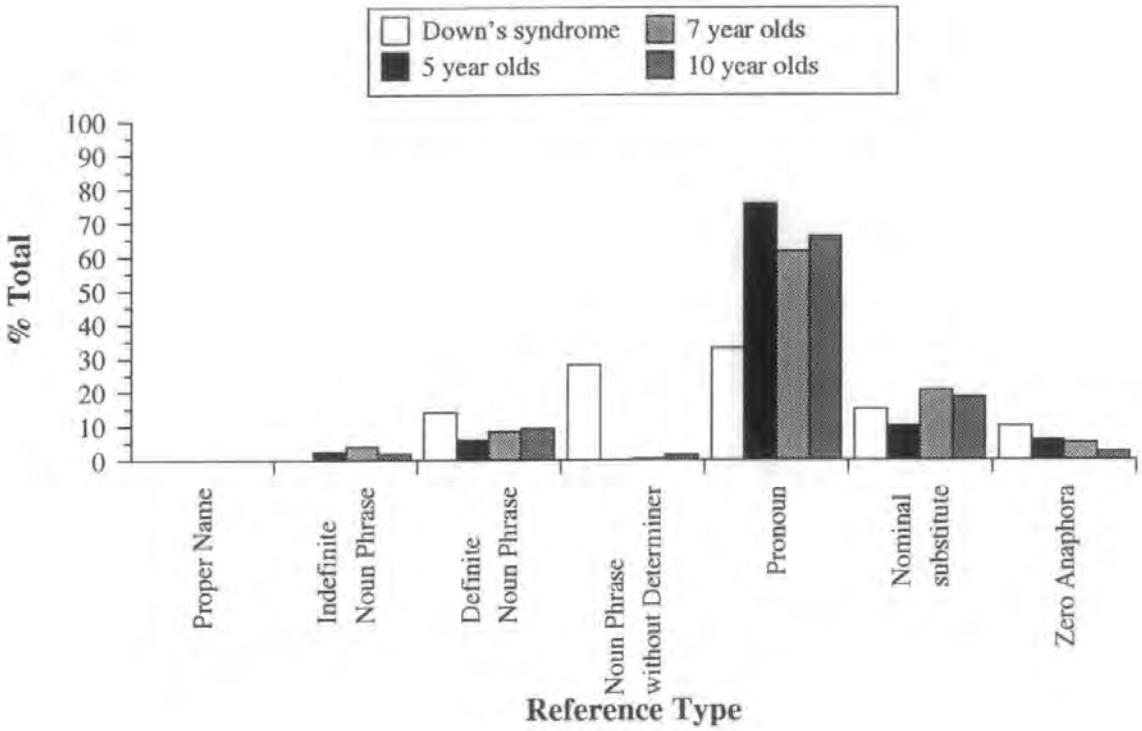


Figure 6.6: *Percentage of each reference type used by each subject group to continue reference to the target object, for experiment 3*

6.4.4 Analysis of Variance For References Used For Objects

Although some preference can be seen in the use of referential forms in each referential context, figures 6.1–6.6 showed that children with Down's syndrome showed a less distinct pattern in their choice of reference type than that shown by typically developing children. Analysis was therefore carried out to investigate whether or not children with Down's syndrome use referential forms in a significantly different way from typically developing children in each context. References used in each context were amalgamated into two groups: full and reduced references, as for analysis for references to characters. The proportion of full references used in each context was assessed in order to determine whether or not the children in each subject group used different proportions of full reference in different contexts, as well as to assess the differences in performance between the groups. Data relating to references obtained from narratives from experiment 2 will be presented first, followed by those of experiment 3.

Initial and Continuing References from Experiment 2 Data

Analysis of Variance was performed to compare the proportion of full references used as initial references with those used for continuing references to objects, full analysis of variance summary tables and tables of means are given in appendix N. A 4 (subject group) x 2 (reference type) x 2 (position of listener) x 2 (video type) analysis of variance was performed on the percentage of full references used by each child (dependent variable) in each condition. This analysis is summarised in Table 6.1 which indicates the main effects and any significant interactions. The results show that there was a significant main effect of reference type and a significant interaction between reference type and subject group. Figures 6.7–6.8 indicate the difference in the proportion of full references used for initial and continuing references.

Interestingly, there was no significant main effect of video type when referring to

Effect	df effect	df error	F	p
1.Subject Group	3	81	1.8	0.1
2.Ref Type (Initial v Cont.)	1	81	624	0.00001
3.Video Type	1	81	0.7	0.3
4.Position of Listener	1	81	0.6	0.4
1×2	3	81	5.8	0.001

Table 6.1: *ANOVA findings for Initial References compared with Continuing References used by Both Subject Groups for Experiment Two Data*

objects, contrary to the significant main effect found when referring to characters (see chapter 4). Although there was no main effect of subject group, indicating that children with Down's syndrome do not use significantly different proportions of full references than typically developing children, Newman-Keuls post hoc analysis showed that children with Down's syndrome use significantly fewer full references as an initial reference than seven-year-olds ($p = 0.001$) and ten-year-olds ($p = 0.002$). Follow-up analysis also indicated that five-year-olds used significantly fewer full initial references than seven-year-olds ($p = 0.006$) or ten-year-olds ($p = 0.02$). There were no significant differences in the proportion of full continuing references used by each age group.

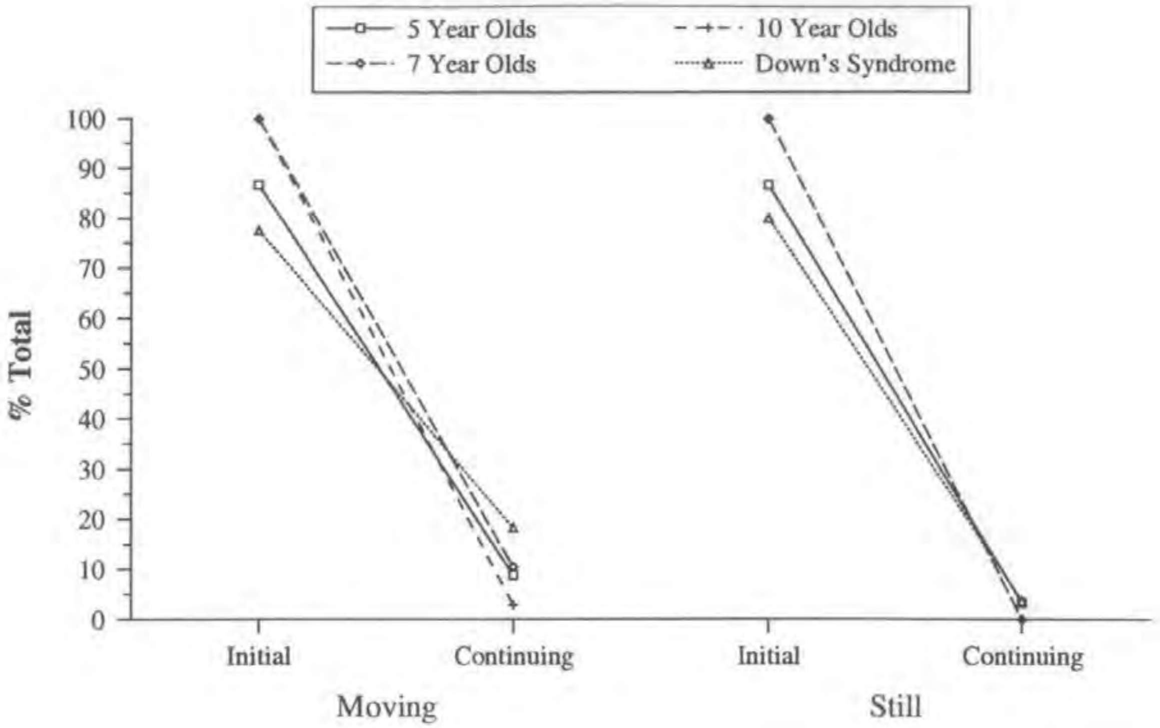


Figure 6.7: *The percentage of full references used as initial and as continuing references by each subject group for experiment 2 data, when the listener is not watching*

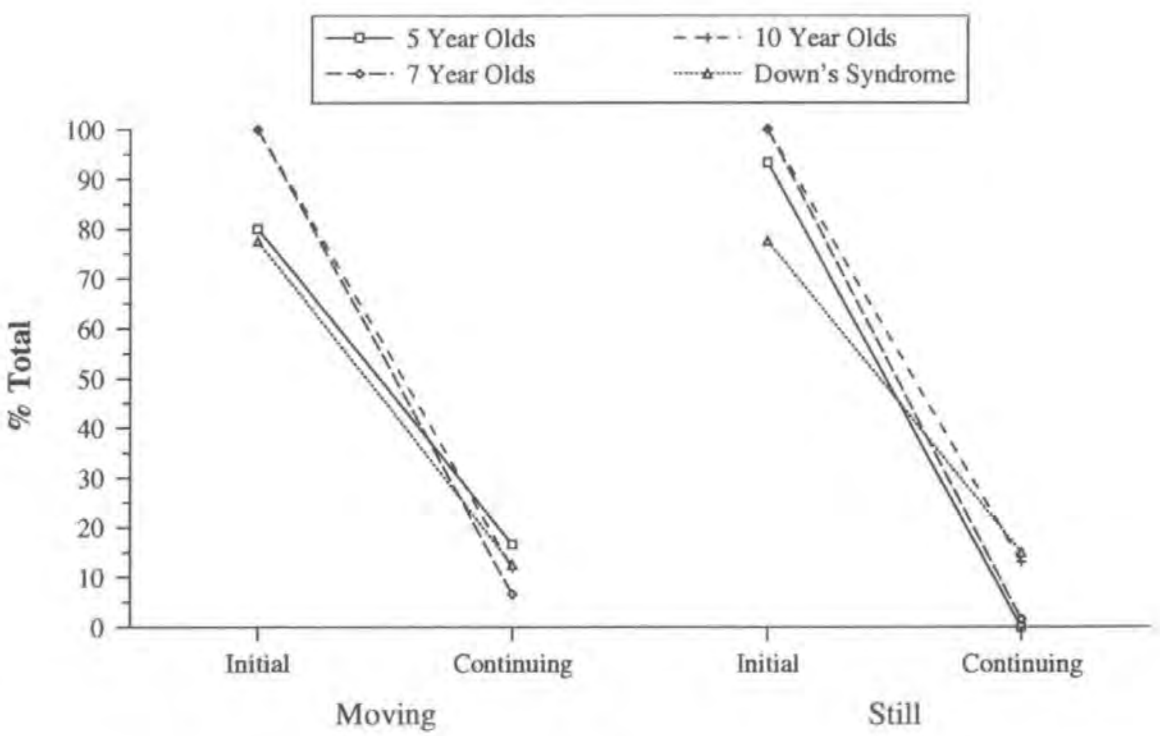


Figure 6.8: *The percentage of full references used as initial and as continuing references by each subject group for experiment 2 data, when the listener is watching*

Summary Of Findings

Initial and Continuing References (Experiment 2)

- Children with Down's syndrome and typically developing children used significantly more full initial than continuing references.
- Five-year-olds used fewer full continuing references than seven- and ten-year-olds.
- Children with Down's syndrome used significantly fewer full initial references than seven- and ten-year-olds.

Initial and Re-establishing References from Experiment 2 Data

Analysis of Variance was also used to examine the difference in the proportion of full references used as an initial reference and as a re-establishing reference for each subject group, as well as to examine the difference in performance of each subject group, using a 4 (subject group) x 2 (reference type) x 2 (position of listener) x 2 (video type) design. Table 6.2 indicates the main effects and any significant interactions. There is a significant main effect of subject group and reference type but no significant interactions. The proportion of full references can clearly be seen to vary between contexts, for both typically developing children and for children with Down's syndrome. Figures 6.9–6.10indicate that more full references were used for initial reference than for re-establishing references.

Post hoc Newman-Keuls test showed that children with Down's syndrome used significantly fewer full references than either seven-year-olds ($p = 0.01$) or ten-year-olds ($p = 0.01$) for initial references, in both moving and still videos. Five-year-olds

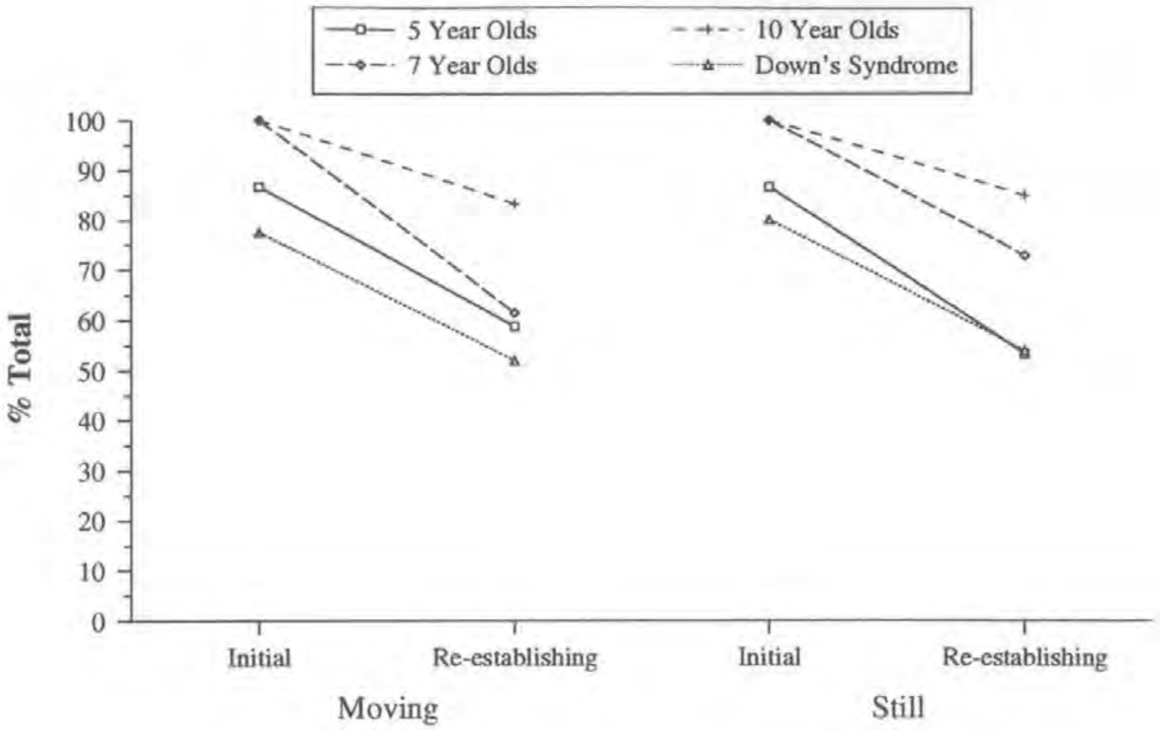


Figure 6.9: *The percentage of full references used as initial and as re-establishing references by each subject group for experiment 2 data, when the listener is not watching*

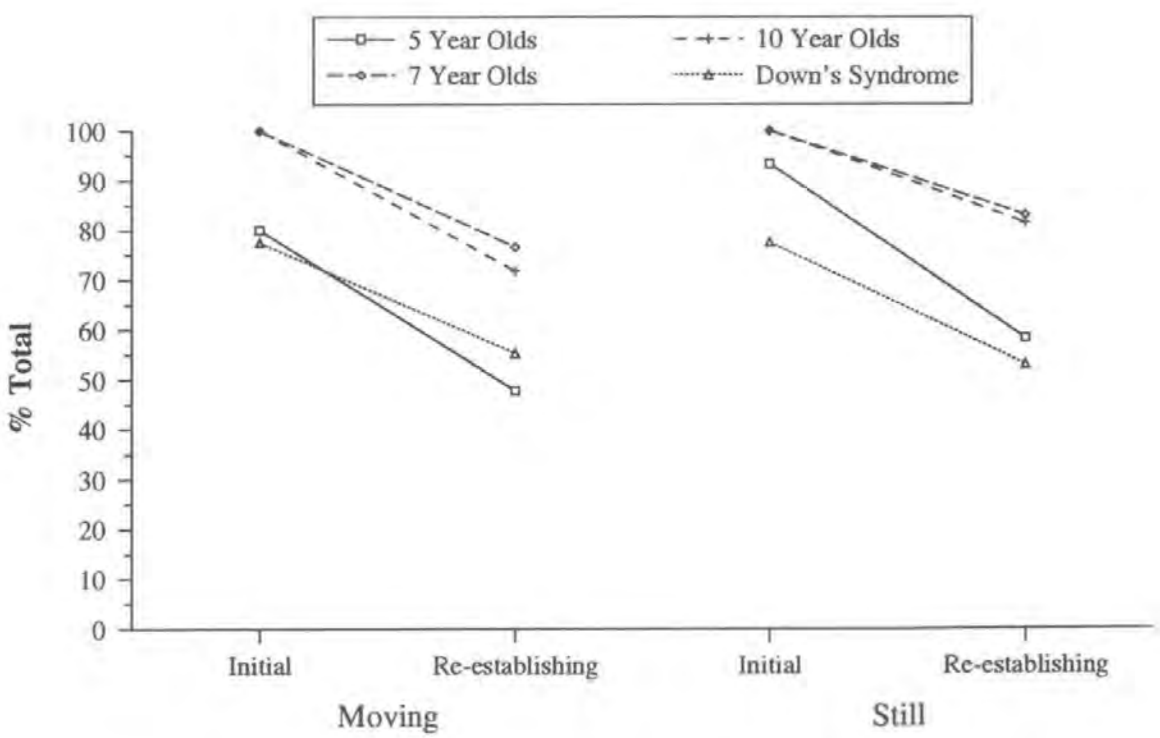


Figure 6.10: *The percentage of full references used as initial and as re-establishing references by each subject group for experiment 2 data, when the listener is watching*

Effect	df effect	df error	F	p
1.Subject Group	3	81	10.5	0.0001
2.Ref Type (Initial v Re-est.)	1	81	71.9	0.000001
3.Video Type	1	81	0.01	0.9
4.Position of Listener	1	81	1.2	0.3

Table 6.2: *ANOVA findings for Initial References compared with Re-establishing References used by Both Subject Groups for Experiment Two Data*

were also shown to use significantly fewer full references than either seven-year-olds as initial reference (p = 0.05) and re-establishing references (p = 0.005), or ten-year-olds as re-establishing references (p = 0.001).

Summary Of Findings

Initial and Re-establishing References (Experiment 2)

- Children with Down's syndrome and typically developing children used significantly more full initial than re-establishing references.
- Children with Down's syndrome and five-year-olds used fewer full re-establishing references than seven- and ten-year-olds.

Continuing and Re-establishing References from Experiment 2 Data

Analysis of Variance was again used to examine the difference in the proportion of full references used as an continuing reference and as a re-establishing reference for each subject group, and to compare the performance of each subject group using a 4 (subject group) x 2 (reference type) x 2 (position of listener) x 2 (video type) design.

Effect	df effect	df error	F	p
1.Subject Group	3	81	2.5	0.06
2.Ref Type (Cont. v Re-est.)	1	81	331	0.00001
3.Video Type	1	81	0.2	0.7
4.Position of Listener	1	81	1.2	0.3
1×2	3	81	7.5	0.0001
2×3	1	81	5.7	0.001

Table 6.3: *ANOVA findings for Continuing References compared with Re-establishing References used by Both Subject Groups for Experiment Two Data*

Table 6.3 shows the main effects and significant interactions. There was a significant main effect of reference type, and significant interactions between subject group and reference type, and between reference type and position of the listener. Figures 6.11–6.12 indicate that significantly more full references were used for the re-establishing reference than for the continuing references.

Newman-Keuls follow-up analysis was carried out, the results indicate that five-year-olds used significantly fewer full references than seven-year-olds (p = 0.02) or ten-year-olds (p = 0.002). When assessing the interaction between the age of the child and the reference type used it was found that five-year-olds used significantly fewer full re-establishing references than seven-year-olds (p = 0.001) or ten-year olds (p = 0.0002), these significant differences occurred for both listener positions. When the listener was not watching, seven-year-olds used significantly fewer full re-establishing references than ten-year-olds (p = 0.03). Although all age-groups used a similarly low proportion of full references for continuing reference to an object, there was an increase with age in the number of full references used for re-establishing references. Children with Down' syndrome used significantly fewer full references for re-establishing references than seven-year-olds (p = 0.002) or ten-year-olds (p = 0.0002).

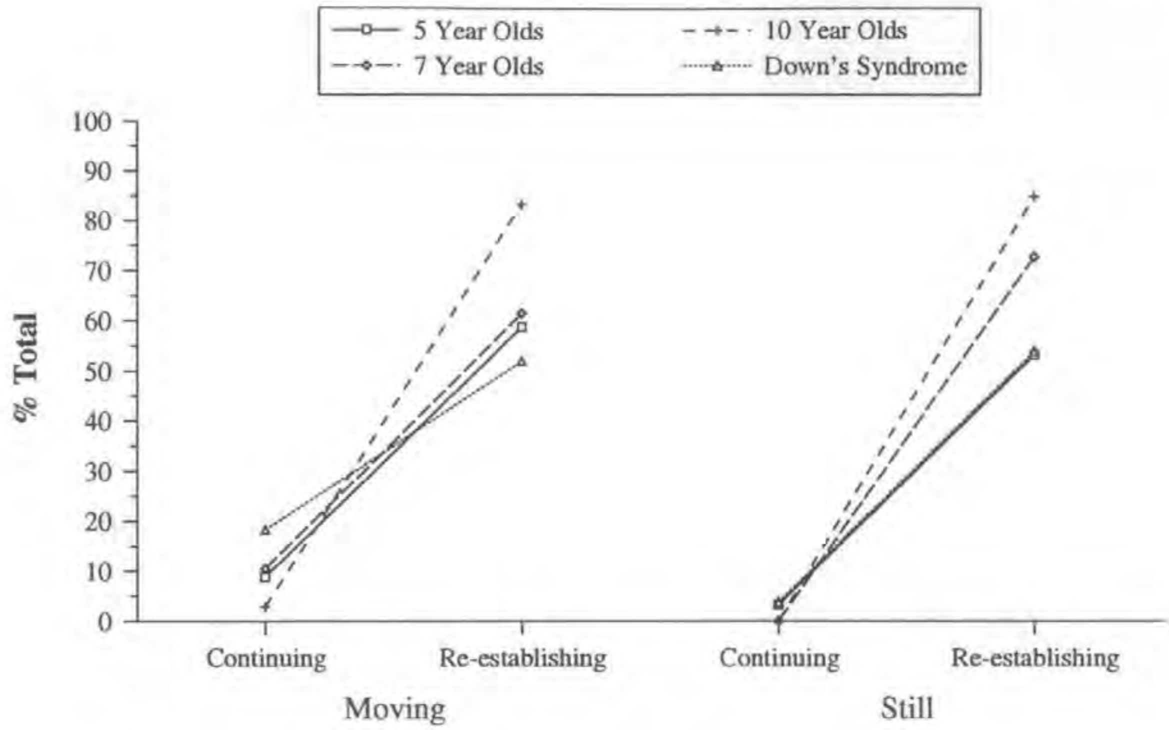


Figure 6.11: *The percentage of full references used as continuing and as re-establishing references by each subject group for experiment 2 data, when the listener is not watching*

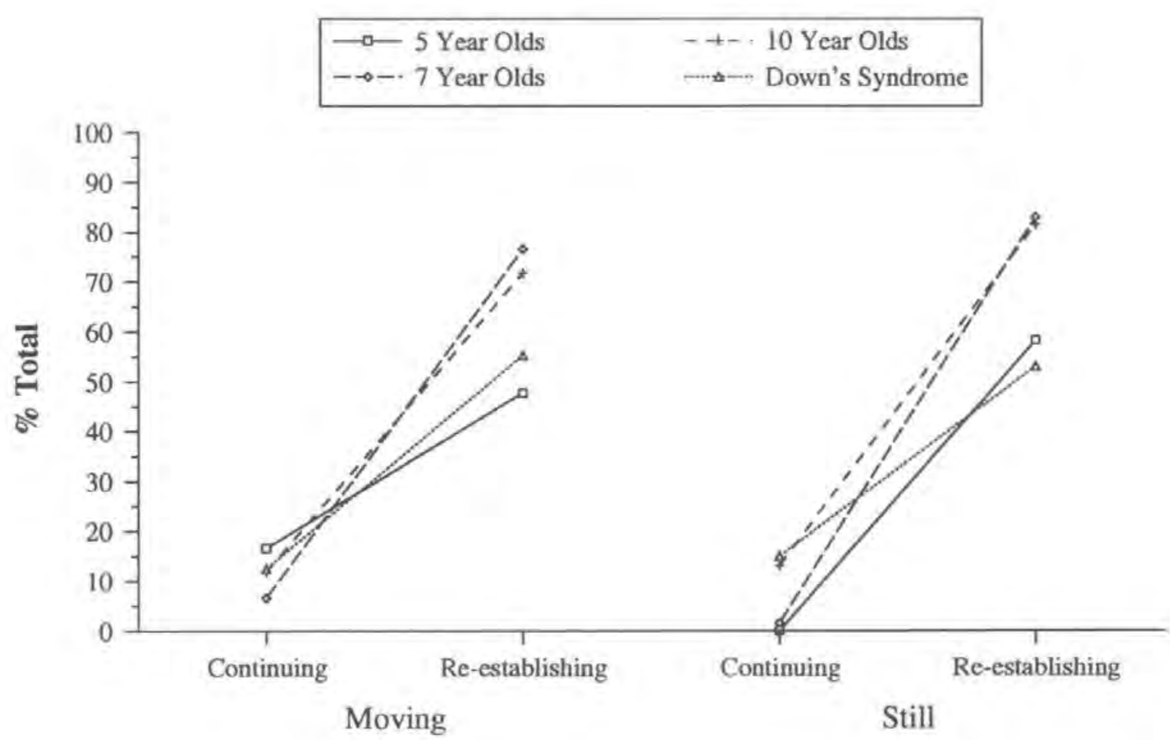


Figure 6.12: *The percentage of full references used as continuing and as re-establishing references by each subject group for experiment 2 data, when the listener is watching*

Summary Of Findings

Continuing and Re-establishing References (Experiment 2)

- Children with Down's syndrome and typically developing children used significantly more full re-establishing than continuing references.
- Children with Down's syndrome and five-year-olds used fewer full re-establishing references than seven- and ten-year-olds.

Initial and Continuing References from Experiment 3 Data

Similar analysis was also carried out for data obtained from narratives reported upon in experiment 3, where the number of peripheral characters in each story was varied. Analysis of Variance was performed on the data for each subject group, using a 4 (subject group) x 2 (reference type) x 2 (number of PCs) x 2 (position of listener) design. The results of this analysis are summarised in Table 6.4, which indicate that there was a main effect of reference type, and a significant interaction between subject type and reference type. These results are also displayed in Figures 6.13–6.14. Significantly more full references were used for initial references when compared with continuing references, for each subject group. Neither the number of peripheral characters, nor the position of the listener affected the proportion of full references used by each subject group for each referential context.

Post hoc analysis using Newman-Keuls showed that children with Down's syndrome used more full continuing references than five-year-olds ($p = 0.007$), seven-year-olds ($p = 0.01$), and ten-year-olds ($p = 0.006$). There were no significant differences between the proportion of full initial references used by typically developing children and children with Down's syndrome.

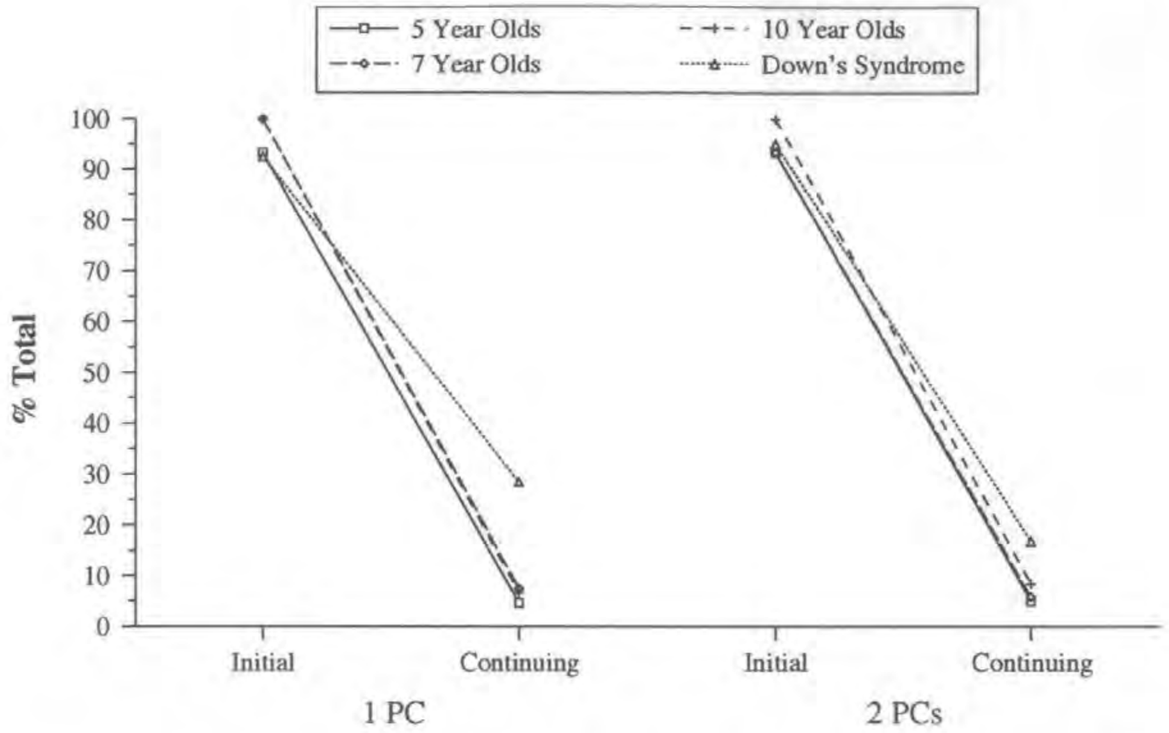


Figure 6.13: *The percentage of full references used as initial and as continuing references by each subject group, for experiment 3 data, when the listener is not watching*

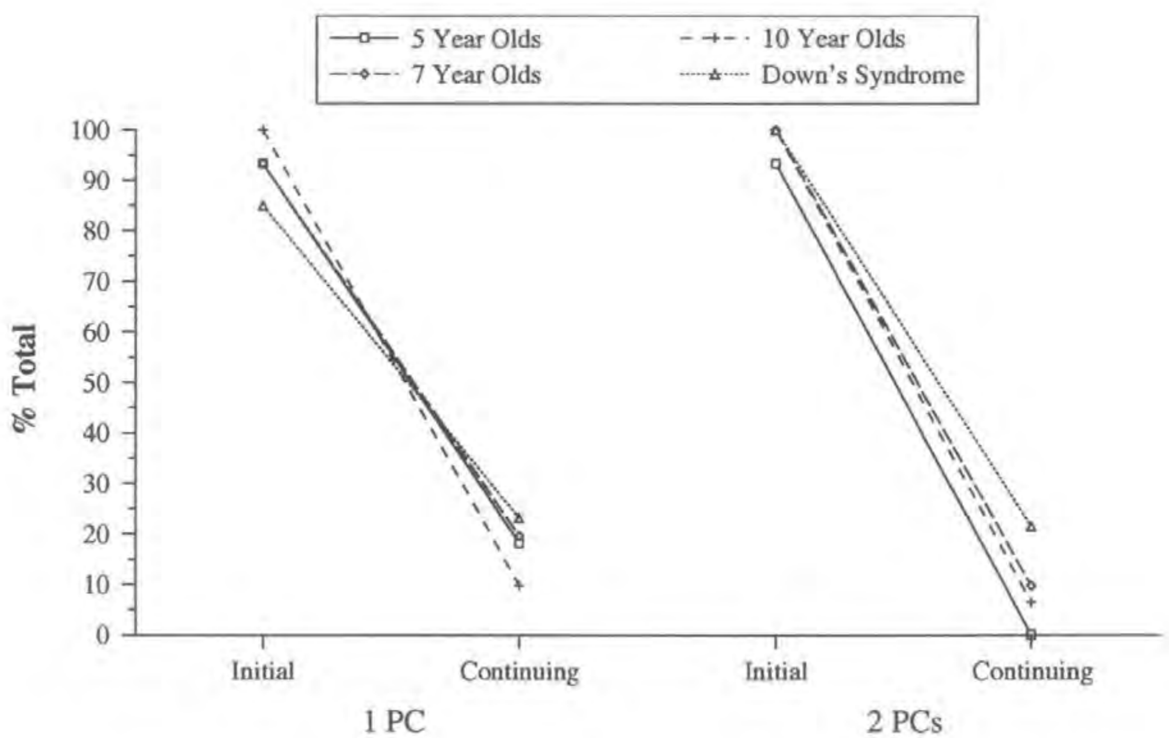


Figure 6.14: *The percentage of full references used as initial and as continuing references by each subject group, for experiment 3 data, when the listener is watching*

Effect	df effect	df error	F	p
1.Subject Group	3	81	2.3	0.09
2.Ref Type (Initial v Cont.)	1	81	1068	0.00001
3.No. of PCs	1	81	0.8	0.4
4.Position of Listener	1	81	0.7	0.4
1×2	3	81	4.9	0.004

Table 6.4: *ANOVA findings for Initial References compared with Continuing References used by Both Subject Groups for Experiment Three Data*

Summary Of Findings

Initial and Continuing References (Experiment 3)

- Children with Down's syndrome and typically developing children used significantly more full initial than continuing references.
- Children with Down's syndrome used more full continuing references than five-, seven-, and ten-year-olds.

Initial and Re-establishing References from Experiment 3 Data

Analysis of variance was performed on the data in order to compare the proportion of full references used by each subject group as initial and re-establishing references, and to compare the performance of each subject group. Table 6.5 shows the main effects and any significant interactions. Significant main effects of subject group and reference type were found, as well as a significant interaction between subject group and reference type. These results are also displayed in Figures 6.15–6.16. Significantly

Effect	df effect	df error	F	p
1.Subject Group	3	81	7.2	0.0003
2.Ref Type (Initial v Re-est.)	1	81	58.7	0.00001
3.No. of PCs	1	81	2.3	0.1
4.Position of Listener	1	81	0.2	0.6
1×2	3	81	4.2	0.01

Table 6.5: *ANOVA findings for Initial References compared with Continuing References used by Both Subject Groups for Experiment Three Data*

more full references were used for initial references when compared with re-establishing references, for each subject group. Neither the number of peripheral characters, nor the position of the listener affected the proportion of full references used by each subject group for each referential context. Post hoc analysis using Newman-Keuls showed that significantly fewer full references were used by five-year-olds than by seven-year-olds ($p = 0.002$) or ten-year-olds ($p = 0.002$). As well as the differences between five-year-olds and seven- and ten-year-olds, children with Down's syndrome used significantly fewer full re-establishing references than either seven-year-olds ($p = 0.0001$) or ten-year-olds ($p = 0.0001$). There were no significant differences for initial references for any subject group.

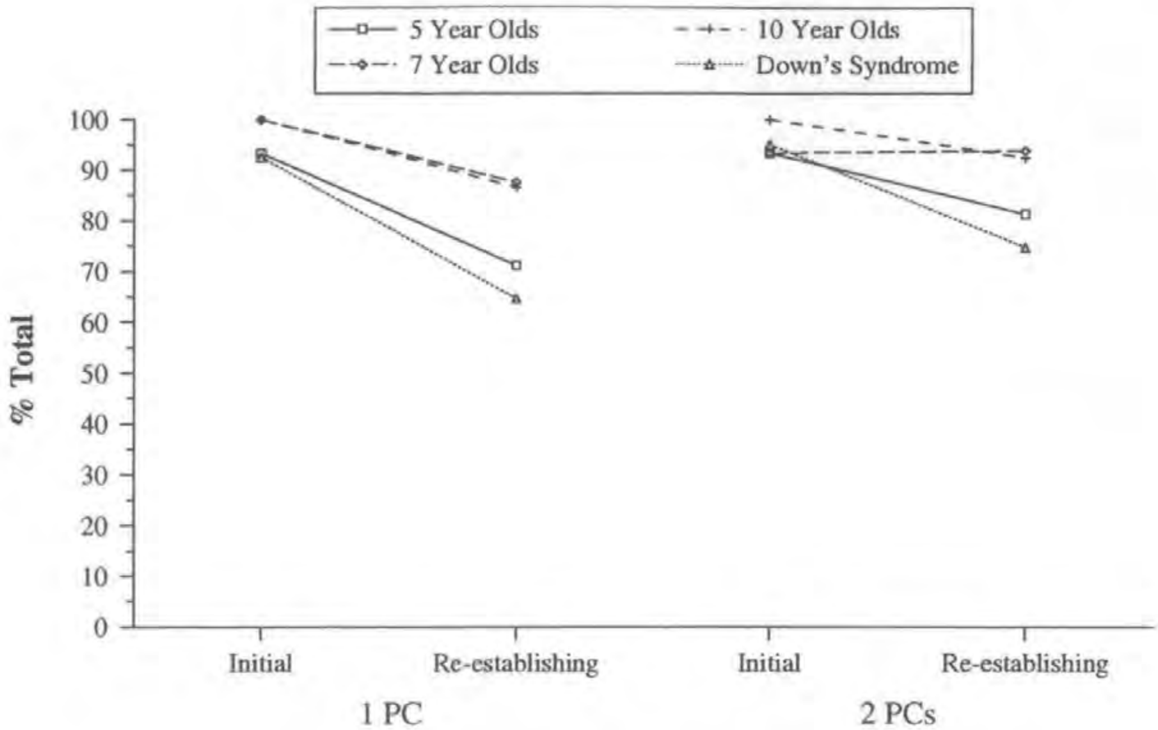


Figure 6.15: *The percentage of full references used as initial and as re-establishing references by each subject group, for experiment 3 data, when the listener is not watching*

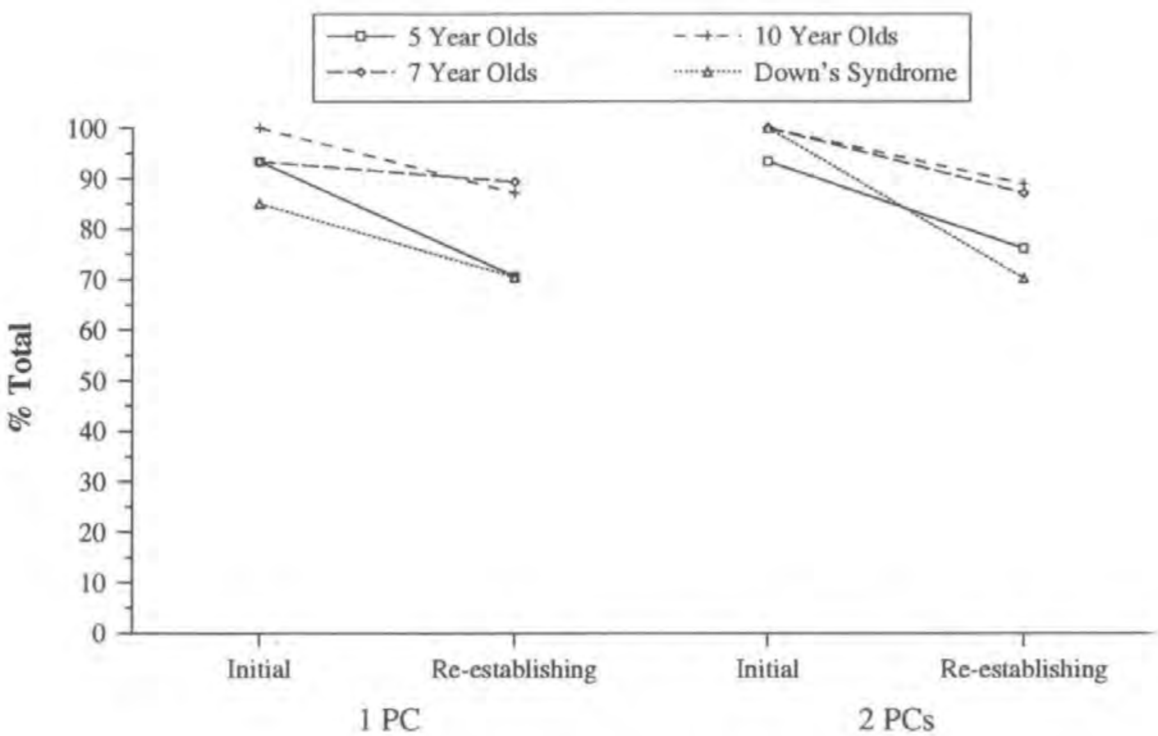


Figure 6.16: *The percentage of full references used as initial and as re-establishing references by each subject group, for experiment 3 data, when the listener is watching*

Summary Of Findings

Initial and Re-establishing References (Experiment 3)

- Children with Down's syndrome and typically developing children used significantly more full initial than re-establishing references.
- Children with Down's syndrome and five-year-olds used fewer full re-establishing references than seven- and ten-year-olds.

Continuing and Re-establishing References from Experiment 3 Data

The proportion of full references used for continuing references was then compared with full references used as re-establishing references, the proportion of full references used by children with Down's syndrome compared with typically developing children was also examined. This was carried out using a 4 (subject group) x 2 (reference type) x 2 (number of PCs) x 2 (position of listener) analysis of variance. The results of this analysis are summarised in Table 6.6 which shows that there was a significant main effect of reference type, significantly more full references were used for re-establishing references than for continuing references. There was also a significant interaction between subject group and reference type. These results are also displayed in Figures 6.17–6.18. Using Newman-Keuls follow-up analysis, it was found that children with Down's syndrome used significantly more full continuing references than five-year-olds ($p = 0.01$), seven-year-olds ($p = 0.02$) and ten-year-olds ($p = 0.01$). Children with Down's syndrome also used significantly fewer full re-establishing references than seven-year-olds ($p = 0.001$) and ten-year-olds ($p = 0.001$). As has been previously established using Newman-Keuls follow-up analysis, five year olds used significantly fewer full re-establishing references than seven-year-olds ($p = 0.05$) and ten-year-olds ($p = 0.02$).

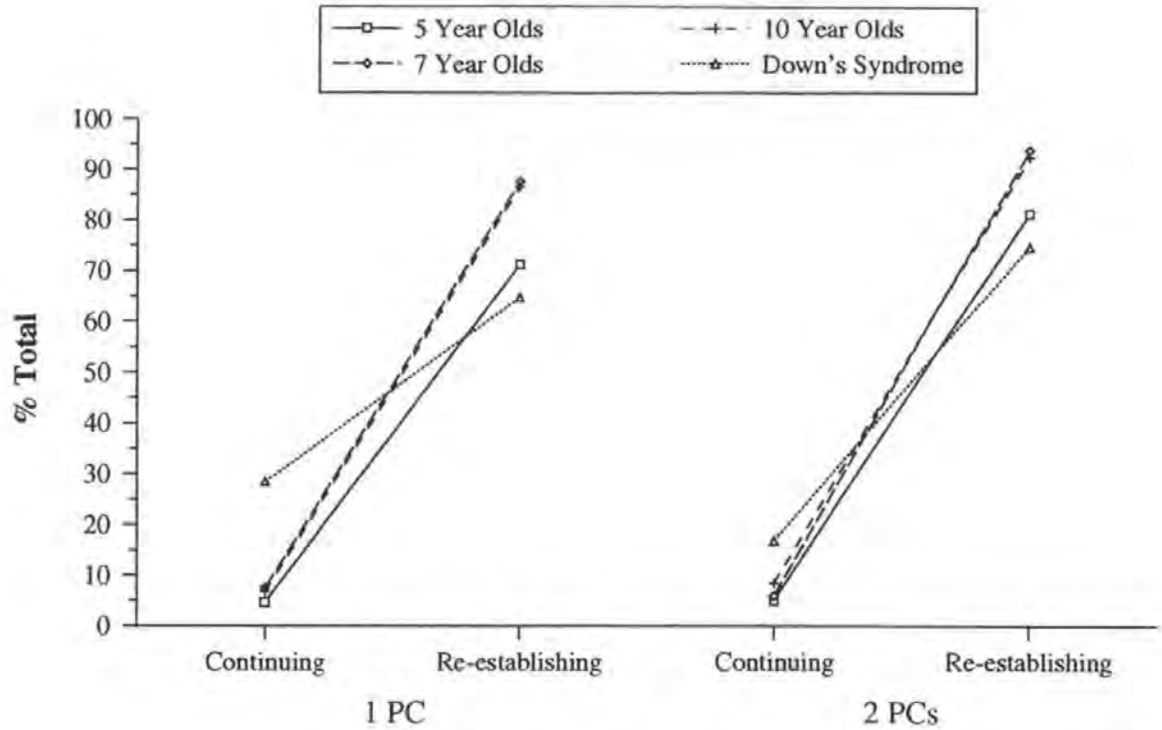


Figure 6.17: *The percentage of full references used as continuing references and as re-establishing references by each subject group, for experiment 3 data, when the listener is not watching*

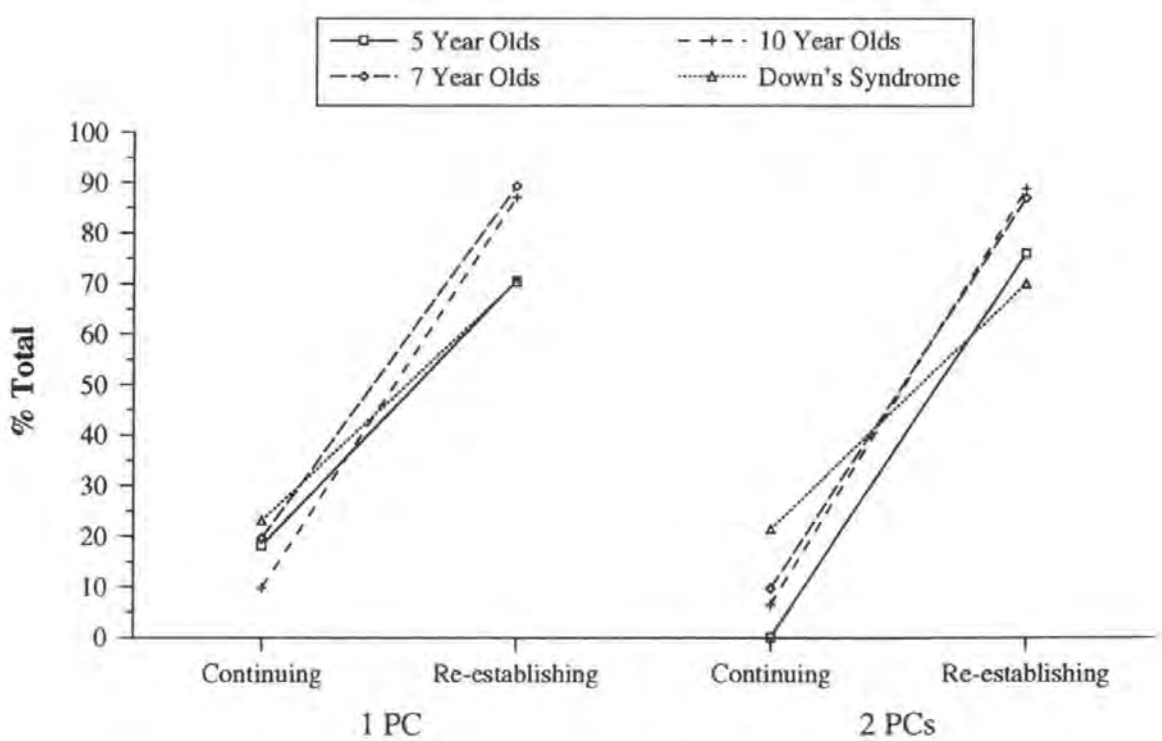


Figure 6.18: *The percentage of full references used as continuing and as re-establishing references by each subject group, for experiment 3 data, when the listener is watching*

Effect	df effect	df error	F	p
1.Subject Group	3	81	1.5	0.2
2.Ref Type (Cont. v Re-est.)	1	81	610	0.000001
3.No. of PCs	1	81	0.05	0.8
4.Position of Listener	1	81	0.2	0.7
1×2	3	81	11.1	0.00001

Table 6.6: *ANOVA findings for Continuing References compared with Re-establishing References used by Both Subject Groups for Experiment Three Data*

Summary Of Findings

Continuing and Re-establishing References (Experiment 3)

- Children with Down's syndrome and typically developing children used significantly more full re-establishing than continuing references.
- Five-year-olds used significantly fewer full re-establishing references than seven- and ten-year-olds.
- Children with Down's syndrome used significantly fewer full re-establishing references than seven- and ten-year-olds, and significantly more full continuing references than five-year-olds.

6.5 Discussion

The ability to manipulate the wide range of referential forms used for objects is dependent upon certain factors; for example, it must be understood by the child that once introduced using a full reference, an item may be referred to using a reduced reference. In order to use this rule children must be able to store information about events in the story, as well as the information already given by themselves in the narration, in a manner suitable for subsequent retrieval. They must also assume that the listener will be operating the same referential rule in order for coherent discourse to be maintained. The ability to produce a narrative based on these factors would seem to be demonstrated for reference types used for the target object. This is an important observation which must affect the overall conclusions reached about children's ability to use referential forms for objects in a selective and consistent manner. For the stories in the present study, different referential forms are used only to signal whether or not reference to the object has already occurred, or whether or not the referent is being maintained in focus. An object can be referenced at a local level at any point in the story. Due to the shortness of the story, a particular object from the overall class of objects may be re-established periodically, but the class of objects remains in focus throughout the story. Therefore, reference to objects need only take account of story-information at a local level in this study. It is not surprising to find that children with Down's syndrome perform similarly to typically developing children, since they have shown that they can store limited information about aspects of the story which in turn influences the referential form used for characters.

The clear distinction made between the reference types used for initial and further references which is evident for reference to objects is not repeated for reference to characters, for either typically developing children or for children with Down's syndrome. It is therefore possible to argue that, at a local level within the story, and without having to consider status when deciding upon an appropriate reference type, children with Down's syndrome demonstrate their awareness that a reduced form is acceptable as a continuing reference (to an object), while when re-establishing reference they are also aware that a full reference is more appropriate. This pattern of referencing can be seen for both typically developing children and children with Down's syndrome. Such a finding is contrary to that which was expected based on the findings in experiments 2 and 3 which focused upon references to characters. Typically developing children were shown to use thematic subject strategies, by which referential forms are manipulated to mark the status of each character. Children with Down's syndrome were shown to be able to linguistically mark the status of the characters only if the difference in status was maximised, or if the reference depended only on local context rather than taking account of the overall context of the discourse. However, for reference to objects in this task only local information is necessary for consistent referential forms to be used successfully.

The findings obtained from data regarding children's references to objects has proved invaluable in identifying one possible reason why children with Down's syndrome differ in their ability to maintain coherent discourse. Children with Down's syndrome appear able to manipulate linguistic forms in order to distinguish between initial, re-establishing and continuing references by using full references for the two former referential contexts and reduced forms for the latter referential context. They perform this linguistic manipulation in much the same way as typically developing children. However, the specific linguistic forms used within the broad categories of full and reduced references differ for children with Down's syndrome when compared with typically developing children, indicating some linguistically-based difference in their ability to use referential forms.

More importantly, the analysis of references used for objects shows that children with Down's syndrome must be able to form a mental representation of the discourse and access information about the appropriate use of referential forms. Therefore, the difficulty seen when referencing characters must be related to the status of the characters and the inability to represent or access this information, rather than problems with storage and retrieval of information about the story, or problems associated with the use of the linguistic forms. Further work to assess the referential strategies used for objects of differing status, and which do not remain in focus during intervening references may therefore be useful in determining such a claim. Information other than basic contextual cues relevant to the context in which the referential forms are used is necessary in all but the simplest of discourse. An inability to integrate numerous sources of information, and in particular the inability to represent specific information about characters may be one underlying cause of the difficulty which children with Down' syndrome have in maintaining coherent discourse.

Chapter 7

Final Conclusions

7.1 Introduction

The use of mental representations in discourse has been the central theme of the discussion, in relation to language comprehension and production of both typically developing children, and children with Down's syndrome. The main aim of the thesis has been to examine language production in children with Down's syndrome in order to illuminate possible underlying causes for the difficulty exhibited in using expressive language. Numerous abilities have been highlighted in the literature as being precursors of, prerequisites for, scaffolding for, or consequences of general language development, as well as specifically for productive language. Previous research has concentrated predominantly on typical development, although increasing attention is being focused on the underlying processes associated with language development in children with Down's syndrome.

Research which has investigated language development in children with Down's syndrome has, until relatively recently, focused on the developmental sequence of events which surrounds language development, resulting in a detailed account of similarities and differences from typical language development. Descriptions of language development provide a basis upon which to examine potential causes for the differences from typical language development which have been shown to occur. It has been proposed here that one underlying cause for the difficulties experienced by children with Down's syndrome in productive language may be the inability to successfully form or use a mental representation of events. The formation and use of a mental representation enables the integration of information from different sources, and is therefore dependent upon mechanisms which allow for information to be maintained—such as the various components of both long term and short term memory. Without information processing skills such as those identified in working memory, mental representations could not function—the underlying importance of working memory and mental representations will be further discussed.

7.1.1 Information Processing in Referential Strategies

The ability to integrate information is essential in order to maintain cohesive discourse, especially through the use of a thematic subject referential strategy (such as the one identified by Clibbens (1992)). A referential strategy is the use of referential forms, such as a definite noun phrase or a pronoun, to consistently differentiate the characters in the discourse. The referential forms are usually used to distinguish the characters on the basis of their status: for example the main character may be referred to using a pronoun (or other reduced form), while a peripheral character may be referred to using a definite noun phrase (or other full form). There are various reasons why a child may exhibit an inability to use a referential strategy, possible reasons are outlined below.

Language Ability

An inability to acquire the linguistic markers will obviously prevent the use of those linguistic markers which are necessary for the use of a referential strategy which allows the child to distinguish the status of each character in the discourse. Both children with Down's syndrome and typically developing children have provided evidence in experiments 2 and 3 that they had acquired the necessary linguistic markers. Children with Down's syndrome showed that their inability to use a referential strategy could not therefore purely be a consequence of a lack of the linguistic skill needed.

Contextual Information

Contextual information which is shared by the speaker and listener is another factor which must be considered when the speaker decides upon the appropriate referential form to be used. For example, contextual information such as whether or not the listener can see the events described must be considered by the speaker. Any referential strategy which is employed must be flexible enough to take account of such contextual change. It has previously been suggested (Stevenson, 1988) that the referential forms used by children are dependent upon the context, such that different referential forms are used when the listener can see the story from those used when the listener cannot see the story. However, it is suggested here, in the light of the results presented in chapters 4 and 5, that children may be able to make use of a referential strategy which clearly marks the characters, regardless of the position of the listener. However, when additional features of contextual information must be considered—for example when the number of peripheral characters increases, the referential forms used by the typically developing child become increasingly less ambiguous. An increase in the number of contextual factors which must be considered in order to maintain clarity in the discourse requires additional processing resources, the child must therefore be efficient and economical with the referential forms used, to avoid unnecessary processing load both for the listener and for themselves. In general, the use of referential forms by both typically developing children and children with Down's syndrome was not affected by the position of the listener. But other contextual features, such as the way in which the story was presented and the increased distinction in status of the characters, did affect the referential forms used.

Representing Status

A further reason why children may not use a referential strategy may be that they are unable to internally represent the events of the discourse in a way that marks the status of the characters. Without a continually revised representation of events and accompanying discourse the status of the characters in that discourse may not be marked. If the status is not represented the appropriate referential form will not be consistently assigned to each character. As has been shown in the experiments presented here, typically developing children were able to distinguish between the characters, assigning the correct status to each, both through the use of a linguistic referential strategy, and subsequently in answering questions about the characters. The same evidence was used to indicate that status of the characters did not appear to be marked by children with Down's syndrome. However, although clearly not using the thematic subject referential strategy identified by Clibbens (1992), varying the number of peripheral characters caused children with Down's syndrome to alter the choice of referential forms used when re-establishing reference to the characters in the story. That is, when the status of the characters was maximally different (in stories containing only one peripheral character), children with Down's syndrome used significantly more full references for the main character than for the peripheral character—this was true only in cases where the listener could not see the screen. This would suggest that, while children with Down's syndrome do not generally consider the position of the listener as relevant contextual information for influencing the referential forms used, when status is maximally different, such contextual factors can influence the referential forms used.

Such a finding indicates that children with Down's syndrome are able to form a mental representation of the event and of the discourse used to describe it, but are unable to mark the status of the characters in that mental representation, unless it is maximally different.

Maintaining Reference Locally and Globally

The influence of contextual factors on the strategic use of referential forms also seems to be related to the position of the utterance within the discourse. That is to say, children with Down's syndrome have shown (in experiment 3) that at a local level in the discourse—where an event can be reported in isolation from the rest of the story—referential forms are used in much the same way as used by typically developing children. Characters are distinguished linguistically, by using more full references for the peripheral characters than for the main character. This suggests that when only limited amounts of information surrounding the most current events in the story, and where focus need only be maintained rather than re-directed by re-establishing reference to another character, children with Down's syndrome are able to represent relevant information in such a way as to influence the strategic use of referential forms. However, when information must be represented and drawn upon on a global level in the story—such as in cases where attention must be drawn to more than one event in the story and focus to the characters must be re-established—children with Down's syndrome seem unable to maintain the strategic use of referential forms. Overall this suggests that, as would be expected, children with Down's syndrome are able to use mental representations, although in a way which can represent only limited quantities of information. This results in the ability to use a referential strategy at a local level but this cannot be maintained globally.

7.1.2 Language and Processing Ability in Children with Down's Syndrome Revisited

Integration of information has been shown to underlie many of the difficulties of children with Down's syndrome. Literature which has been reviewed in chapter 2 outlined a number of issues which have been examined in relation to language ability and the processing of linguistic information by children with Down's syndrome. Increasingly, research has sought to assess the relationship between linguistic and non-linguistic abilities in children with Down's syndrome in order to establish possible underlying causes for the language deficit exhibited. Such research provides evidence for the domain-specific nature of language abilities. For example as has been shown symbolic representation and development appear to reflect cognitive ability, while linguistic ability is not reflected by cognitive attainments (Beeghly and Cicchetti, 1987; Bates et al, 1988). The specific linguistic deficit experienced by children with Down's syndrome is also shown by difficulty in processing auditory-sequential information and their poor use of the articulatory loop in short term memory, as well as slow access for lexical information from long term memory. Such difficulties in processing linguistic information in short term memory and accessing relevant related information from long term memory may have implications for the use of mental representations in discourse by children with Down's syndrome. Linguistic input is not held for long enough to be processed and systematically encoded to allow it to be transferred to the mental representation of the ongoing discourse. Information relevant to the discourse which must be accessed in order for the discourse to be understood fully may also be less readily available. Without the functioning of these processes the mental representation cannot be revised and relevant information cannot be fully integrated.

Further processing difficulties have also been highlighted as creating problems specifically for grammatical abilities, where the encoding and storage of grammatical information is not thought to undergo reorganisation preventing development of grammatical abilities (Fowler, 1990). The inability to organise information systematically has also been regarded by Karmiloff-Smith (1992) as necessary for cognitive and language processes to function flexibly and efficiently. Representations which accommodate the long term storage of information must be organised so that they can be easily accessed for the formation and use of an on-going representation of current discourse or other changing events. Without the rapid access to such information inferences cannot be made about the most likely interpretation of the discourse. Mental representations of discourse therefore allow potential, literal, or inferred meaning to be assessed by the listener, pragmatic processes enable relevant contextual linguistic and non-linguistic information to be integrated into the mental representation in order for a correct judgement to be made about utterances in the discourse.

7.1.3 Mental Representations and Memory

It can therefore be seen that mental representations form an important part of the ability to maintain coherent discourse, both in its comprehension and production. But what is also important to consider is the fact that working memory must also influence the ability to use and maintain information within a mental representation. The use of grammatical markers and referential strategies are aspects of discourse which can be seen to benefit from the use of mental representations in order to function efficiently and accurately, since they depend on systematic organisation of representations and the integration of other sources of information. Difficulties with these processes, as shown by children with Down's syndrome, may therefore be associated with the formation and use of mental representations. It would be erroneous to suppose that children with Down's syndrome do not have the ability to form a mental representation, how ever limited or simple the representations might be. Since without this ability information could not be integrated but would remain in isolation. As has been previously noted, as well as their importance in the processing of information in general, mental representations are also thought necessary for the development of language and its use in discourse. Therefore, to claim that children with Down's syndrome do not use mental representations at all would be akin to suggesting that language development—or any other skill which depends upon accessing and integrating information—cannot occur. This is clearly untrue, since how ever rudimentary the language skills of children with Down's syndrome may be, some development and use does occur.

It seems likely that poor working memory may interact with other processing deficits, such as poor attentional skills and an inability to organise information, to hinder the efficient use of mental representations. However, little research has focused on the specific relationship between working memory and language production, either in typically developing children or in children with Down's syndrome. Research has largely focused upon the role of working memory in language comprehension in adults. What is known is that while typically developing children are still in the process of developing basic language skills (below the age of five) working memory—and more specifically the central executive—is involved in integrating the various cognitive processes needed to mediate language production. Once basic language development has occurred, the central executive is thought to be less influential, perhaps because the processes have become more automatic and modularised. The central executive is thought to be involved in co-ordinating the interaction between language specific modules and other cognitively based modules necessary for language production, particularly the pragmatic and semantic aspects. Although the central executive is not involved in the process of constructing the precise grammatical forms used in utterances, it is involved in processing and representing the conceptual and semantic content of utterances. Another component of the working memory model—the phonological loop—has been speculatively implicated in language production abilities. Of the limited research in this area, consensus seems to be that the phonological loop is not necessary for the planning and production of spontaneous speech (see Gathercole and Baddeley (1993) for a review of these studies). Research which has focused on memory development is equally sparse, but what seems clear is that short term memory difficulties are related to the retrieval rather than the storage of information (McDade and Adler, 1980). Perhaps this finding can be related to those from the typical development of memory in relation to language, as well as to findings presented in experiments 2 and 3. That the retrieval of information is found to be difficult suggests that the central executive may be experiencing difficulty in co-ordinating the necessary information—perhaps because of an overly limited capacity. If the central executive in unable to perform this important function efficiently, then information cannot be passed to the mental representation of the event or discourse, it will remain incomplete and result in an inflexible system which may only be able to function on a limited scale.

7.2 Theoretical Framework

Models which acknowledge the importance of integration of information are seen to be useful in an investigation of possible causes for the linguistic difficulties experienced by children with Down's syndrome. Models which are likely to be of most use in attempting to explain the problems found in children with Down's syndrome are those which combine representational ability with processing ability and which recognise that, although language has domain-specific aspects, cognitive abilities are also necessary for successful language comprehension and production. A number of the theoretical models highlighted earlier emphasise this focus: including the "Less is More" hypothesis (Newport, 1988), the Representational Redescription (RR) model (Karmiloff-Smith, 1992), and Relevance Theory (Sperber and Wilson, 1986).

The principles of relevance have been shown to offer insight into the mechanisms by which discourse is represented and understood—namely through the use of mental representations of that discourse. Other models which recognise the importance of mental representations in order to understand discourse, such as Johnson-Laird's Mental Models approach or Sanford and Garrod's Focus theory fail to provide both a mechanism by which the initial mental representation can be formed, and a reason why certain aspects of discourse may be interpreted as the most prominent: the principles of relevance provide explanations for both of these. The information which is considered to be important in a particular utterance is selected on the basis of its relevance within the context of the discourse. The amount of processing required to interpret any utterance in the discourse must be minimal, this is made possible by the assumption by both the speaker and listener that any utterance will be unambiguous and relevant to the discourse, without these qualities the utterance will not be processed by the listener. The process by which information is initially selected for processing is underemphasised by Johnson-Laird's Mental Models account. However, as with relevance theory, it does describe the way in which information is subsequently represented and processed. A continually revised representation of the discourse is constructed from inferences made from the interpretation of the utterances and other contextual and world knowledge.

It is this representation of the discourse which allows Sanford and Garrod's notion of Focus to operate. As with the mental models approach, focus emphasises the importance of the integration of various processing resources, such as phonological and semantic decoding, as well as the ability to infer meaning based on non-linguistic information. The speaker will adopt a referential strategy based on the perceived status of the characters in the discourse. What seems unclear is how either the speaker or listener decide upon the main focus of the utterance, or indeed how an utterance would be interpreted if the referential strategy was not followed. The principle of relevance offers a solution to this dilemma.

An explanation of why certain referential forms are used is one application of the RR model. As with Focus theory, Karmiloff-Smith has demonstrated the reasons for the use of referential strategies using narrative tasks, and emphasises the importance of the integration of information and processing resources. Karmiloff-Smith adopts a developmental perspective to the mechanisms by which coherent discourse is maintained, and suggests that children develop the ability to use referential strategies as a consequence of the systematic reorganisation of representations of individual examples of referential forms into rule-systems. Processing resources are therefore seen as central to a child's ability to use a referential strategy, an important implication for the use of referential strategies by children with Down's syndrome, given the known processing difficulties experienced by them. The child's focus of attention will be influenced by the processing resources available to the child. Karmiloff-Smith suggests that initially the child may use a referential strategy which is governed purely by external stimuli rather than by a linguistic rule-governed system. After having systematically reorganised the linguistic information relevant to referential strategies, which requires considerable processing resources, children are now able to access a rule-governed system which determines which referential form will be used for each character in the discourse. Karmiloff-Smith proposes that initially this system is rigidly enforced, but flexibility is achieved after subsequent reorganisation of referential information. Such flexibility may also occur as a consequence of the developing ability to represent discourse and draw on other non-linguistic information to infer meaning, thus allowing for the use of referential forms in a more relevant and less ambiguous way—ultimately leading to discourse which can be interpreted with the use of minimal processing.

Grammatical development has been shown to be incomplete in children with Down's syndrome, and has been thought to be associated with auditory sequential processing difficulties which they also experience. Slow access to linguistic information in long term memory as well as difficulty in processing such information has also been thought to be related to the general delay in the development of expressive language. That access to linguistic information is found difficult by individuals with Down's syndrome may be related to the way in which it is represented, possibly indicating that information has not undergone linguistic reorganisation as it does in typical development. It is possible that such reorganisation may not be possible because of the restricted ability to form and use mental representations based upon limited processing resources needed to maintain them. This would indicate that integration of information may be problematic for individuals with Down's syndrome and may prevent, for example, the use of referential strategies in discourse, as well as other important elements of expressive discourse, such as grammatical markers.

The claim that individuals with Down's syndrome may exhibit an inability to use such strategies in discourse has been given support from evidence at the neural level. Researchers who have investigated neural connections and limitations have identified possible observable associations between neural development and the use of discourse devices. Cognitive development often involves a process of parcellation (isolation between neural circuits), such development may result in modularity (Ebbesson, 1984). Johnson (1988) proposes a theory of neural development which takes account of timing and patterns of loss. The timing and extent of loss of connections or neurons may be genetically controlled, while the specificity or particular pattern of that loss is determined by the external environment, for example characteristics of the input language. The pattern of development seen in individuals with genetic disorders, such as Down's syndrome, is seen to be a consequence of delayed timing of parcellation.

Aspects of the acquisition of discourse strategies can be explained using this theory.

For example, it may be possible that while acquiring discourse cohesion rules, children (between the age of seven and eleven) do have some limited conscious access to them, since there is evidence of an ability to explain reasons for repairs which occur due to discourse constraints, whereas in adulthood that access is lost. This may be a result of the discourse cohesion system becoming more modularised and operating automatically. For the typically developing child selective parcellation for discourse cohesion rules for spoken language may occur at approximately eleven years and result in cognitive modularity. This further supports (in a general sense) the findings of Newport (1988) with regard to second language acquisition in adults and the notion of maturation of cognitive processes limiting the ability to acquire grammatical aspects of language. It also provides neural evidence for the mechanism by which the principle of relevance may operate to maintain coherent discourse, since integration of linguistic and cognitive information must take place via a mental representation of the discourse in order to be interpreted; this therefore requires specific neural connections.

Indeed it has been found (Ross et al, 1984) that brains from people with Down's syndrome have shown increased density of cells and synapses, which may be taken as indicating delayed timing of neural parcellation. In typical development a form of cognitive parcellation occurs as the child builds up efficiently functioning specific procedures, it is this process which may be absent in children with Down's syndrome. The absence of parcellation may lead to the child with Down's syndrome being unable to organise representations systematically since the specialisation of neural pathways has not occurred in order for reorganisation to be carried out. If information has not been organised in a systematic way this may prevent access to relevant information necessary to make the correct inferences about utterances in the current discourse, thus coherent discourse will not be maintained. Systematic organisation also allows rule-systems to be stored and accessed, without which the rule-system cannot be used efficiently. This may indicate the neural basis for the difficulties in using referential devices to maintain coherent discourse which are experienced by individuals with Down's syndrome.

7.3 Grammatical Performance

As has been outlined in chapter 3, the grammatical abilities of adults with Down's syndrome were assessed using grammatical judgement tasks in order to establish grammatical markers which were found to be most and least problematic. The grammaticality judgement task was initially designed to assess the sensitivity of agrammatic aphasics to syntactic constraints using a wide range of sentence structures and grammatical markers (Linebarger et al, 1983). The task therefore provided a structure for assessing abilities of individuals on a range of grammatical markers. An imitation task was also used to assess whether or not the individuals were able to produce and, if possible, to correct the grammatical markers. Many studies have assessed the ability of children with Down's syndrome to develop or produce certain grammatical markers but usually these focus on a very limited number of grammatical markers. A comparison between tasks is often inappropriate or impossible given the range of abilities of the individuals with Down's syndrome who participate as well as the range of tasks used. Therefore, using this set of tasks, assessment of a range of grammatical markers was possible, both their production by imitation and in a spontaneous speech sample, and their comprehension using the grammaticality judgement task.

The main findings from experiment 1 revealed that adults with Down's syndrome were poorer at identifying errors made in ungrammatical sentences when compared with second language learners on a similar task. Their ability to produce grammatical markers correctly by imitating sentences as well as in spontaneous speech was also found to be limited. The errors made on each of the tasks were assessed and showed that the error rate was similar for each task with regard to each grammatical marker.

These results, therefore, clearly show that grammatical achievement is rather limited in adults with Down's syndrome across a wide range of grammatical markers. The reasons for this inability are unclear; Newport (1988) points to processing abilities underlying the development of grammar, others (e.g. Fowler, 1990; Karmiloff-Smith, 1992) suggest that reorganisation of linguistic information into rule-based representational systems must form the basis for linguistic competence, both in comprehension and production. This has been shown to be the case in grammatical development as well as more general discourse strategies.

What also becomes clear from this study is that further work must focus on the processes involved in producing grammatical markers in context by using a task which does not take sentences in isolation but which assesses the processes involved in discourse. By adopting a more discourse-based approach the underlying processes necessary to maintain discourse can be assessed, since they are also necessary for the understanding and production of grammar. It has been suggested that when the overall meaning of a sentence was not altered the adult with Down's syndrome was not able to detect the error in the sentence. This finding suggests that they are not processing the individual grammatical markers in a sentence, and so, as Newport found when assessing second language learners, they are unable to produce the same grammatical markers. However, this finding also suggests that, while the exact nature of the sentence is not encoded and linguistically analysed, the adult with Down's syndrome does seem able to represent the general meaning of an utterance. This would suggest that adults with Down's syndrome are able to form an accurate mental representation of the meaning of isolated sentences. However, the ability to successfully use both grammatical markers and discourse strategies depends on the ability to access and integrate sources of information on a wider scale than from one single sentence. The integration of information within a mental representation and also the ability to mark that information efficiently so that it can subsequently be used to make inferences about the utterances in discourse may be what hampers adults with Down's syndrome from using grammatical forms and referential strategies in discourse.

7.4 Referential Strategies Identified

Following the findings of the first experiment, focus was given to discourse strategies which make use of grammatical markers. Particular attention was given to the ability to use referential forms by both typically developing children and children with Down's syndrome. This was investigated for a number of reasons. First, pronominalisation was identified as one grammatical marker for which the adults with Down's syndrome showed some aptitude, but equally was a grammatical form which proved more difficult from some other grammatical forms. That adults with Down's syndrome were able to use it with some apparent success, signalled that children with Down's syndrome would have at least some ability to use referential forms. Second, the understanding and use of referential forms demands the integration of numerous sources of information both linguistic and non-linguistic. For example, in order for nominal reference to be used efficiently in discourse, the individual must be able to produce and understand the relevant referential forms, therefore linguistic skill is necessary. The referential forms must be represented internally and associated with the intended referent in order for the correct inferences to be made about each utterance. It must also be possible to access other contextual, and linguistically relevant information once it has been established which information is relevant to the discourse.

Models of typical development have suggested that integration of information is achieved through the use of a mental representation of the discourse which can be continually updated to take account of linguistic and contextual information as it arises. It is the ability to integrate information which has previously been identified as difficult by individuals with Down's syndrome. This would suggest that children with Down's syndrome may not be able to form and use mental representations effectively in the understanding and production of referential forms, especially over a period of discourse longer than one or two utterances. This inability also implicates the working memory skills known to be limited in individuals with Down's syndrome.

The task designed in the second experiment therefore sought to elicit a spontaneously produced discourse which contained referential forms from both typically developing children and children with Down's syndrome. The narrative task used attempted to examine certain factors which were deemed to be important to the way in which children used referential forms. From the review of previous research outlined in chapter 4, the process by which typically developing children assign reference is not completely understood, therefore, this experiment was able to examine typical development as well as the development of children with Down's syndrome regarding the use of referential forms in a strategic manner.

7.4.1 The Influence of the Mode of Presentation

The task was designed to address some of the criticisms of previous narrative studies. It was also designed to compare the various methods of presentation used to assess the impact this has on the narrative style and referential strategies used by children. The types of narrative task which have been used are outlined in chapter 4, but the main distinction seems to be between story-book presentation (Bamberg, 1986; Karmiloff-Smith, 1985; Emslie and Stevenson, 1981) and video presentation (Clibbens, 1992). It is possible to alleviate some of the cognitive burden imposed by a narrative task. Bamberg achieved this by giving children prior exposure to the stories to be narrated. Video presentation has also been thought to provide similar advantages over traditional story-book presentation (Clibbens) thus resulting in different types of referential strategies from those seen when the story was presented in a static form. Results reported in chapter 4 indicate that when the characters in the video presentation were still the typically developing children of all age-groups produced a similar referential strategy to the one used when the characters in the presentation were moving but one which more clearly identified each referent. This is contrary to expectations based on previous findings. Clibbens, using video presentation, found that children used a referential strategy which clearly marked the status of each character using linguistic forms and suggested that this was because the cognitive processing requirements for video presentation were less than for story-book presentation. Karmiloff-Smith, using a story-book presentation, found that the status of the characters would be marked by their position in the utterance as well as the referential form used by children over the age of five. Clibbens identified a different referential strategy in which children as young as five were able to distinguish the status of the characters by using full references for peripheral characters and reduced references for main characters. The data presented here suggests that the differing referential strategies identified by Clibbens and Karmiloff-Smith may be due to the fact that presentation occurred on video rather than the fact that in one presentation the characters were moving and in the other they were still. When stories are presented on video there may be the necessity to be more reliant on an internal representation of events than when those events are presented in story-books. It is possible that it is the distance between the child and the stimulus which is the important difference between studies using video and story-book presentation. In story-books the pictures are close to the child, allowing pointing and deictic reference, once the events have been described the next picture can become the focus of attention. The internal representation may be "scaffolded" by the presence of the static picture. For video presentation the internal representation must be continually revised to take account of new information—so in that respect this type of presentation is more akin to the way in which natural discourse is conducted. It has been suggested that story-telling devices are developed in the school years as children become familiar with the procedure. Tasks such as the one devised by Karmiloff-Smith are likely to assess that ability—perhaps an explanation as to why younger children did not exhibit the same referential strategy as older children. Video presentation may be less likely to prompt children to use their story-telling skill, instead prompting them to use referential strategies which they would normally adopt for discourse.

More full references were used in the still video presentation than in the moving one. Children tended to opt for clarity in referencing the characters in still videos—where more full references were used for both characters. Perhaps this indicates the efficiency with which mental representations can be used when a longer length of time is given for children to focus on one event and assess the referent. The more rapid presentation in moving videos may prompt a "default" referential strategy, as suggested in chapters 4 and 5.

For children with Down's syndrome, no clear referential strategy was evident for either type of video presentation, since the status of the characters was not consistently marked linguistically. It would be tempting to assume that this finding was the result of linguistic incompetence, however, children with Down's syndrome are able to use a range of nominal referential forms. Therefore, this further suggests that it is the difficulty in assigning status to a character in a story which prevents them from using a thematic subject referential strategy consistently in instances where global information about the discourse as well as local information must be acknowledged. One likely reason for such a limited ability may be that they are not able to use a mental representation effectively to integrate the necessary information which would allow status to be assigned and maintained.

7.4.2 The Influence of the Listener

The position of the listener as well as the status of the listener was assessed. In general, contrary to findings by Emslie and Stevenson (1981) and suggestions by Stevenson (1988), whether or not the listener could see the story did not cause typically developing children to alter their referential style, perhaps either assuming that their referential strategy was familiar to the listener, or that the referential forms chosen were not ambiguous. Similarly, children with Down's syndrome did not alter the way in which they referred to characters when the position of the listener was changed. Initially, the experimenter was the listener, but it was suspected that the child had assumed that the experimenter was already familiar with the story. Therefore, subsequently in experiment 3, another child was asked to be the listener; however, this did not significantly affect the referential forms used by the narrating child for stories with the same number of characters. However, when altering the number of characters in the story, the position of the listener was found to influence the referential strategy used. This additional factor may perhaps have alerted the child to the need to pay particular attention to the referential forms used, particularly when more characters were in the story and when the listener could not see them. The child cannot rely on the listener being aware of the structure of the story, since it changes from story to story.

7.4.3 The Influence of Character Status

In experiment 3 the number of peripheral characters in the story was varied in an attempt to maximise the difference in status between the characters. Results from experiment 2 had shown that children with Down's syndrome did not use a thematic subject referential strategy. It was suspected that this may have been due to an inability to mark status. Therefore, where the story contained only one peripheral character, it was predicted that the difference in status between the main and peripheral character would be more pronounced than when there were two peripheral characters and would result in there being a clearer distinction between characters in the narratives—using differing referential forms for each character. For both typically developing children and for children with Down's syndrome more full references were used to refer to both characters when there were two peripheral characters in the story. This indicates that, not only were children aware of the need to disambiguate references to characters, they were also possibly less clear which referent should be marked as the main character and which as the peripheral characters.

Children with Down's syndrome were able to distinguish character status linguistically only in stories which contained one peripheral character, and only then when the listener could not see the screen. It would therefore appear that they are able to represent the events of a story and also have some understanding of the need to distinguish between characters but can only do this when the distinction is made very clear to them. This contradicts the claim made by previous research which has suggested that the underlying cause of the inability of individuals with Down's syndrome to maintain coherent discourse through their difficulty in production of expressive language is purely linguistic in nature. Results of this study would suggest that they are able to use referential forms. As indicated, they may be able to form representations of the events in a story or in discourse, but perhaps are unable to use the mental representation efficiently to integrate other sources of information which would allow them to maintain a distinction between the characters. It has been shown that children with Down's syndrome are able to use referential forms to mark the status of a character at a local level in a story, but are less able to maintain this distinction globally. This may be related to the fact that more information must be drawn upon in order to use referential forms in this way on a global level. Therefore, the influence of a very limited processing capacity of the central executive in working memory may prevent the co-ordination of the increases sources of information needed for global referential strategies to be maintained.

Explicit Investigation of Status Representation

Further evidence from experiment 3 has shown that the inability to mark the status of characters clearly using referential forms in a narrative may be the result of a difficulty in maintaining status information within a mental representation. Each child was asked to identify the main characters in the stories, while typically developing children were able to perform this task flawlessly, children with Down's syndrome were unable to consistently identify one character as the main character and the other(s) as peripheral. In order to prevent such a task from being influenced by memory abilities, photographs of actual and potential characters were given as prompts. While the majority of children with Down's syndrome were able to identify the relevant characters, thus indicating that they could remember them and had encoded them internally, they were unable to identify their status. Clearly the problems of limited working memory cannot be alleviated simply by providing memory aids since working memory is implicated in the use of mental representations which store and manipulate such information.

The perspective of a relevance theoretic approach is useful in understanding the implications of such findings. Relevance Theory relies on the ability of both interlocutors to distinguish the most important or salient features in discourse. Such features must first be identified and subsequently marked within a mental representation of the discourse. This allows the speaker to make assumptions about what the listener already knows about the discourse. Referential strategies can also be used on this basis, since the speaker assumes that the listener has identified and marked the status of each character, enabling them to retrieve the antecedent of a potentially ambiguous referential form without the use of additional processing resources. If the speaker is unable to identify the main character of the discourse, a referential strategy of this type cannot be used. The purpose of a referential strategy is to preserve processing resources once the status of each character is established. If a referential strategy is not used additional processing will be required to identify referents and their importance to the discourse, ultimately resulting in less cohesive discourse.

Cognitive processing resources are essential for maintenance of coherent discourse. Referential strategies used in discourse are not governed purely by linguistic skills, but rather are largely reliant upon cognitive skills, this suggestion is reinforced by the fact that scores obtained on all standardised tests correlated with the ability to use referential strategies. This in turn strengthens the claim that the problem faced by children with Down's syndrome is one concerning cognitive processes, specifically in the ability to effectively use a mental representation, rather than a problem in using linguistic forms.

7.4.4 Referencing Objects

In order to further assess the use of referential forms, the way in which children refer to objects in the story was investigated. Such analysis has provided further information about the ability of children with Down's syndrome to store and manipulate linguistic information within a mental representation of the narrative. Although the preferred individual referential forms used by children with Down's syndrome differed from those used by typically developing children, children with Down's syndrome were shown to use a similar proportion of full references as five-year-olds in each of the linguistic contexts assessed—initial, continuing and re-establishing references. While for characters their status dictates the referential form used for them, for objects the context within the story is the most important factor which influences the referential form used. Children with Down's syndrome have shown that they are able to use a thematic-subject referential strategy only in very specific conditions, occurring predominantly in instances where information about the preceding discourse needs to be considered at a local level only. Typically developing children have shown, in both experiments 2 and 3, that they are able to use a thematic subject referential strategy in most conditions, although the flexibility with which this is employed increases with age. However, the way in which children use references for objects shows that not only are all subject groups able to manipulate the relevant linguistic forms, they are also able to do so in a way which is appropriate to the various linguistic contexts. What is also interesting is that children with Down's syndrome perform at a level similar to five-year-olds. Such a finding confirms the previous conclusions reached when assessing the referential forms used for characters in a story, that children with Down's syndrome are able to use linguistic forms reliably, and—at a local level—to take account of the linguistic context. These abilities indicate that children with Down's syndrome are able to use a mental representation of the discourse in order to store and manipulate both linguistic-, and to a lesser extent, non-linguistic information. What remains less clear is how efficiently a mental representation can be used by children with Down's syndrome when increasing amounts of information need to be retrieved and manipulate in order to maintain a referential strategy—for example to mark the status of the character and the change of focus.

7.5 Current Understanding

The experiments presented here have contributed to the current understanding of the way in which grammatical forms are used by typically developing children of various ages, and by children with Down's syndrome. The experiments have therefore provided some insight into the developmental progression of the use of referential forms for both groups and have indicated differences in the developmental pathway. From such results possible causes for the difficulties experienced by children with Down's syndrome have been addressed. More importantly, the experiments have identified instances where children with Down's syndrome can perform successfully. The findings from these experiments can be seen in the context of previous research below.

The advantages of using a narrative task have been clearly indicated, since it allows underlying processes associated with the maintenance of discourse to be investigated. It also enables the use of certain grammatical forms to be assessed in a controlled context rather than in isolated sentences. Many variations of narrative tasks have been used in developmental studies, examining abilities of both typically developing children as well as those with learning disabilities. These have highlighted that narrative performance is related to age and more specifically the processing abilities of those different age groups in relation to their ability to represent and systematically store rule-governed systems (Karmiloff-Smith, 1985; Clibbens, 1992).

Narrative ability at various ages has been assessed in experiments 2 and 3 for typically developing children. Previous research has identified several forms of referential strategies, the one identified by Clibbens (1992) has been largely replicated in the experiments presented here, which indicates that children as young as five are able to use a thematic subject referential strategy in which more full references are used for the peripheral characters than for the main character. This is not consistent with the precise nature of the referential strategy proposed by Karmiloff-Smith (1985). However, findings from experiments 2 and 3 show an increased flexibility in the use of a referential strategy with an increase in age (for typically developing child) which support her claims related to the RR model. The RR model predicts that further reorganisation of representations allows greater flexibility in the use of referential forms since the child can use referential forms based on information other than purely linguistic constraints.

The type of task used has also been shown to affect the narrative competence of children, which has also been related to skills attained at school regarding the structuring of a story (Spinillo and Pinto, 1994; Cain and Oakhill, 1996). Such claims indicate that training may enhance the child's ability to produce full narration; if this is possible, training may enhance the ability to maintain cohesive discourse in children with Down's syndrome. Others have indicated that the inability to produce clear narrative may be due to the inability to integrate sources of information (Hemphill et al, 1991), perhaps explained by an inability to build a representation of the story rather than limitations of working memory (Cain and Oakhill, 1996). Findings presented from experiments 2 and 3 support and enhance suggestions from this recent research.

The type of narrative task has also been varied in this study, indicating that referential strategies used by typically developing children can be affected by the way in which the story is presented, as well as the number of characters in the story. This has been more evident for typically developing children than for children with Down's syndrome mainly because children with Down's syndrome tend not to use a thematic subject referential strategy reliably and consistently. Assessment of the reasons underlying this inability to use a referential strategy seems to indicate that the problem lies in the limited ability to use mental representations in discourse, or at least in maintaining information within a mental representation across prolonged discourse. This finding has been specifically identified as being related to an inability to represent the status of the character—unless that status has been clearly differentiated, perhaps because this depends upon the integration of both linguistic and non-linguistic sources of information.

The ability to integrate information has previously been shown to be difficult for children with Down's syndrome, this ability is achieved through systematic organisation of that information so that it can be accessed and used within a mental representation. Therefore, it can be concluded that children with Down's syndrome, although able to use linguistic forms (such as referential forms) in an isolated fashion, are unable to integrate their use with information about the status of the characters in a sustained manner. This leads to the difficulties exhibited in maintaining cohesive discourse and those problems associated with expressive language which have been previously reviewed (see chapter 2) such as limitations imposed by a deficient working memory. While some researchers have focused on a purely linguistic explanation for difficulties found in children with Down's syndrome in productive language, results obtained in this study suggest that an integration of cognitive and linguistic processes may be a more likely explanation.

7.6 Further Work

Although contributing substantially to the understanding of typical development, such a study has opened an interesting and important area of research, exposing the relationship between cognitive and language abilities, and potential causes for difficulties of language production for children with Down's syndrome. More work is clearly necessary to further the understanding of the contribution cognitive processes make to language production in children with Down's syndrome.

Perhaps the practical implications of the findings presented here related most specifically to the way in which language production can be enhanced for children with Down's syndrome. It has been indicated that for typically developing children training on language tasks, such as the ones which have been used for this research, can improve performance. Some form of training may be possible for children with Down's syndrome for their use of grammatical forms. An immediate focus may be on the use of thematic subject referential strategies since obvious consequences of using ambiguous terms may be demonstrated. Comprehension tasks may be used to initially introduce the concept of ambiguity, and then progress to production tasks, supported by training.

There is some reservation for using training tasks with children with Down's syndrome because of the inability with which they build on previous experience of a situation and flexibly apply that learning to other situations. However, training has been used successfully in a number of learning domains, indicating that given a carefully planned task training is possible. Considerations such as providing smaller steps in instructions, more frequent repetition of those instruction may assist in such a learning environment. Findings from the experiments presented here indicate that the more distinct the information, and the more limited the amount of information to be considered, the more successfully language is produced.

Although children with Downs syndrome demonstrate that they are able to use a mental representation of the discourse, the amount of information which can be manipulated within that mental representation is relatively limited. Such a finding indicates that the limited central executive processing capacity of working memory may underlie the problems associated with the use of the mental representation mechanism. If this is the case, further work needs to focus on whether or not such a link exists, and if so how it can be overcome. Clearly, a memory test which assesses the central executive aspect of working memory could be used in conjunction with the other tasks used in the experiments presented here in order to assess the link between memory ability and referential ability. However, this has been previously considered in the course of designing the experiments, and search for a memory task which was known to assess such related skills was unforthcoming. Given the fact that it is only very recently that attention has been directed at the connection between the development of language production and working memory ability, this is unsurprising—but clearly needs to be further assessed.

Manipulations to the tasks used, such as the way in which the stories have been presented and the story structure, have shown that it is possible to influence the referential forms used by children—the success with which this is achieved largely depends on the developmental progress of the child. However, one important implication of this finding is that general conclusions about the ability of children to use referential strategies based on one single type of task can be made only with extreme caution. Following this acknowledgement, there are obvious further manipulations of the tasks already used in order to assess the impact they have on referential strategies used. For example, altering the presentation mode and the number of peripheral characters are two elements of the story which have been manipulated and have been shown to significantly effect that referential forms used. Therefore, these features should be further combined to test the effect of stories which are presented on screen and which have still characters, and which contain only one peripheral character. Interestingly this would be more closely related to the stimulus used by Karmiloff-Smith (1985), and so would offer clearer comparison between findings using a story book when compared with video presentation.

Other manipulations would also include attempting to demonstrate a thematic object effect. If children with Down's syndrome were unable to use the referential forms as consistently as typically developing children when a status is attached to the object, and when reference to the object must more definitely be re-established, this would parallel findings shown by references used for characters. Such a finding would indicate that it is the amount of information which must be manipulated in order to maintain reference globally throughout the story which inhibits the successful use of a thematic subject—or object—referential strategy.

The ambiguity apparently experienced by children with Down's syndrome regarding the identification of the status of each of the characters may be alleviated using the presentation of an event in which the characters (and their relative status) are familiar to each child. Although some form of control could be imposed, and could be performed on a relatively small subject group, the main problem would be controlling the event—for example its nature, length, relative importance of each character, familiarity with child—the list is endless. In the light of such difficulties, the tasks already used seem to be more beneficial than a personalised form of the task.

7.7 Conclusion

The experiments which have been carried out in this study have highlighted a number of difficulties experienced by both adults and children with Down's syndrome. The initial experiment indicated that adults with Down's syndrome find both the comprehension and production of grammatical forms problematic. One such form was pronominalisation. Subsequent experiments have therefore investigated possible underlying causes for difficulties in the use of referential forms using a narrative task.

It has been argued that the successful use of referential forms is dependent upon forming and maintaining a mental representation of the discourse. It has therefore been concluded that in order to use a thematic subject referential strategy numerous sources of information must be integrated into such a mental representation, especially when re-establishing reference to a character in the discourse.

The success with which a thematic subject referential strategy is used by typically developing children increases with age and is largely dependent upon context—especially for older children. However, children with Down's syndrome have shown that the use of such a strategy can only be maintained in contexts where limited amounts of information need to be integrated into a mental representation. This may be as a consequence of limited working memory capacity which may prevent the integration of information. Clearly the way in which information about the status of characters in a story is stored by children with Down's syndrome seems to be impaired, or at least different from that of typically developing children. This seems to be related to cognitive rather than purely linguistic problems, since children with Down's syndrome indicate that they are able to use the linguistic forms appropriately when less information needs to be integrated and the importance of status is removed.

In addition to the understanding gained about the difficulties experienced by children with Down's syndrome, further understanding of the use of referential strategies by typically developing children has been gained. This has been achieved by manipulating various contextual variables and comparing results of this study with previous studies. The way in which typically developing children use referential forms is clearly dependent upon both age and contextual features. The principles of relevance (Sperber and Wilson, 1995) and Karmiloff-Smith's (1992) Representational Redsecription model have provided a framework from which to interpret the results obtained.

Following the identification of the ability to maintain a mental representation of discourse as a possible underlying cause for difficulties with the use of referential forms by children with Down's syndrome, further work must investigate the exact nature of the mechanisms which allow such a process to operate. Implicated in such a mechanism is the functioning of working memory. Therefore it would be useful to develop a measure which could assess each type of information necessary for the use of a referential strategy, and the way in which it is encoded, represented and accessed in association with referential skills and memory ability in order to highlight more clearly the exact nature of the representational problem shown by children with Down's syndrome.

Appendix A

Sentences used for the Grammatical Judgement Task and the Imitation Task.

Twelve grammatical markers were tested in experiment 1. There are four morphological and eight syntactic rules. Each grammatical marker is listed below. Each section indicates the way(s) in which the sentences were made ungrammatical in the format section, the sentences which were used are then listed.

A.1 Morphology

Format

a Omitting required morpheme

b Replacing required morpheme with an inappropriate morpheme from a different class

c By making an irregular item regular

d By attaching a regular marking to an already irregularly marked item.

A.1.1 Past Tense

a Omitting required morpheme

1 The cat popped the balloon this morning

2 The cat pop the balloon this morning

3 Earlier Peter shouted the instructions loudly

4 Earlier Peter shout the instructions loudly

5 When we were on holiday our engine overheated

6 When we were on holiday our engine overheat

7 Ethel recovered well after her operation

8 Ethel recover well after her operation

b Inappropriate morpheme

9 Yesterday the hunter shot a deer

10 Yesterday the hunter shoots a deer

11 I bought a new dress for my doll last year

12 I buy a new dress for my doll last year

13 I watched the frog jump over the log

14 I watches the frog jump over the log

15 Farmers were happy because it rained last night

16 Farmers were happy because it rains last night

c Regularising item

17 Many birds slept in the tree

18 Many birds sleeped in the tree

19 The man left before she woke

20 The man left before she waked

21 The dog ate the bone quickly

22 The dog eated the bone quickly

23 Small fish swam away from the big net

24 Small fish swimmed away from the big net

d Attaching regular marking to an irregular item

25 A bat flew into our attic last night

26 A bat flewed into our attic last night

27 Five men drove past the traffic jam

28 Five men droved past the traffic jam

29 The policeman found the jewels which had been stolen

30 The policeman found the jewels which had been stolened

31 The children read the notice in the playground

32 The children readed the notice in the playground

A.1.2 Plural

a Omitting required morpheme

1 The farmer bought two pigs at the market

2 The farmer bought two pig at the market

3 Most flowers grow better in the sunshine

4 Most flower grow better in the sunshine

5 The child in the park was frightened by all the dogs

6 The child in the park was frightened by all the dog

7 The ships were sailing in a long line

8 The ship were sailing in a long line

c Regularising item

9 The shoe salesman sees many feet during the day

10 The shoe salesman sees many foots during the day

11 The way the geese flew was beautiful

12 The way the gooses flew was beautiful

13 The cat likes to chase the mice in the shed

14 The cat likes to chase the mouses in the shed

15 The dentist thought the girls teeth were dreadful

16 The dentist thought the girls tooths were dreadful

d Attaching regular marking to an irregular item

17 All the fish in the pond were black

18 All the fishes in the pond were black

19 The shepherds brought all their sheep into the field

20 The shepherds brought all their sheeps into the field

21 The deer ran away when they heard us coming

22 The deers ran away when they heard us coming

23 Highland cattle often live in Scotland

24 Highland cattles often live in Scotland

A.1.3 Third Person singular

a Omitting required morpheme

1 Bill says he likes the chocolate

2 Bill says he like the chocolate

3 The boy thinks he is clever

4 The boy think he is clever

5 Susan sits down because she is tired

6 Susan sit down because she is tired

7 The woman knits a jumper

8 The woman knit a jumper

9 When the water gets too cold it freezes

10 When the water get too cold it freezes

11 The plate breaks on the hard floor

12 The plate break on the hard floor

A.1.4 Present Progressive

a Omitting required morpheme

1 The little boy is speaking to a policeman

2 The little boy is speak to a policeman

3 Ducks are washing their beaks in the water

4 Ducks are wash their beaks in the water

5 The children are laughing at the clowns

6 The children are laugh at the clowns

7 The monkeys are swinging in the branches of the trees

8 The monkeys are swing in the branches of the trees

9 The Chef is cooking a wonderful meal

10 The Chef is cook a wonderful meal

11 The man is painting white lines on the road

12 The man is paint white lines on the road

A.2 Syntax

A.2.1 Determiners

Format

a Omitting determiners in required contexts

b Substituting the indefinite for the definite

c Inserting them where neither article is allowed

Sentences

a Omitting determiners

1 Tom is reading a book in the bath

2 Tom is reading book in the bath

3 The musician is playing a piano

4 The musician is playing piano

5 The footballer kicks the ball

6 The footballer kicks ball

7 My car has a broken steering wheel

8 My car has broken steering wheel

b Substituting indefinite for definite

9 The boys are going to the zoo this Saturday

10 A boys are going to the zoo this Saturday

11 The girl blew out the candles

12 The girl blew out a candles

13 The best way to get home is by taxi

14 A best way to get home is by taxi

15 The whale is the largest mammal in the world

16 The whale is a largest mammal in the world

c Inserting articles inappropriately

17 Larry went home after the party

18 Larry went the home after the party

19 Mable baked a cake for my birthday

20 Mable baked a cake for the my birthday

21 The roundabout was spinning very quickly

22 The roundabout was spinning a very quickly

23 A fireworks display was organised for the queen

24 A fireworks display was a organised for the queen

A.2.2 Pronominalizaton

Format

a the wrong case marking

b an error in number or gender agreement

c an erroneous form of the possessive adjective

Sentences

a Wrong case marking

1 Susan is making some cookies for us

2 Susan is making some cookies for we

3 The bouquet of flowers was for me

4 The bouquet of flowers was for I

5 They were sure it was his birthday yesterday

6 They were sure it was him birthday yesterday

7 We have painted the house for the old man

8 Us have painted the house for the old man b Error in gender agreement

9 The girl cut herself on a piece of glass

10 The girl cut himself on a piece of glass

11 The man went to have his head shaved

12 The man went to have her head shaved

13 The children saw the 5 lions and were frightened by them

14 The children saw the 5 lions and were frightened by it

15 We watched the kite as it floated in the air

16 We watched the kite as they floated in the air

c Erroneous form of possessive adjective

17 Carol is cooking dinner for her family

18 Carol is cooking dinner for hers family

19 Your house is on fire

20 Yours house is on fire

21 The poor woman borrowed some of my clothes

22 The poor woman borrowed some of mine clothes

23 The trees in our garden were coming into blossom

24 The trees in ours garden were coming into blossom

A.2.3 Particle Movement

Format

a treating prepositions as particles (prep. to right of object NP)

b particles in their moved and unmoved positions and moving particle outside its own clause

Sentences

a Prepositions as particles

1 The man climbed up the ladder carefully

2 The man climbed the ladder up carefully

3 The aerial came through the roof during the storm

4 The aerial came the roof through during the storm

5 All sales men were told to wait in the hall

6 All sales men were told to wait the hall in

7 The boy played with the ball energetically

8 The boy played the ball with energetically

b Moving particles

9 Kevin phoned up Nancy for a date

10 Kevin phoned Nancy up for a date

11 Kevin phoned Nancy for a date up

12 The guard dog barked at the intruder yesterday

13 The guard dog barked the intruder at yesterday

14 The guard dog barked the intruder yesterday at

15 The doctor had to cut off the leg of the injured man

16 The doctor had to cut the leg off of the injured man

17 The doctor had to cut the leg of the injured man off

18 The boat sailed down the river to the sea

19 The boat sailed the river down to the sea

20 The boat sailed the river to the sea down

A.2.4 Subcategorization

Format

Ungrammatical sentences formed by exchanging the different subcategorisation frames of the 2 semantically similar verbs

1 The man allows his son to watch TV

2 The man allows his son watch TV

3 The dog lets the cat eat his supper

4 The dog lets the cat to eat his supper

5 He came to my house at 6 O'clock

6 He came my house at 6 O'clock

7 The girl visited the pet shop after school

8 The girl visited to the pet shop after school

9 The policeman was talking to a woman

10 The policeman was talking a woman

11 The teacher was instructing his pupil

12 The teacher was instructing to his pupil

A.2.5 Auxiliaries

Format

a "Have" requires a past participle

b following any form of "be" the main verb must take the progressive

c only the first element of aux. is tensed

Sentences

a Missing past participle

1 The lamb has fallen into the ditch

2 The lamb has fall into the ditch

3 The boy has shown me his prize

4 The boy has show me his prize

5 The birds from the pond have migrated

6 The birds from the pond have migrate

7 The biscuits have started to break

8 The biscuits have start to break

b Progressive form of verb after "be"

9 Fred will be getting a new greenhouse soon

10 Fred will be get a new greenhouse soon

11 It has been raining all week

12 It has been rain all week

13 The musician will be performing in the concert

14 The musician will be perform in the concert

15 I am going swimming at the weekend

16 I am going swim at the weekend

c First element of auxiliary is tensed

17 Joseph should have written a letter to his mother

18 Joseph should has written a letter to his mother

19 The flower would have grown taller if we had watered it

20 The flower would has grown taller if we had watered it

21 We should have played in the snow at Christmas

22 We should has played in the snow at Christmas

23 I would have worn a hat if I had known about the cold weather

24 I would has worn a hat if I had known about the cold weather

A.2.6 Yes/No Questions

Format

a 2 auxiliaries are moved in front of the subject

b both the auxiliary and verb are fronted

c the verb is fronted in a sentence were do-insertion would normally occur

d copying instead of moving the auxiliary verb

Sentences

a Moved auxiliaries

1 Has the king been served his dinner

2 Has been the king served his dinner

3 Have you been following the news recently

4 Have been you following the news recently

5 Will we be eating the picnic on the beach

6 Will be we eating the picnic on the beach

7 Can you be trusted to tidy the house

8 Can be you trusted to tidy the house

b Fronted auxiliary and verb

9 Can the little girl ride a bicycle

10 Can ride the little girl a bicycle

11 Have you fed the animals today

12 Have fed you the animals today

13 Shall I meet Frank at the theatre

14 Shall meet I Frank at the theatre

15 Will you take the old man to see the doctor

16 Will take you the old man to see the doctor

c Do-insertion removed

17 Did Bill dance at the party last night

18 Danced Bill at the party last night

19 Did Betty put the washing out to dry

20 Put Betty the washing out to dry

21 Did the hounds chase a fox up the hill

22 Chased the hounds a fox up the hill

23 Did the typist spell my name correctly

24 Spelt the typist my name correctly

d Copying not moving the auxiliary verb

25 Can the boy drive a tractor

26 Can the boy can drive a tractor

27 Is the boy having a good time

28 Is the boy is having a good time

29 Are they playing cricket in the park

30 Are they are playing cricket in the park

31 Has the girl learnt to use a knife and fork

32 Has the girl has learnt to use a knife and fork

A.2.7 Wh-Questions

Format

a no subject-auxiliary inversion occurs

b Do-insertion is omitted

c substituting an incorrect wh-word for a correct one

Sentences

a No subject-auxiliary inversions

1 When will Sam mend his car

2 When Sam will mend his car

3 What time should the next bus arrive

4 What time the next bus should arrive

5 Why can Mary play with the train set

6 Why Mary can play with the train set

7 Which book has John already bought

8 Which book John has already bought

b Do-insertion omitted

9 What do they sell at the corner shop

10 What they sell at the corner shop

11 Why do you like my new car

12 Why you like my new car

13 Which fruit do you prefer

14 Which fruit you prefer

15 Where did they go on holiday

16 Where they go on holiday

c Incorrect wh-words

17 Where did she put the blanket

18 Why did she put the blanket

19 Why is that man staring at you

20 Which is that man staring at you

21 Which way should I go to the library

22 What way should I go to the library

23 What time do you come home from work

24 Where time do you come home from work

A.2.8 Word Order

Format

a Intransitive (NP-V)

b Transitive (NP-V-NP)

c Dative (NP-V-NP-NP)

Sentences

a Intransitive (NP-V)

1 The woman paints

2 Paints the woman

3 The choir boy sang

4 Sang the choir boy

5 The telephone rings

6 Rings the telephone

7 The fire burned

8 Burned the fire

b Transitive (NP-V-NP)

9 The boy bounces the ball

10 The ball bounces the boy

11 The farmer milks the cow

12 The cow milks the farmer

13 A bird built a nest

14 A nest built a bird

15 The girl dug a hole

16 A hole dug the girl

c Dative (NP-V-NP-NP)

17 Martha asked the policeman a question

18 Martha a question asked the policeman

19 The teacher gave the boy some lines

20 The boy the teacher some lines gave

21 The milkman loaned Mrs Smith a pound

22 Loaned a pound Mrs Smith the milkman

23 The hairdresser gave the man a haircut

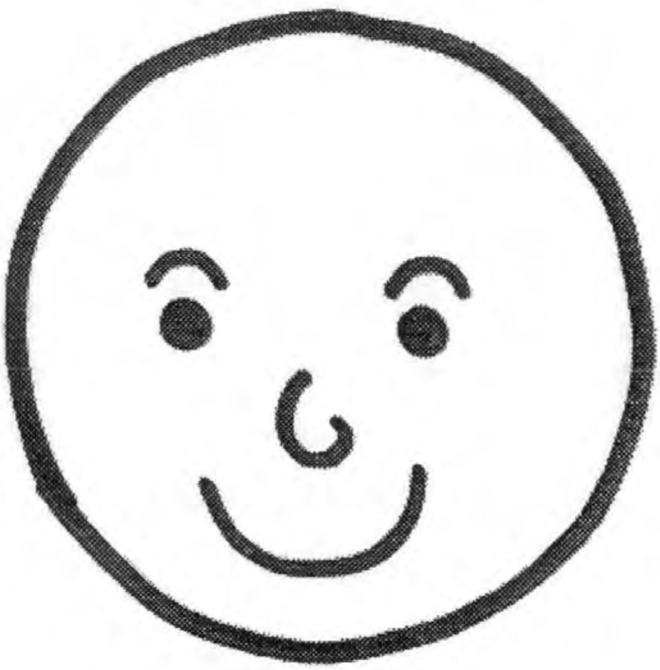
24 A haircut gave the man a hairdresser

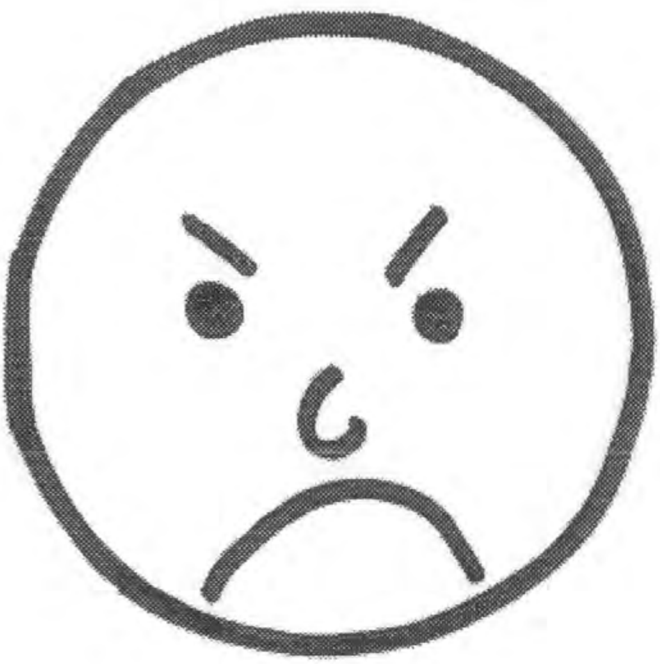
Appendix B

Experiment 1: Picture Judgement Task

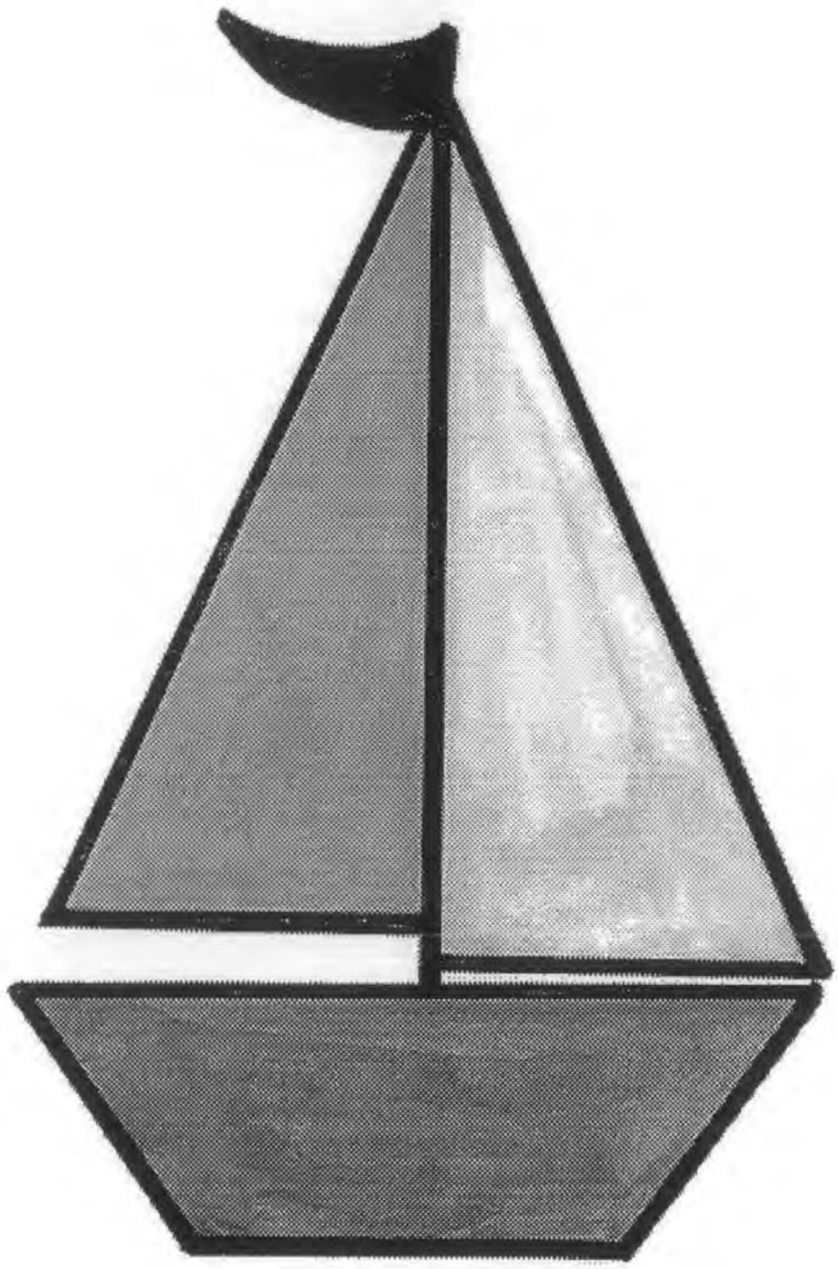
The pictures shown below are those used to introduce adults with Down's syndrome to the concept of judgement about structure. The first ten pictures are correct in structure, while the remaining ten are incorrect in some structural respect. The pictures of faces were used as prompts whereby the adults could indicate whether or not the pictures were correct (happy face) or incorrect (sad face).

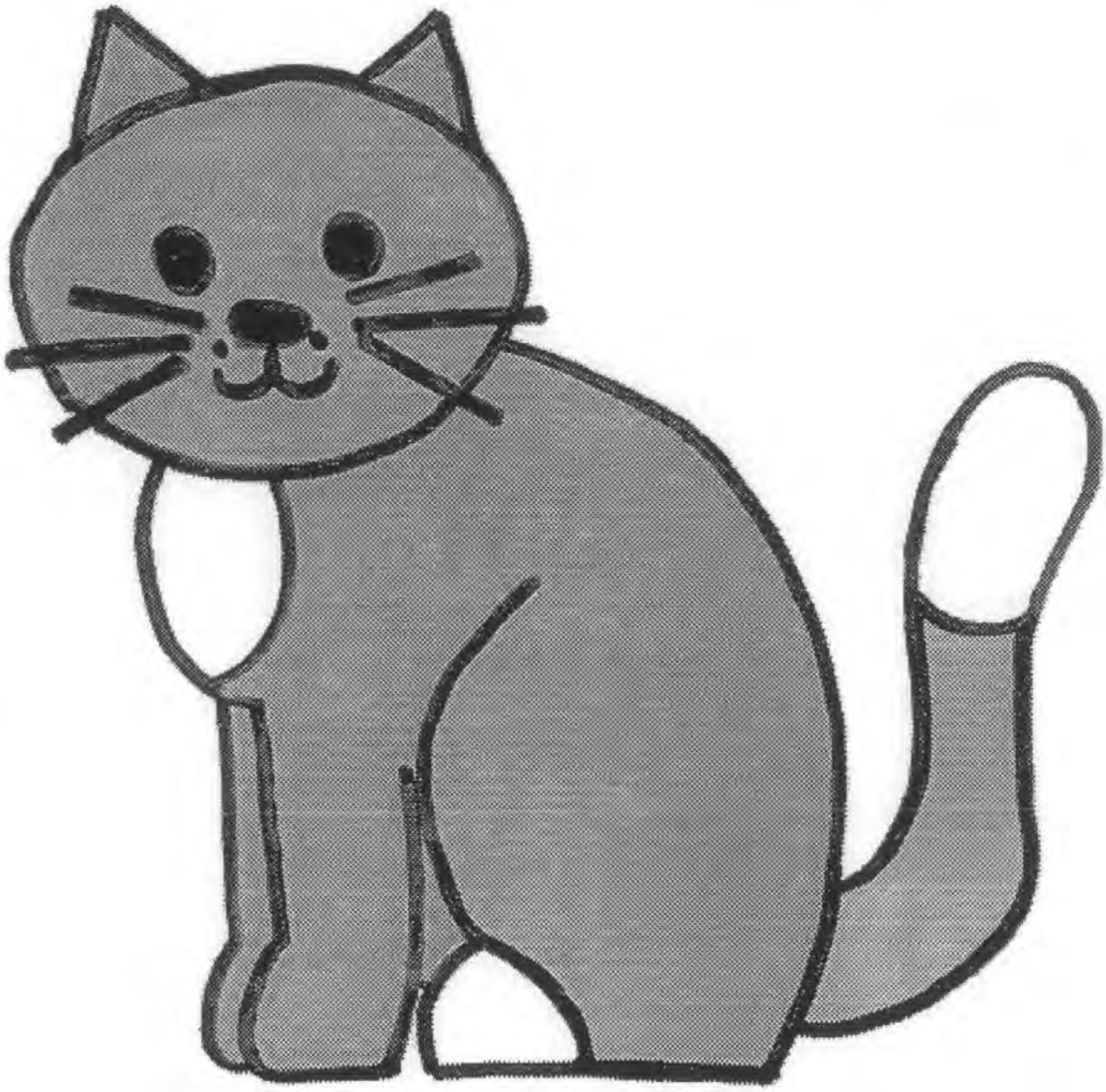
B.1 Face Pictures

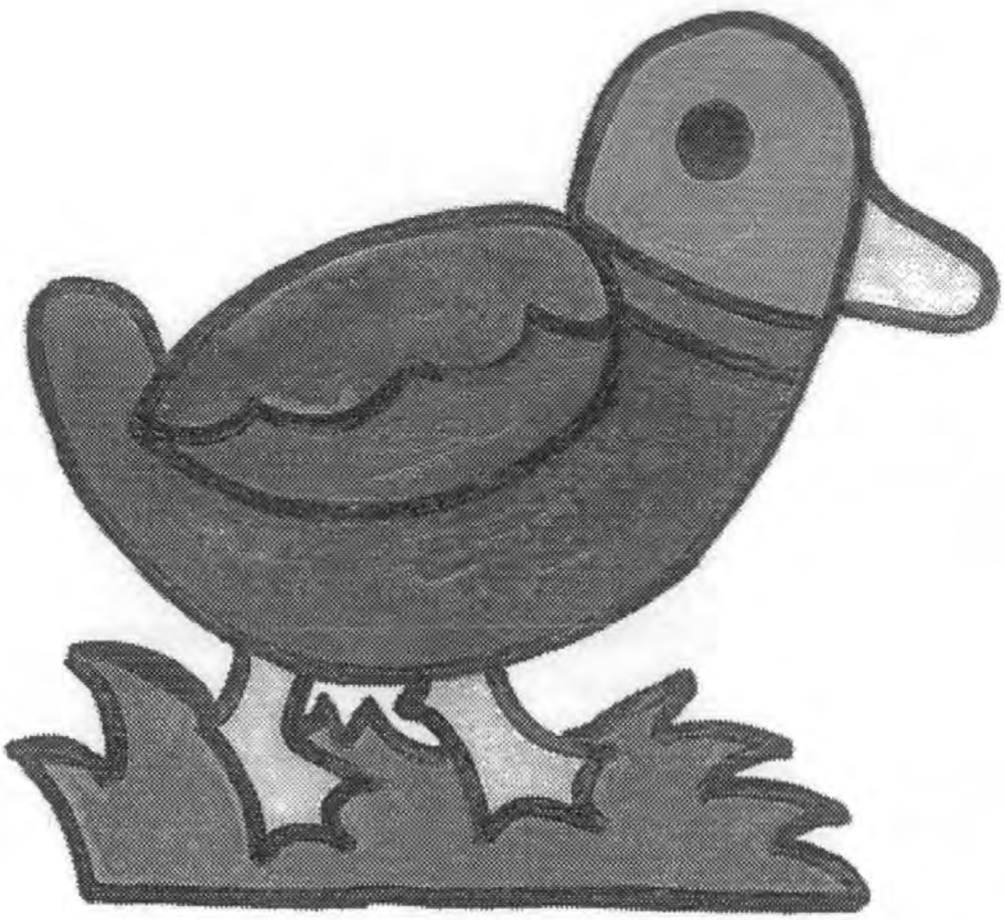


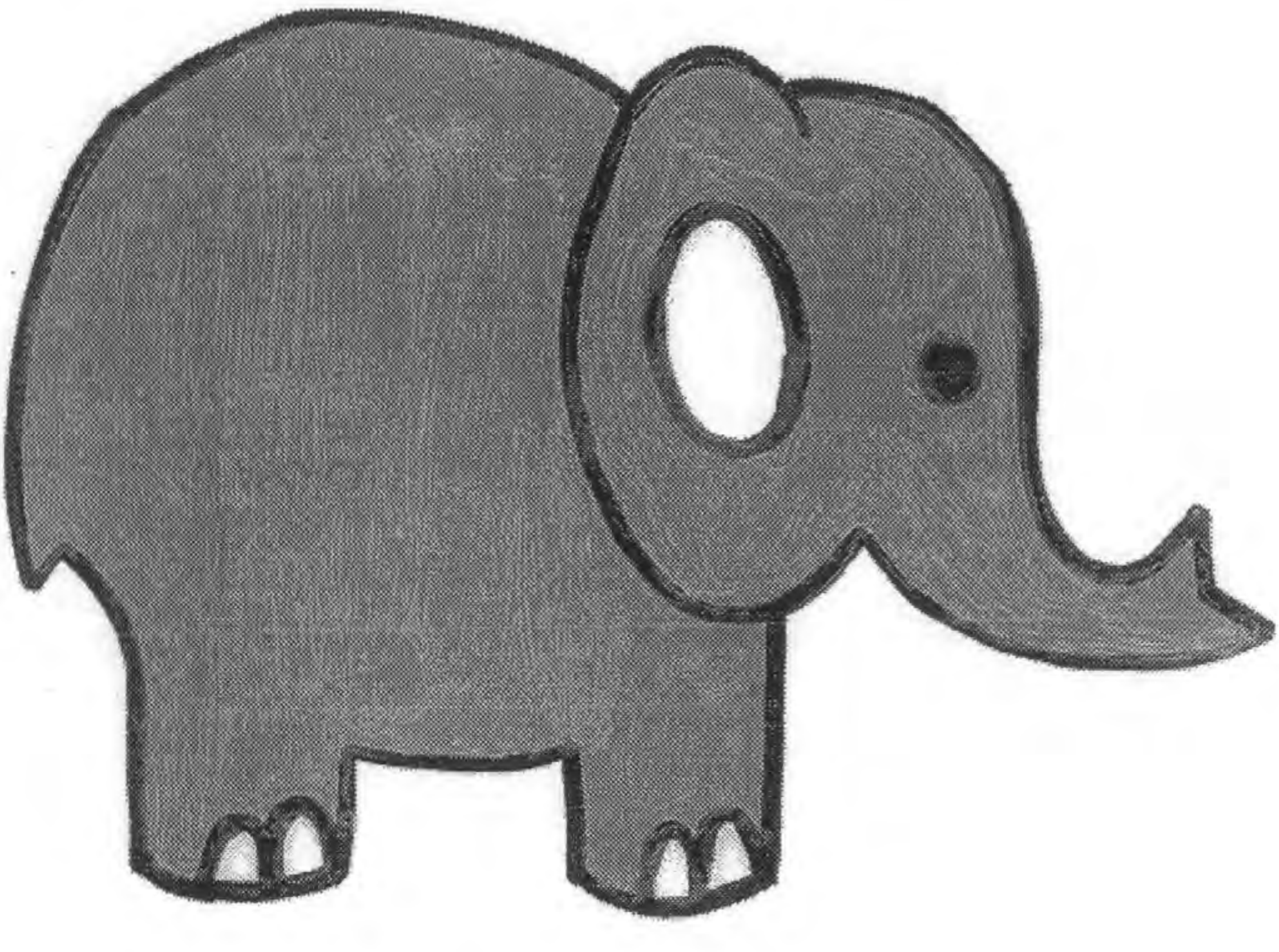


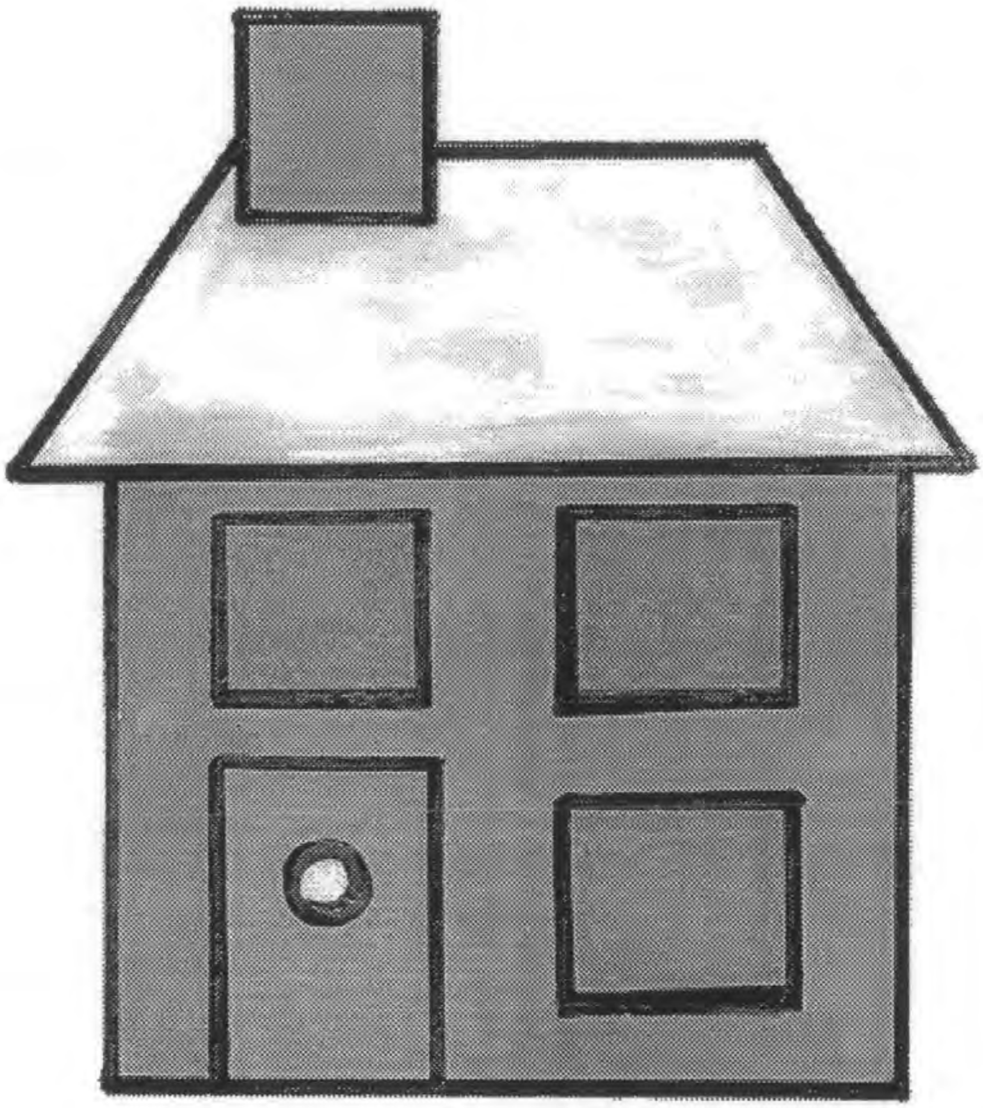
B.2 Structurally Correct Pictures

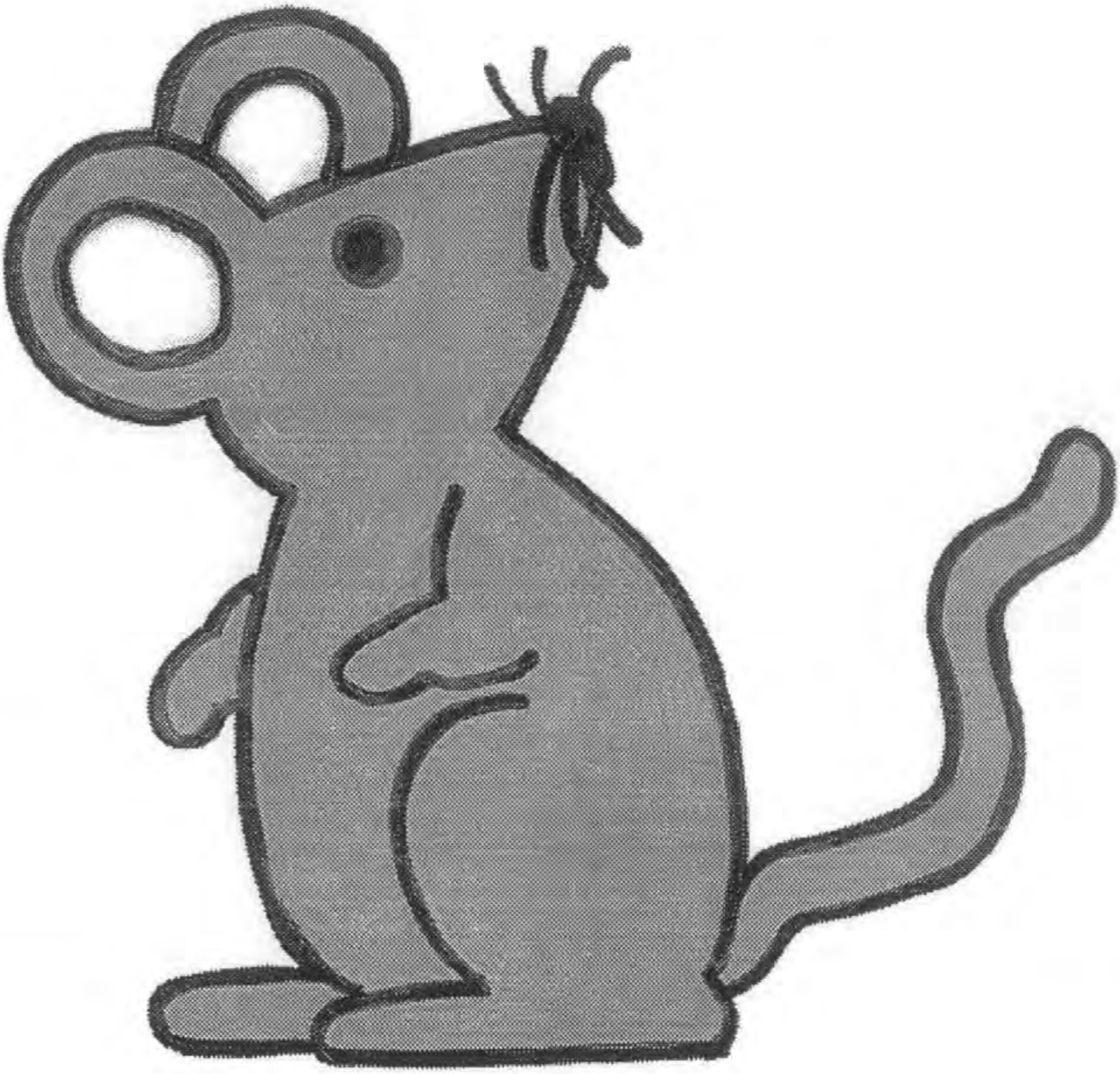


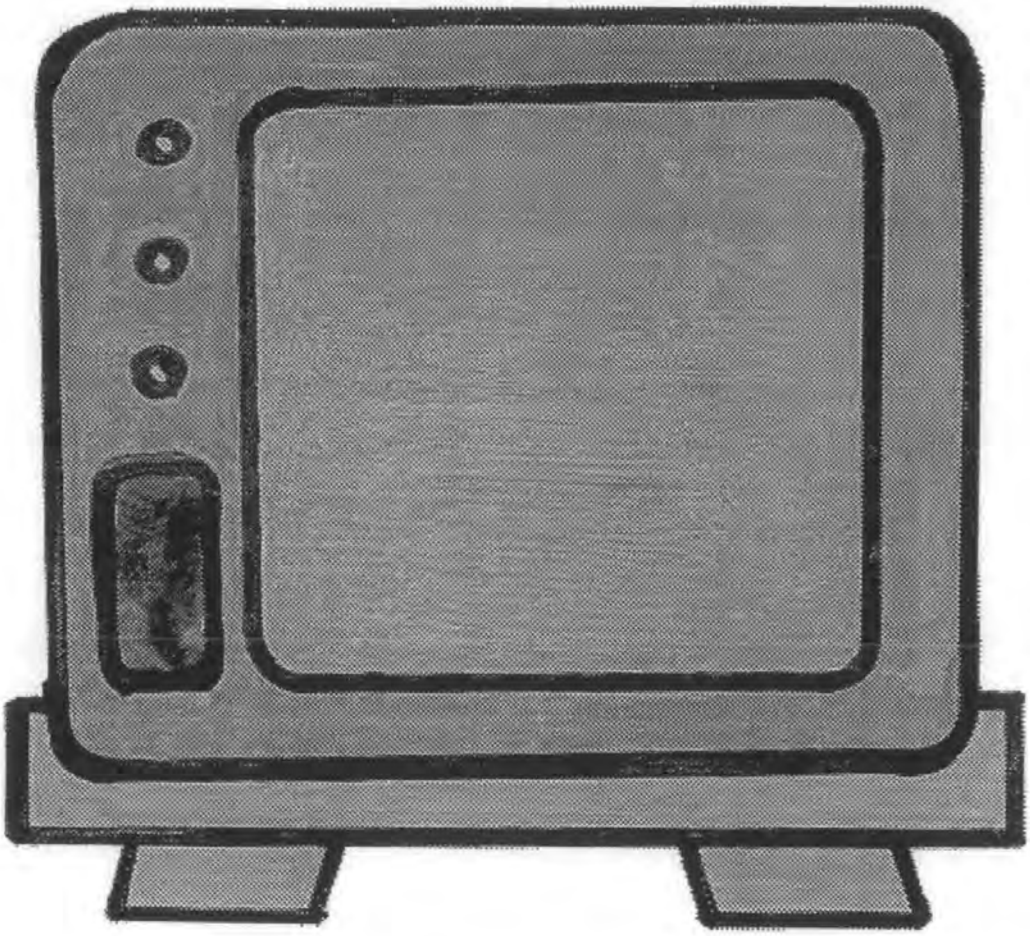


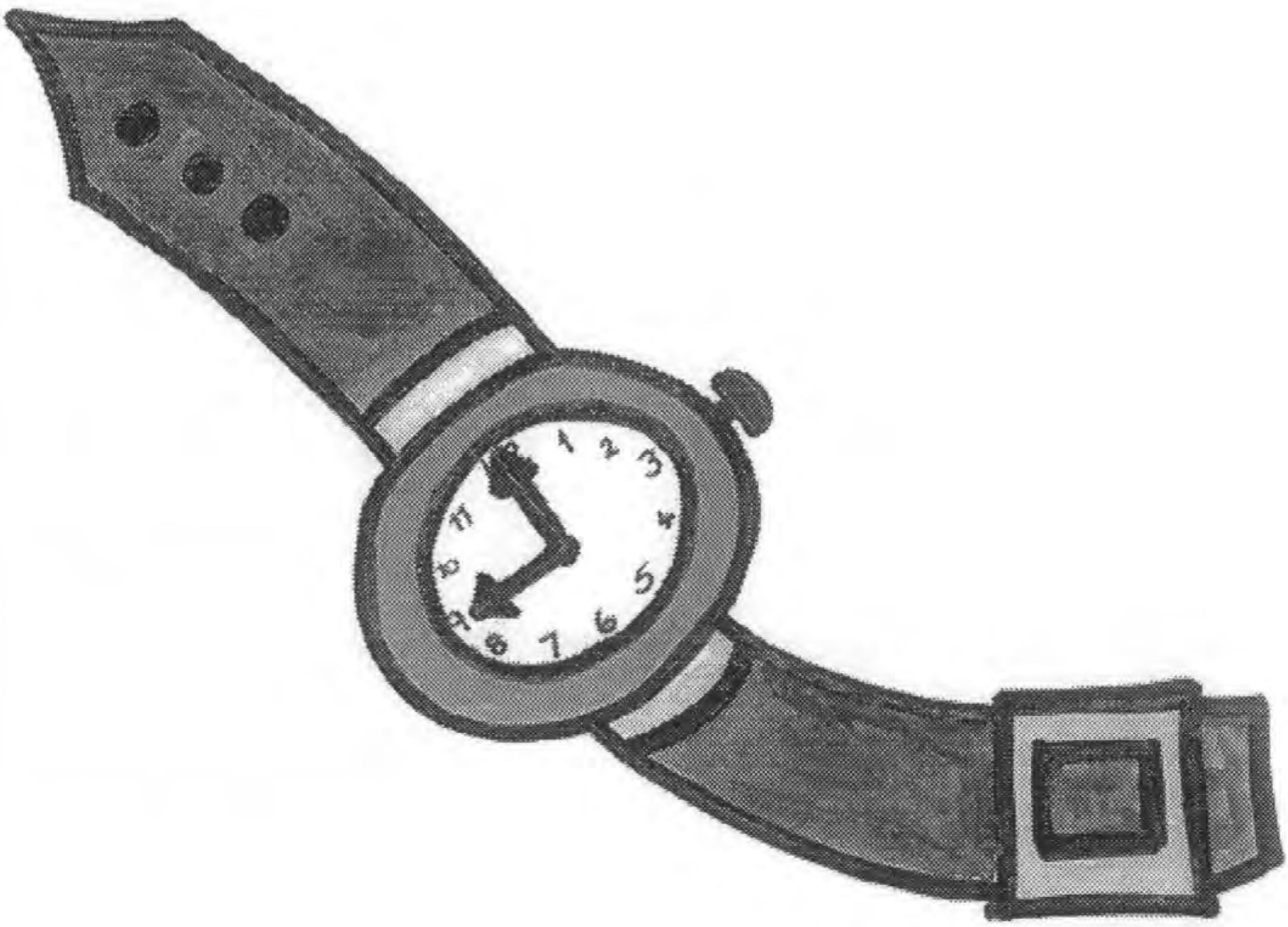




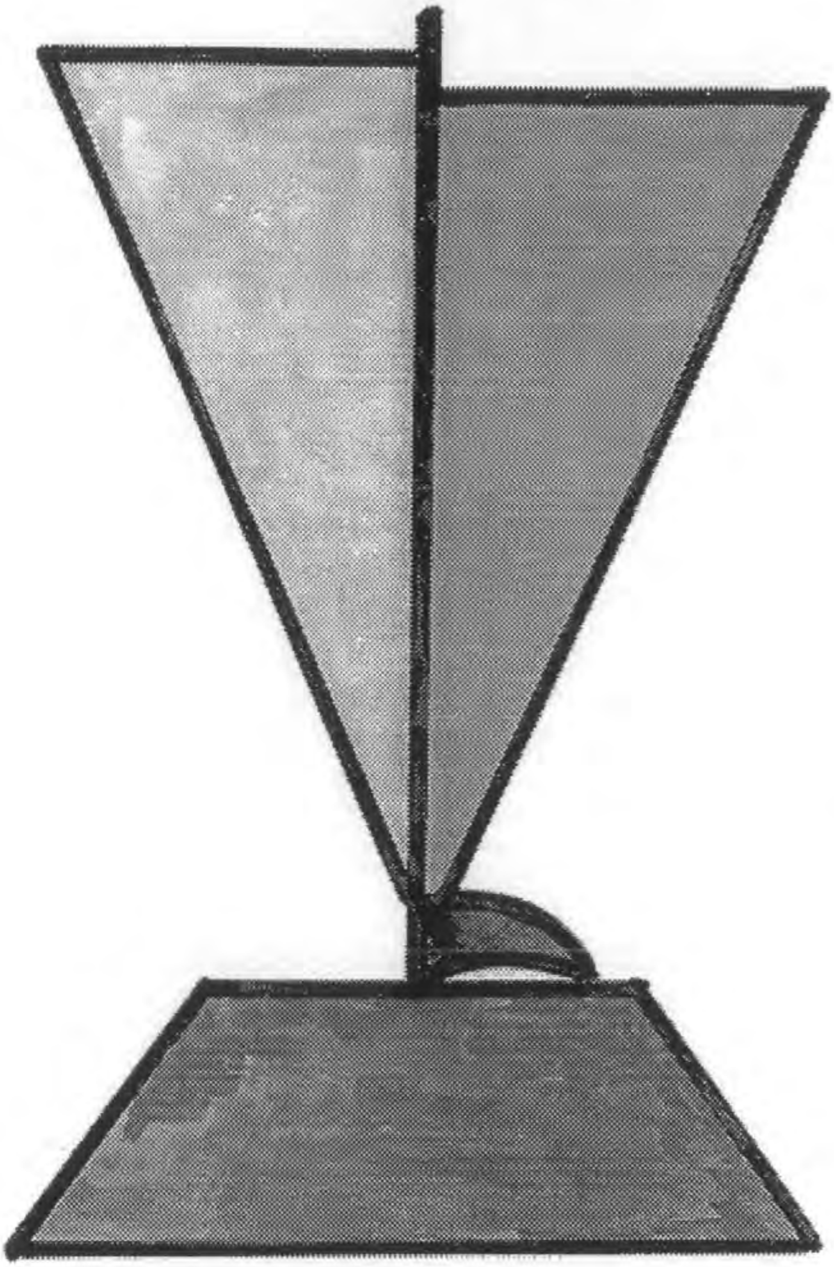


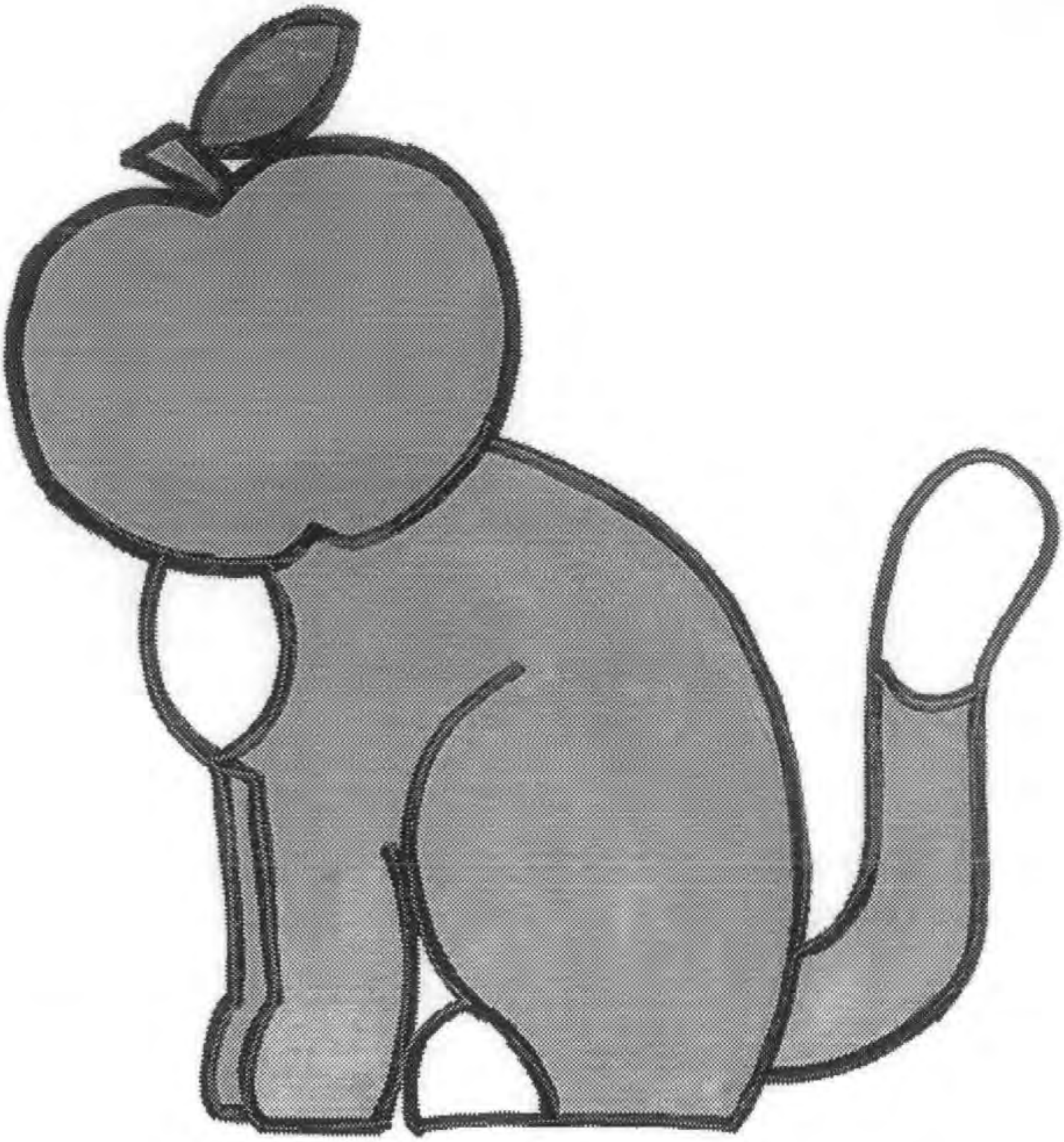


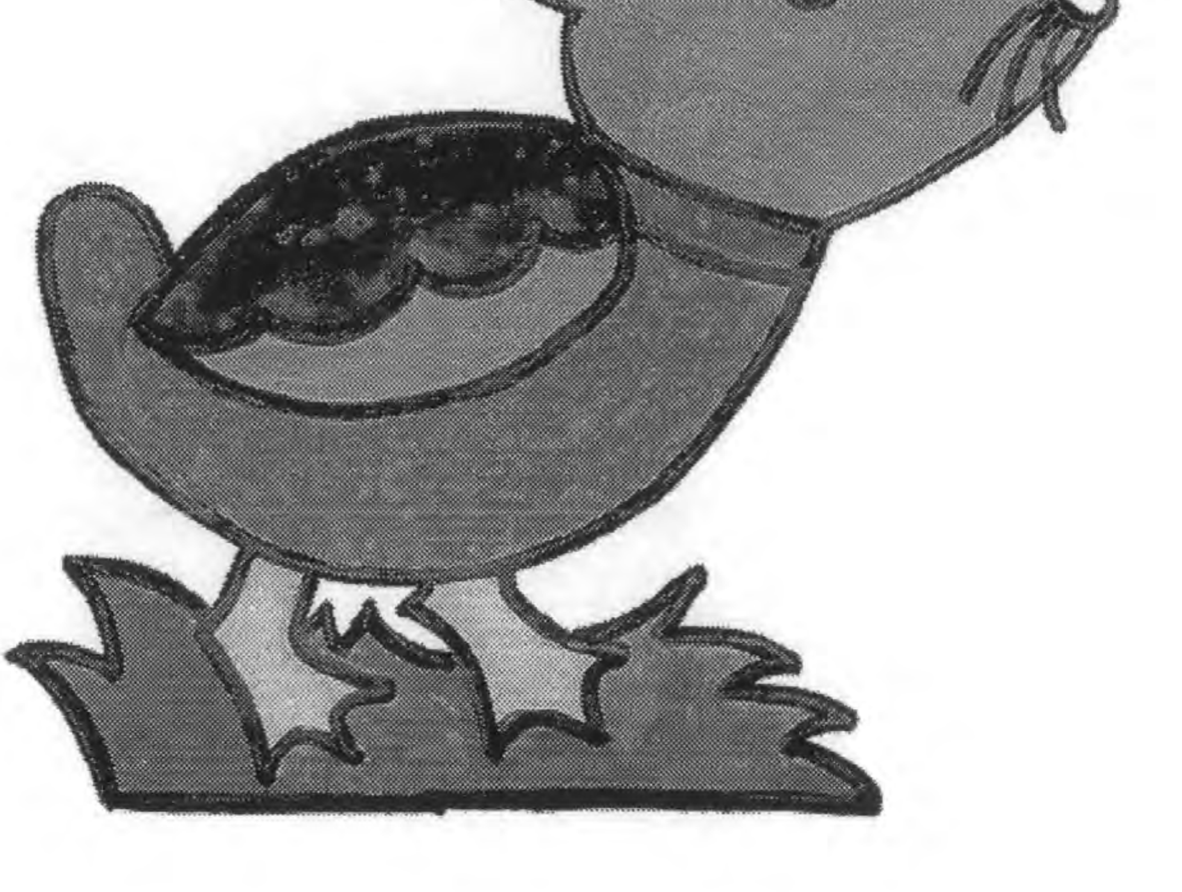


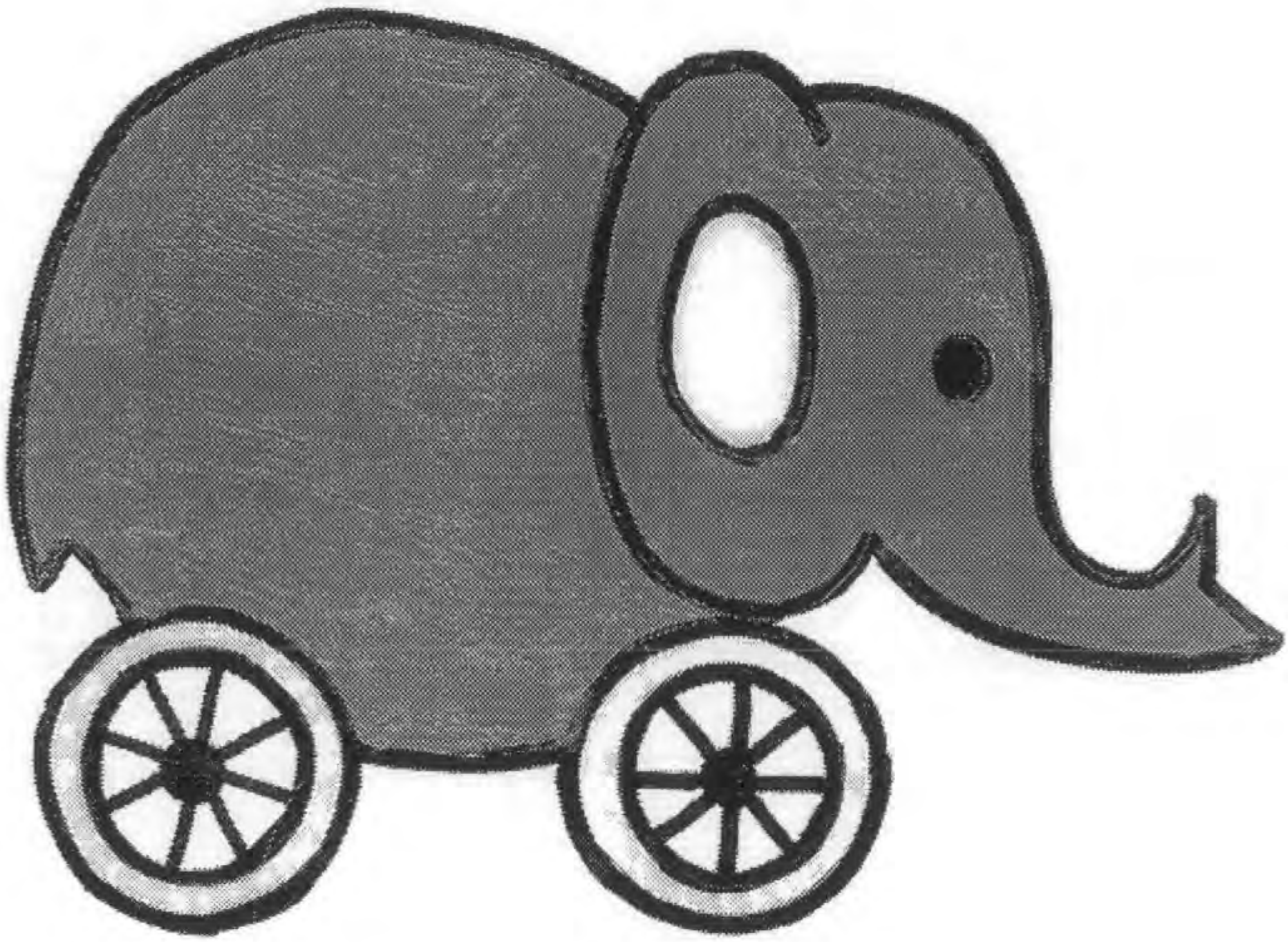


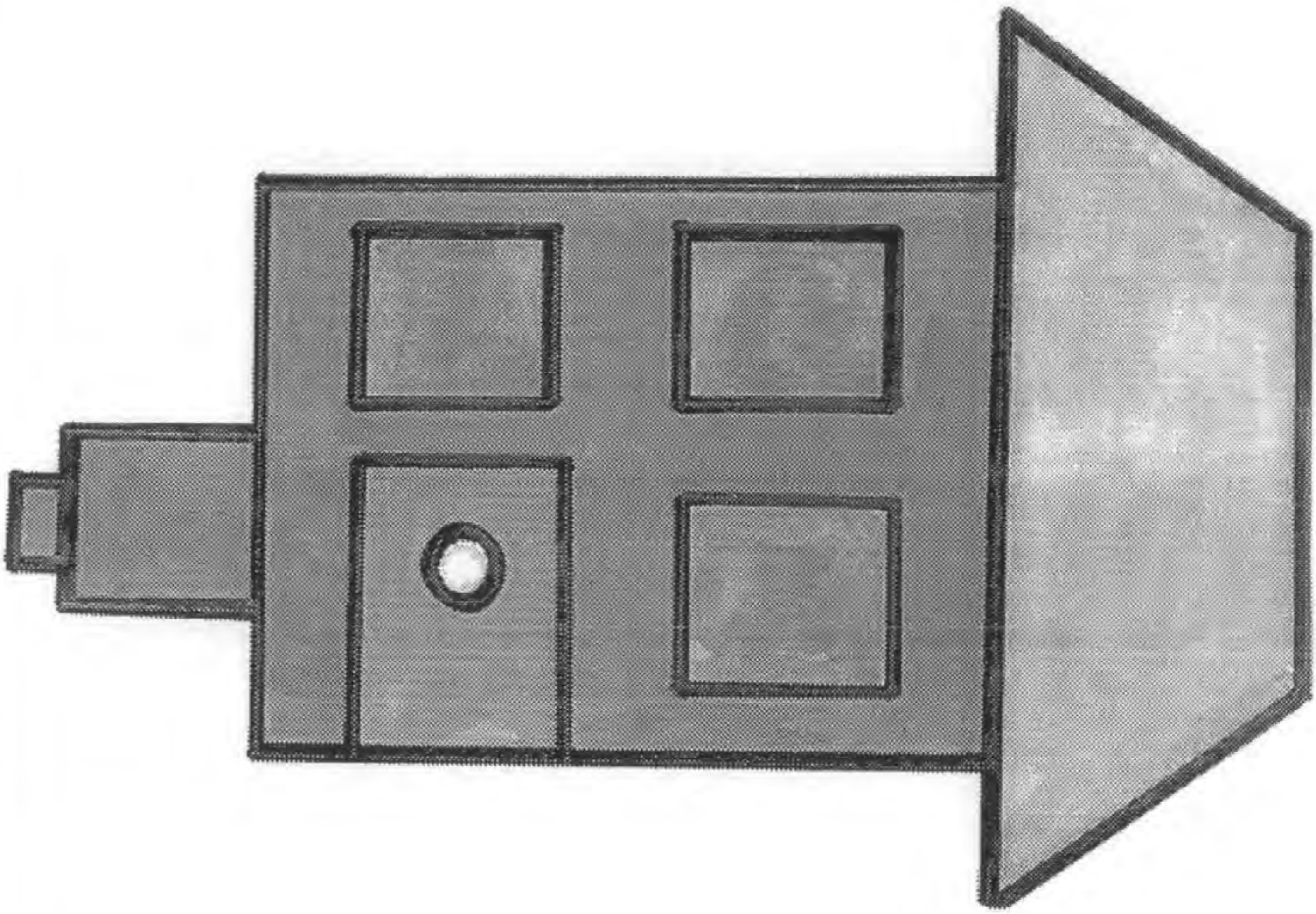
B.3 Structurally Incorrect Pictures

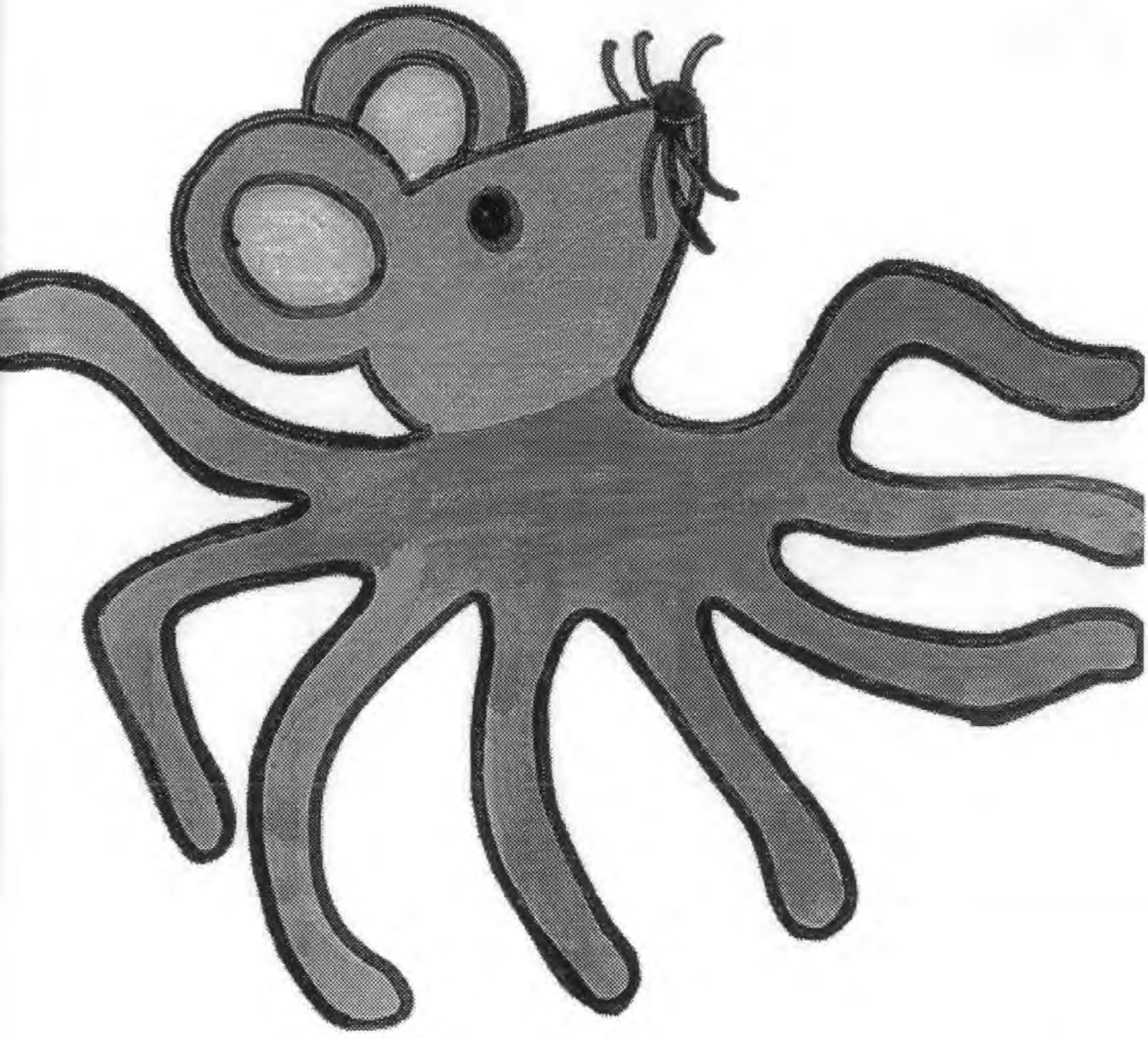


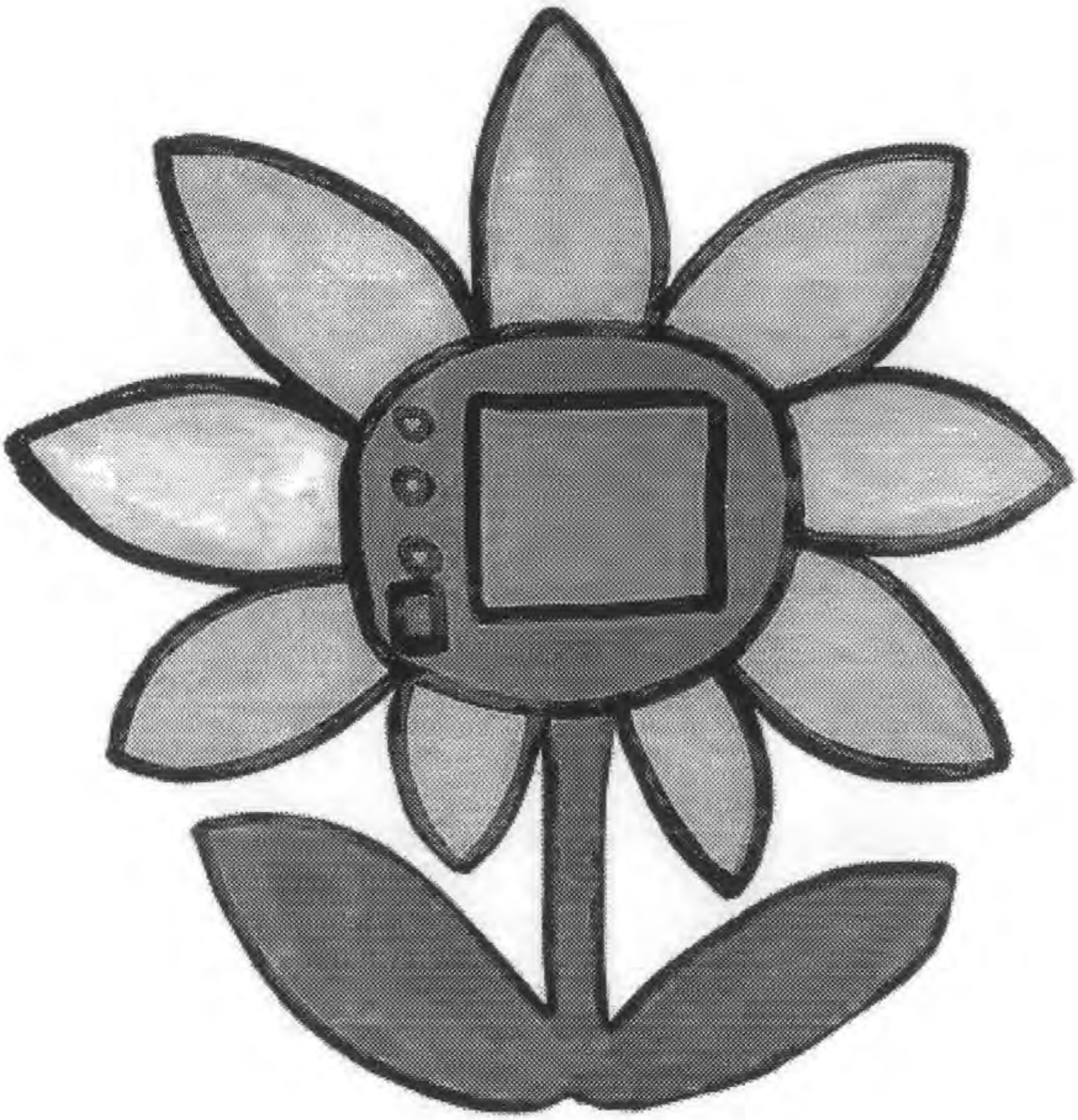


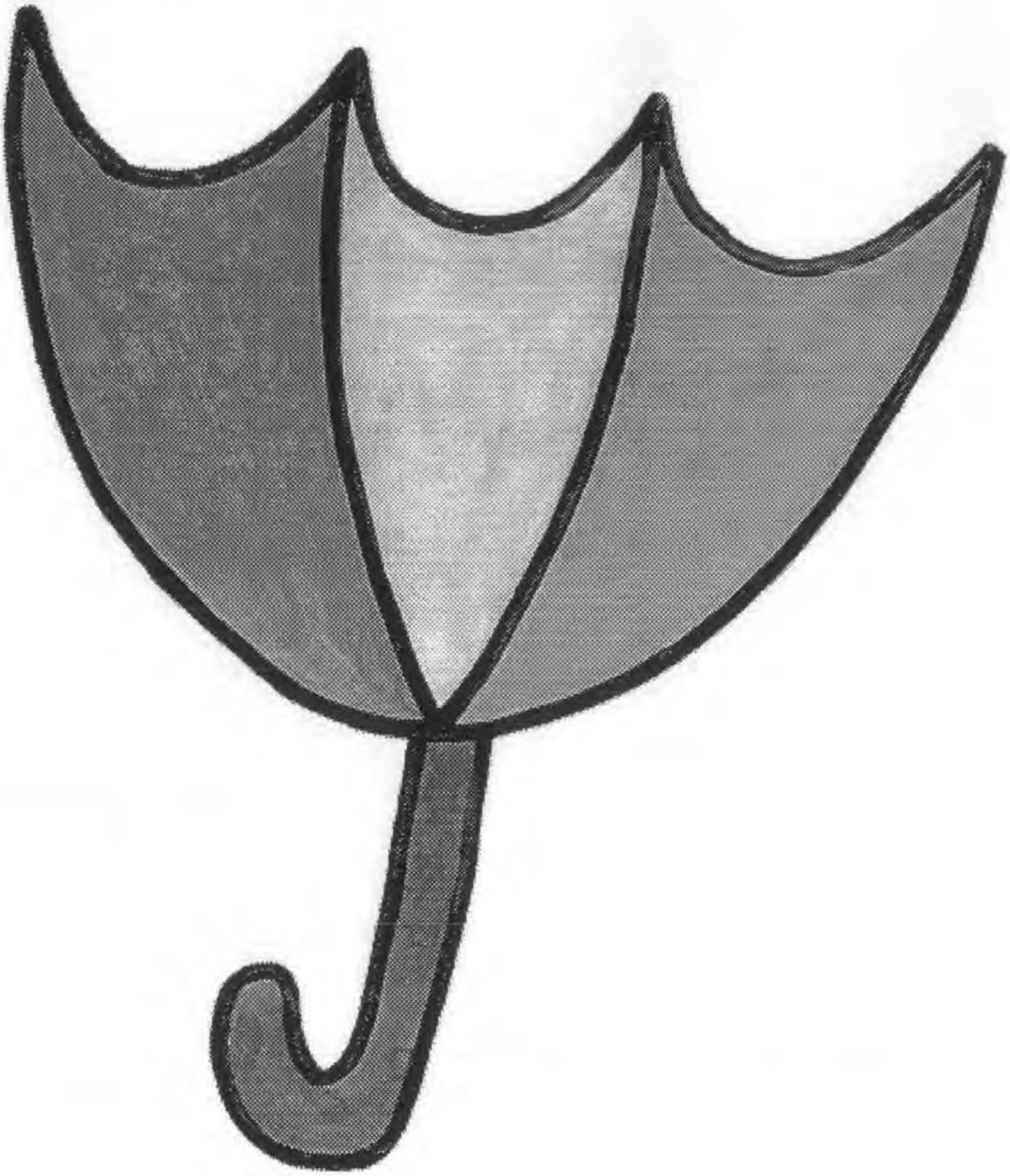


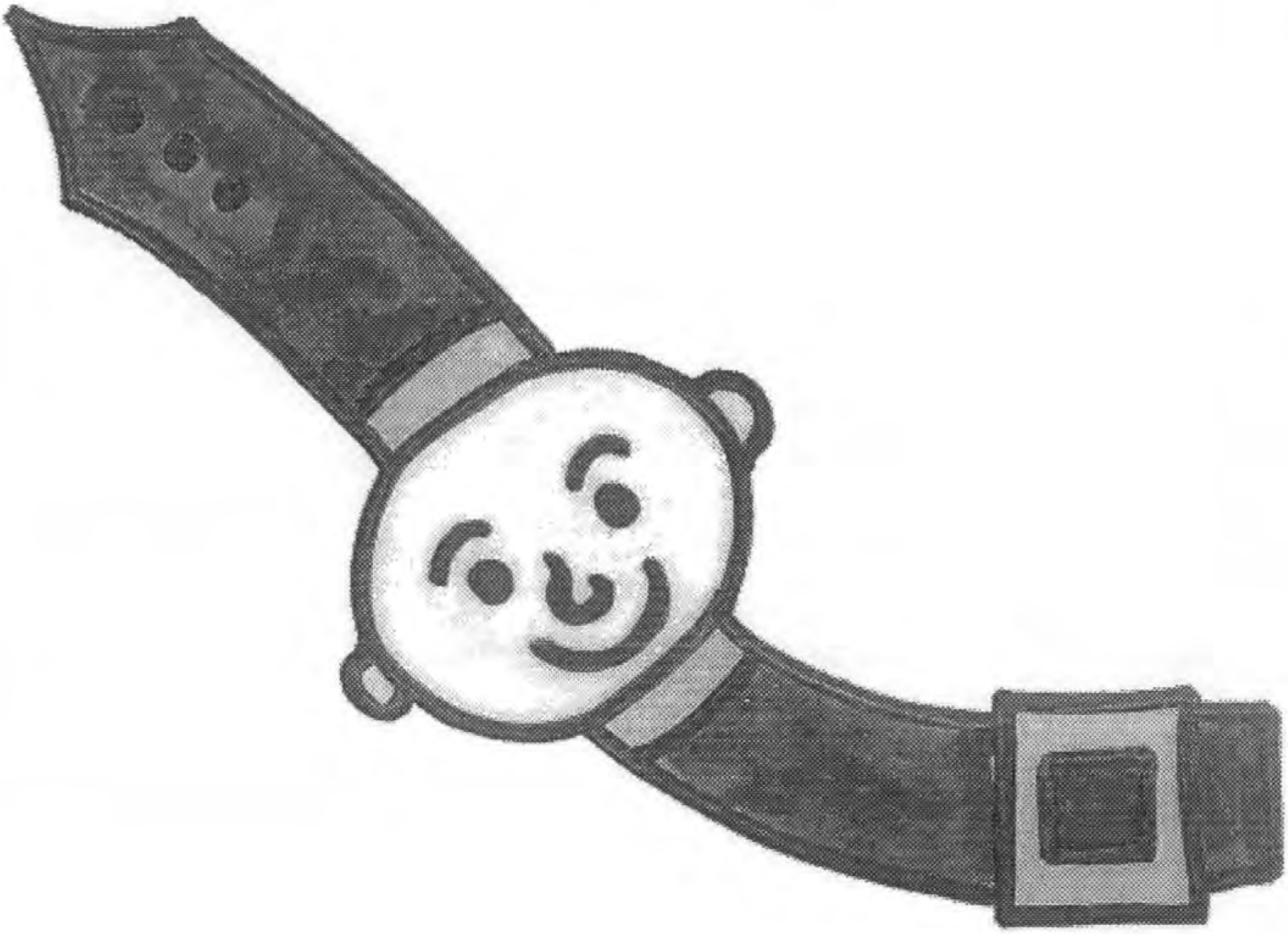












Appendix C

Experiment 1: Sentence Imitation by Adults with Down's syndrome

This appendix contains a sample of sentence imitation carried out by two subjects. The sentences imitated by each subject are divided into nine experimental trials.

C.1 Subject: E

I

1 The cat pop a balloon he say yes

2 Deer kill deer

3 The dog have eat the bone

4 Bat attic

5 The farmer the two pigs

6 Shoe shop did see the day

7 Thats a pass

8 Bill a like a chocolate

9 Boy talk to police

10 Boy read a book a bath

11 Boy Saturday at the zoo

12 To the party

13 Susan making cookies a us

14 Girl cut the glass

15 Carol cook a dinner

16 Man climbed up ladder

17 Dog barking today

18 Man boy watch the telly

19 Sheep fall in a pit

20 Fred new greenhouse

21 Joseph letter a mother

22 King had a dinner

23 Can the girl ride a bike

24 Bill dance the party

25 Boy drive tractor

26 Boy play train track

27 Sell

28 Blanket

29 Lady paint

30 Boy play the ball

31 Boy talk the police

II

1 Cat pop the balloon

2 Today man shot the deer

3 Dog the bone too quick

4 Bat flying today

5 Farmer three pigs

6 Shoe shop make a shoes today

7 Shepherd sheep in field

8 Bill like it chocolate

9 Boy talk to policeman

10 Read the book the bath

11 Boy Saturday to the zoo

12 Boy the party the home

13 Su cookie today

14 Little girl cut glass today

15 Carol Sunday dinner

16 Man climb ladder carefully

17 Boat in sea

18 Man some TV

19 Sheep falling in deep

20 Fred new greenhouse

21 Joseph letter to mother

22 King had the dinner

23 Girl drive the bike

24 Bill go the party

25 Boy drive tractor

26 Girl play the train

27 Shop today

28 Blanket the bed

29 Woman paint himself

30 Ball bounce his head

31 Boy talk to policeman

III

1 Boy shouted today

2 Girl last year

3 Girl the wake the man

4 Five man drive jam

5 Big ship sailing

6 Flew beautiful

7 Fish the black the pond

8 Boy thought clever

9 Boy feet in the water

10 Football player kick the ball

11 Way get home black cab

12 Make the cake the birthday

13 Flowers marry flowers

14 Man wet shaver

15 The house in fire

16 Boy football

17 Guard dog bark

18 Dog eat the bone the food

19 Boy the prize

20 Raining today

21 The white snowing snowman

22 The news today

23 Fed animal

24 Washing out

25 Boy time today

26 Man mend the car

27 Like new car

28 Man big eyes

29 Boy singer

30 Farmer the cow farmer

31 Boy teacher the lines

IV

1 Peter shout it later

2 Dress doll today

3 Man wake up

4 Five men bought a cars

5 Ship the water silly

6 Beautiful

7 Fishes the pond the black

8 Boy clever

9 Duck water the feet the clean

10 Football player kick the ball

11 Black taxi today

12 Meg birthday cake today

13 Me flowers to you

14 Man wet shave your head

15 Your house start a fire today

16 Boy play the ball today

17 Boat in river

18 Dog summer

19 Prize the person today

20 Raining all week

21 Christmas white snowman

22 News today

23 Animals today

24 Washing out outside

25 Boy the nice time

26 Sam make the car

27 You like my new car

28 Man staring to me

29 Singer the boys

30 Farmer milk the cow

31 Boy teacher to line

V

1 Holidays today

2 Frog jump the log

3 Bird fly the tree

4 Policeman the ring the robber

5 Flowers sunny day

6 Cat run the mouse

7 Deer heard it a run away

8 Susan tired today

9 All the boys laughing the clown

10 Man piano a singing

11 Girl blow candle

12 All the cars to quick to turn about

13 Birthday today

14 All the boy lion scared of it

15 Girl my clothes

16 House came a storm

17 Kevin phoned girl

18 A house 8 o'clock
19 Bird pond today
20 Boy singing today
21 Flowers bigger the water
22 Today the beach today
23 [an a pass
24 Fox me sees the fox today
25 Cricket the park
26 Time the bus coming
27 The fruit the good
28 To go bookshop
29 Phone ringing today
30 Bird singing today
31 Workman the lot the work the pound today

VI

1 Holidays the car goes to France
2 Frog jump the log
3 Tree today
4 Policeman the ring and watch did nick it
5 Flowers sunny today
6 Cat to chase today
7 Deer heard him run away
8 Su sit down tired
9 People laughing the clown
10 Man piano
11 Girl blow the candles
12 Roundabout a too quick
13 Birthday today
14 Boy the scared the lion
15 Old lady my clothes
16 Storm aerial off
17 Doctor man old man cut the leg off
18 Six o'clock there the house
19 Birds the grey the pond
20 Man performing
21 Man big the water it
22 Picnic there the beach today
23 Theatre meet the man

24 Hill the fox today

25 Cricket play today

26 Time the bus to come

27 Fruit today

28 Bookshop today

29 Telephone ring

30 Bird the nest the tree

31 Smith today

VII

1 Ethel recover well

2 The raining tonight today

3 Big net today

4 Playground read today

5 Boy is scared the dog

6 Dentist girl teeth awful

7 Scotland today

8 Woman knitting jumper that had design

9 Monkey swing through the tree today

10 Car broke the wheel

11 Big fish the world

12 Firework today the queen mother

13 Paint the house old man

14 Kite float the cloud

15 Tree garden all the leaf out

16 Hall today

17 Dog bark at man

18 Girl the pet shop today

19 Biscuits to break today

20 Swimming the weekend today

21 Boy and a hat today

22 Cleaning the house today

23 Old man to the doctor and cut your leg today

24 My name today

25 Girl knife and fork today

26 Boy buy the book

27 Where go holiday

28 Home to work date a for

29 Fire house today

30 Girl a hole today

31 A hairshop man cut a hair today

VIII

1 Ethel the operation

2 Farmer the rain today

3 Fish swim the net

4 Children the playground today

5 Boy frighten dog

6 Dentist girl teeth bad

7 Cattle in Scotland

8 Lady knitting the jumper today

9 Monkey swing in trees

10 The car broke a wheel

11 Whale big in world

12 Firework for queen

13 Paint the house old man

14 Kite float in air

15 Tree in garden today

16 Man in hall today

17 River today

18 Girl go to shop

19 Biscuits break

20 Swim at weekend

21 Hat the cold weather

22 Me clean a house

23 Old man a doctor

24 My name right

25 Girl use the knife and fork

26 Boy have a book

27 Where go the holidays

28 When I go home

29 Fire house today

30 Girl dig a hole

31 Haircut today

IX

1 Cold water ice in it

2 Plate broke today

3 Chef is cook a dinner

4 Paint the road today

5 Man date the girl today

6 Doctor cut leg off

7 Policeman talk to lady

8 Teacher talk a pupil

9 Water cold froze it

10 Plate it broke

11 Chef is good cook today

12 Man paint the road

13 Man phone a date

14 Doctor cut leg off man

15 Policeman talk to woman

16 Pupil talk today

C.2 Subject: G

I

1 Cat pop the balloon

2 Yesterday hunter got shot

3 The dog eat a bone quickly

4 A bat for it last night

5 The farmer bought two pigs at the market

6 The sale man see the feet in the day

7 The shepherd in the sheep the field

8 Bill said like the chocolate

9 Boy spoke to the policeman

10 Tom reads the book in bath

11 Boy go to the zoo tomorrow

12 Larry went home after the party

13 She is making sweets

14 Girl cut herself

15 Carol cooked the dinner

16 The man went up the ladder

17 Dog barked at the man

18 Man watch the TV

19 Lamb fell in the ditch
20 We are getting a greenhouse
21 Joseph has wrote a letter
22 The king has his dinner
23 A girl ride a bike
24 Bill danced at the party
25 The boy drives a tractor
26 Why Mary plays with trains
27 What do they sell at the shop
28 She put the blanket
29 Woman paints
30 Boy bounced the ball
31 Martha the policeman

II

1 Cat pop balloon this morning
2 Yesterday the hunter shoot the deer
3 The dog eat up a bone quickly
4 A bat flew in to our attic
5 Farmer buy the pigs
6 Man sells the shoes
7 Shepherds have the sheep in the field
8 Bill likes the chocolate
9 Little boy is speaking to a policeman
10 Tommy read a book in the bath
11 A boy go on a zoo yesterday
12 Larry went the home after the party
13 Susan make a sweets
14 Man cut a glass
15 Carol was cooking dinner her family
16 The man go up the ladder
17 The boat sailed in the sea
18 The man his son watch TV
19 A lamb is fall in a ditch
20 Fred will get new greenhouse soon
21 Joseph write a letter
22 Has the king be serve his dinner
23 Ride a bicycle
24 Dance the party last night

25 Can the boy drive a tractor
26 Why Mary play with train set
27 What is the shop in the corner
28 Where did you put the blanket
29 Painted woman
30 A boy bounce a ball
31 Martha or boy get a policeman

III

1 Early Peter said anything the morning
2 I buy a new dress for my doll last year
3 The man left before he's woke
4 Five man drove past the traffic jammed
5 The ship is sailing in long line
6 The goose was fly is beautiful
7 All the fish in black
8 Boy though he was clever
9 Ducks wash beaks in water
10 Football kicks the ball
11 Get home by taxi
12 Make a cake for my birthday
13 Bunch of flowers for me
14 The man had head shaved
15 The house is on fire
16 Boy played ball
17 Dog barks at the man
18 The cat eats the food
19 A boy saw the prize
20 It rains all week
21 We play in snow at Christmas
22 We follow the news
23 I fed the animals
24 Betty put the washing out
25 The boy had a good time
26 Sam mend the car
27 You like my new car
28 The man stares at me
29 Choir boy sang
30 Farmer milks a cow
31 The boy got lines

IV

1 Earlier people shout instruction

2 I buy a new dress for my doll

3 The man has left before he's awake

4 Five drove past the traffic jammed

5 Ship sails in line

6 The geese are beautiful

7 The fish in pond

8 Boy is clever

9 A duck a wash a beak in the water

10 The football kicks in the ball

11 Best way to come home by taxi

12 Bake a cake for my birthday

13 The bouquet for I

14 A man shave cut a head

15 Your house on fire

16 A boy play ball

17 Boat sailed the river

18 The cat eat his supper

19 A boy bought me a prize

20 Has be rain all week

21 Should play in snow in Christmas

22 Have been follow news

23 I fed the animals

24 Put back the washing to dry

26 When to the car

27 Why you like the new car

28 Man there staring at me

29 Sang choir boy

30 A cow be at the farmers

31 Write a boy

V

1 When we on holiday engine heated

2 I watch the dog

3 Many birds in the tree

4 The policeman find jewels had been stolen

5 Flowers grow better in the sunshine

6 The cat flys

7 A deer ran away it heard her coming
8 Susan sit down was tired
9 Children laugh at the clown
10 Musician plays piano
11 Girl blew the candle
12 Roundabout spinning quickly
13 His birthday yesterday
14 Saw the lion frighten it
15 The woman wore my clothes
16 The aerial came the roof
17 Kevin phoned up for a date
18 He came at six o'clock
19 Birds are migrating
20 Musician plays in the show
21 The flower grows when we water it
22 We eating picnic on the beach
23 Meet Frank at the theatre
24 Hounds chase the fox
25 They play cricket in the park
26 What time the bus arrives
27 What fruit do you like
28 What way to the library
29 The telephone rings
30 The bird builds a nest
31 The milkman gave a pound Mrs Smith

VI

1 When we on holiday the engine overheats
2 I watch the frog jumping over the log
3 Birds sleep in the tree
4 Policeman found jewels
5 Flowers grow in sunshine
6 Cat chase the mouse
7 Deer ran away when it heard us
8 Susan sat down
9 The children laugh at the clown
10 The musician play on the piano
11 A boy blew out candles
12 A roundabout is spinning very quickly

13 Sure him birthday yesterday
14 The children saw 5 lions frighten it
15 Poor woman borrowed my clothes
16 My aerial came for the storm
17 The doctor cut the leg off
18 He came my house at six o'clock
19 The pond have migrate
20 Musician performing the concert
21 The flower get taller
22 Will be eating a picnic
23 Shall Frank
24 Chase the hound up a hill
25 Are we play a cricket in the park
26 What time would arrive
27 Which fruit prefer
28 What way going to library
29 Ring a telephone
30 A nest built a bird
31 A pound Mrs Smith the milkman

VII

1 Ethel cover well at operation
2 Farmers happy the rain last night
3 Small fish swim away from big net
4 Children read the notice in the playground
5 The park was frighten all the dogs
6 The dentist though a girl teeth are dreadful
7 Highland cattle often live in Scotland
8 The woman knitting jumper she designed
9 Monkey swing in trees
10 New car has broken the wheel
11 Whale is largest mammal in the world
12 Fireworks were organized for the queen
13 We painted the house old man
14 We watch the kite float in the air
15 Trees in the garden blossoming
16 Sailmen wait in the hall
17 Guard dog barked the man
18 Girl go to pet shop

19 Biscuits started to break

20 I am going swimming at the weekend

21 I wear a hat in cold weather

22 Can be trusted to tidy the house

23 Will you take the man to the doctor

24 Typist spelt my name correctly

25 Has the girl use a knife and fork

26 John bought the book

27 Where they go on holiday

28 What time go home

29 Fire burns

30 Girl dig a hole

31 The hairman got a haircut

VIII

1 Recover well after a operation

2 Farmers was happy because the rain last night

3 Some more fish swim away for a big net

4 Children in playground

5 Children frighten the dog

6 Monkey swing in trees

7 Highland cattle live in Scotland

8 Woman knitted the jumper

9 The monkeys are swing in branches of the trees

10 The car is broken silly wheel

11 Whale is largest mammal in the world

12 Fire was a play organized for the queen

13 Us paint the man old man

14 Watch the kite float in air

15 Trees in our garden coming in blossoms

16 All sale men told wait the hall

17 The ship sailed the sea

18 The girl visited pet shop after school

19 Biscuits started to break

20 I am going swimming at weekend

21 I wore a hat in cold weather

22 Can be trusted to tidy house

23 Will take old man

24 My name correctly

25 Has the girl to learn fork and knife

26 Read the book is bought

27 Where go on holiday

28 What time go home and do work

29 Fire burns

30 A hole get a girl

31 A haircut give man hairdresser

IX

1 Temperature the water so cold it froze

2 Plate was broken it arrived

3 Cook a lovely meal

4 Man paints white lines on the road

5 Kevin phoned for a date

6 Doctor cut the leg off the man

7 A policeman was talking to the woman

8 A teacher intructing a pupil

9 Temperature of the water froze

10 Plate broken when it arrived

11 Man cooks a nice meal

12 The man paints the lines on the road

13 Kevin phoned Nancy up

14 Doctor cut the man's leg off

15 Policeman talks to the woman

16 The teacher instruct the pupil

Appendix D

Experiment 1: Spontaneous Speech Sample from Adults with Down's Syndrome

This appendix contains two samples of spontaneous speech by adults with Down's syndrome. The speech of adults with Down's syndrome is set in bold type to distinguish it from that of all other participants, who are workers or other clients of the day centre. Speech which was unintelligible and annotations which place the speech sample in context for clearer understanding are provided in italics within square brackets.

E: AK! the big news me have to you, me my worker have found, before the Christmas, a buy the new place, all that here all a come
As: to the house warming when you've got your new place
E: yes
As: good, look forward to that, have a few beers?
E: yes I have the three bottles in my cupboard and a plate, me cooking
Lo: you're cooking - are you good at cooking?
E: yeah, I make a sandwiches, a hot dog, cheese vol au vents, they're good for me, egg, cheese, sausage rolls, pork pies,
L: cheese
E: I done that
Lo: cake?
E: house party cake, and I will buy the beer, I got three wines in my cupboard, all the one here all a come
E: where did T going
A: I don't know
E: all my friend coming
A: yes
E: I done it
Lo: are there 50 there?
E: yes, all that lot there are 50
Lo: so E, are you going on holiday this year
E: yes
Lo: where are you going?
E: I don't know where, meeting
Lo: you've got a meeting have you?
A: meeting? what meeting? oh a committee meeting - I'm in that aren't I
Lo: is that today?
A: I'm in that
Lo: who's in the committee then?
E: yes, me in it and him and XX
A: no she's not
E: XX, XX, XX
Lo: so what sort of things do you decide?
E: what we go on more the trips, that the letter that circulate, that for mother's day
A: mother's day?
E: I go on my holidays, time off the double day, half term that 1, 2, 3 that the 29th, 28th that date me go back, A you know school classes, go back ....
A: 21st
E: 2 then the 8
A: I know
E: that one there, that soon be my birthday
G: what have you done look
A: his birthday is on the 21st
E: you all be friend
L: oh C, cuse me look what C done, do the fall, do the fall, C you bitty boy
E: sack him
L: I know, C!, sack him you
A: he's taken T's chair
E: that right
J: A, when she comes back I'll give her this chair ok?

A: ok
L: what she done with the chair A?
E: a too late now, got one already F
J: T's got another chair
L: oh what about casualty - Christmas
E: yeah
Lo: Christmas?
E: yeah the casualty
Lo: when does it come back on?
L: Christmas
E: Friday night
Lo: oh great is it a new series or repeats?
E: yeah it's a new one
Lo: do you like casualty?
E: yes I do, I like to dress up a doctor, I like a do that
A: what casualty?
E: doctors
A: yeah I like it
L: casualty
E: you see new casualty A?
A: yeah
E: lucky init
A: I know
E: eddy in it
A: that's right
E: you did see that? eddy in it the man play east enders
Lo: you should write to them and ask them if you can be in casualty
E: I do doctor man, AK me , I dress up in doctors man, I like a do that, doctors
As: you want to be a doctor?
E: yeah
As: you have to go to college for that
E: got the case of it
As: there's a lot more to it than that, hey you'll have to pack up smoking first you can't be a doctor if you smoke
E: he sometime a do it
As: did he
E: yeah sometime
L: hey AK look that is a doctor
Lo: it's bad to smoke isn't it?
E: no not, I like a do that a doctor
Lo: you have to take lots of exams
E: the man the bag, the breath, the gas go on the mouth like that gas get better
A: you want to be a doctor?
E: yeah
A: my heart stop, fix my heart! fix my pulse then, hang on, fix my pulse, that's not how you do it, that's right
L: oh hole the sock
Lo: oh no you've got a hole in your shoe and one in your sock
L: AK hole the sock
Lo: is he dead then?

E: he live, nothing can do for him
Lo: I think the best thing for him is to rip out a few more of these coupons what do you think?
E: yeah
F: is that lot finished?
E: not yet
F: oh you're just starting that lot are you
E: yeah, that the fourth lot
L: me four
F: how many have you done?
L: fourth I done
L: AK, you know plumber he died in book
E: have you nearly died A?
A: I like bleeding
As: you leave him alone .... I don't want to know
L: no you P* off, you hurt a bum, AK J had a bum**
Lo: what was that programme called that was all about hospitals?
A: ummm Jimmy's, what day's it on
E: same as east enders 7:30
L: 12 O'clock, east enders
E: late on Sunday, start 3, car racing
E: T, you want go doctors me?
Lo: E wants to be a doctor T, do you
T: [*shakes head*]
A: why not T?
T: I get sick again
Lo: would you like to give people injections
A: ugh no thank you, I don't like the needle going in
E: tell your girlfriend stop the bleeding
A: why don't you tell her
E: I tell her?
A: yeah go on
E: T, you want doctor stop a bleeding? you know that pulse, doctor, I like a do that
E: oh that better oh my god, L no
Lo: what was he doing?
E: not going tell you
Lo: was he putting his hand in front of the camera?
E: no
A: yes that's right
L: F you done another pile?
E: look what my brother done the camera
Lo: is that what he did?
E: no not that! I know he doing
A: it's him, he did that, he did it in front of the camera
L: M talk to you minute
E: M my brother talk to you
Lo: you've caught the sun haven't you, your arms are all brown
T: it's sore on the shoulder
Lo: ooh that is sore isn't it, when did you do that - this weekend?
E: done in the sun
T: yeah

A: oh wow T
E: me do me have the sun go brown
E: know doctors, wrist, doctor man, know there a big thing up there, they call my name out, all people, I like a do that. TM come in to me
A: don't say that to me I stick my fingers up
F: how are the Cornish men getting on here?
E: we do well here, got good team here, only two more left
E: you know doctor man, says umm AK to see me now
A: oh no
E: bless you, hey AK stick bum, know doctor man says, up there, AK in to see me now
A: stick a needle up who?
E: AK
E: you miss a college A?
A: yeah
Lo: do you usually go to college on a Monday?
E: no Tuesday
A: we normally go on a Tuesday
Lo: is it the end of term now?
E: yeah end of term, me like that place
Lo: never mind in September you'll be able to go back wont you
E: yeah
Lo: what do you do at college then?
E: sort of thing reading writing and know that (ma)chine like that
Lo: computing?
E: yeah
A: computing, that right, what else?
E: and the doctors
Lo: doctors?
E: yeah
A: hey - sums
E: sums
Lo: did you do anything like art?
E: art one did umm.. you know the doctor man these thing on ear this thing he listen
Lo: oh a stethoscope
E: yeah stethoscope - I like a do that I did
Lo: was it sort of first aid
Lo: So you know how to help someone if they've got a cut arm - you know how to bandage them up?
E: yeah done that
Lo: what about a sling
E: yeah done that and the collar the neck, bandages on the leg all that lot and we did needles
Lo: you didn't did you?
E: he hate it
A: hate what? - college, I like go college
Lo: no needles, he was saying first aid
E: first aid A
A: oh first aid - I don't like needles I used to have a hole once in my arm
Lo: what there
A: that's right

L: I do it
E: you have
L: me too
Lo: oh yes did you have it done on your back
E: doctor man do to my brother - he got a big boil on his back - he cut it
A: what with?
E: the knife
Lo: did it hurt?
L: look that
Lo: what about dentists?
A: dentists? - I like them
E: me hate it
L: look at this. A look
E: matter L?
L: stick up my bum. AK look at there
E: chicken
A: who?
E: AK
A: I know, put a needle up his bum
E: that rude
L: A AK the bum
T: um that rude, what that again, ... put that in two pile and don't jog me I told you that before
L: E those two are doctor man. I have to do the bum
G: yeah that's good, how many more are there to do? Look at the pile ha ha there's a lot here. What's for dinner. We got another one at home yeah it's a good one. My dad take me next week
E: watch east enders?
Lo: no I don't watch it
E: dick had a pain, you know peggy her father he come in house he sing the marry song, then um steve he walk out the marry of he fed up of her, he mean
Lo: he walked out of the marriage?
A: who?
E: steve
Lo: who's he married to?
A: hatty - they went on holiday together
L: he big hulk
E: he big chap
A: he walked out didn't he?
E: yeah he walk out - that naughty do that
L: hey look at this me go pop, there a lot in here
E: me quicker
G: that right that the way I do it. They break in the corner that way, that right, yeah
E: their done yeah I done all in my mind. One more left, yep, me quicker, J, that done - I start a new pack
J: we'll have to check it
E: I did, I check it

G: my birthday is tomorrow, I 36 tomorrow, I GL, I in a gardening group, do all the plants, make holes in the pots, dig it out put water in, water lot of them, were selling some plants, hanging baskets, that's right yeah,
Lo: how much are they
G: 4p
Lo: 4p! that's cheap, do you think they're 8 really
G: 8 yeah all right then
Lo: so you don't do woodwork then?
G: err I used to be in woodwork but now I do the garden group
Lo: oh right you like gardening more do you
G: eerrr very well thank-you yes
Lo: are you doing bingo tickets today
G: eeerr no I wont do that no, I might water the plants later on, we water them everyday, in the plant everyday, we dig all the earth put it in the pot put the plants in on the side
Lo: what happens to them
G: they grows, they not died
Lo: what sort of flowers have you got - what colours
G: ummm loads of things outside
Lo: do you grow vegetables at all
G: errr do vegetables yes, carrots, swede, peas, um, brussel spouts, cabbages, brocolli, I play snooker at N everyday snooker I good player, Steve Davis on telly, I do in one go, I best in N, I win at all the time some of them one beat me I beat him back
Lo: can you beat AK
G: ooh all the time yeah, he was made all right, I got a girlfriend called C and she goes clubs at other night and we dance and go disco and that, yeah tomorrow were going in club and party tonight my club, and all the time I play football my house, I got niece and nephews, we got a big family in my house, we got mum and dad, cathy and fiona, yvonne and rob, james, my bull dog died, another dog died as well all gone, get a new one again soon, holiday in teneriffe, then I go and see her again, and this year in july I go america in california, this year july in july
Lo: oooh what are you going to do there do you know yet?
G: ooh we don't know were going do, we go out for walk and go for meals every night, go swimming everyday something like that
Lo: is that near disney world
G: no disney world the other way
Lo: that should be really nice though, you're gong with your family are you
G: oh only mum and dad and me, three of us, and later on we meet the friends, first of al we go to canada first, for three of us, we all meet up and go to california
Lo: very nice
G: I got a brother called garry, he play snooker with me every friday and thursays, I'm a good player, last night give me couple games and tomorrow night, and I got a big office at home, like ewing oil in dallas, in my office and I phone JR Ewing a lot
Lo: have you got lots of cups for your snooker
G: umm, some of them yeah but not that long, last year I won the snooker in N, one lady die called ?? and I on the um all the centre I beat all of them, I do it again
Lo: was it a tournament

G: a tournament yeah that's right

Lo: so I suppose everyone's jealous of you now then are they

G: no not that lot no

Lo: who's going to win it this year then

G: it be me again see what I can do

Lo: who do you think's going to win it then A

A: I am

G: yeah I think two of them win me and A, A very good player all the time, me and him win this year, I got power, I got cue, I gonna do in one go, I got power I got all balls in one go, I do that I professionals

Lo: A doesn't believe you, look at him

G: I not listening to him, it my birthday tomorrow and umm, I be 36 so ummm

Lo: I hope you get lots of nice presents then

G: yeah I am

Lo: has the group made you a card out of the paper you've made

G: no J make me a card

Lo: we could do that couldn't we A, look he's lost his tongue

G: no, he's my friend, he can play with me, he good snooker isn't he

Lo: he told me he'd been knocked out of the tournament

A: no last year

Lo: oh so A going to beat you this year then is he

G: we both win I be first he be second..... oh yeah we make paper over here, all the pulps we doing, we give it a nice rub down cloth, get a bowl in baskets over there, put it on the able, get 2 of them put it down in the water like that, pull it out like that get al the water off, I show you, the water here right, take that and one of those like that, put it, give it in like that, dig it in the water like that right, put it right down, count to ten, like 1,2,3,4,5,6,7,8,9,10, go up like that put it on the side get all the water out and umm for long time, after that take that one off, put it on the side get a bowl and sponge, get a cloth dry on top with roller then come out the paper, so we take off like that, go over there, tip all the water out first, put it on table like that, then get cloth like that a cloth and a bowl and roller, one bowl there and sponge get all water out, lie that all dry, squeeze the water out like that, and again on the side, press it all down get all the water out, like that and again, get a cloth here get it like that and the roller do the sides like that

Appendix E

Experiment 1: Details of Analysis

Details of Analysis of Variance which was performed as part of the analysis on the data obtained from tasks in experiment 1 are provided.

Tables of means are also included, displaying means for each of the tasks and for the data obtained from a sample of typically developing adults on the grammaticality judgement task. The data obtained by Johnson and Newport (1989) on their version of the grammaticality judgement task used with second language learners is also included.

Effect	df Effect	MS Effect	df Error	MS Error	F	p-level
Grammaticality Judgement	11	1560	110	256	6.1	0.000001

Analysis of Variance Table of Results, Percentage of Errors on the Grammaticality Judgement Task by Adults with Down's syndrome.

Effect	df Effect	MS Effect	df Error	MS Error	F	p-level
Imitation	11	4141	110	305	13.6	0.000001

Analysis of Variance Table of Results, Percentage of Errors on the Imitation Task by Adults with Down's syndrome.

Effect	df Effect	MS Effect	df Error	MS Error	F	p-level
Spontaneous Speech	11	360	110	57	6.3	0.000001

Analysis of Variance Table of Results, Percentage of Errors on the Spontaneous Speech by Adults with Down's syndrome.

Grammatical Category	Grammaticality Judgement	Imitation	Spontaneous Speech
Past Tense	63	47	3
Plural	62	19	1
3rd Person Singular	68	40	2
Present Progressive	73	64	3
Determiners	67	56	9
Pronominalisation	49	55	12
Particle Movement	40	32	2
Subcategorisation	70	41	1
Auxiliaries	64	77	19
Yes/No Questions	50	59	3
Wh-Questions	73	55	1
Word Order	40	8	1

Table of Means, Percentage of Errors made by Adults with Down's syndrome on Each Task.

Grammatical Category	Native	3-7	8-10	11-15	17-24	25-39
Past Tense	1	1	4	20	28	38
Plural	5	3	10	36	46	56
3rd Person Singular	5	8	10	11	23	20
Present Progressive	0	0	3	0	9	9
Determiners	4	11	24	53	64	67
Pronominalisation	1	1	4	3	27	34
Particle Movement	1	2	5	16	29	26
Subcategorisation	1	0	10	24	31	37
Auxiliaries	1	3	4	11	21	23
Yes/No Questions	1	0	1	7	19	21
Wh-Questions	1	0	6	13	24	20
Word Order	3	3	8	6	8	13

Table of Means, Percentage of Errors made by Second Language Learners, Initially Exposed to a Second Language at Different Ages (based on results presented by Johnson and Newport (1989))

Grammatical Category	% Errors
Past Tense	1
Plural	4
3rd Person Singular	4
Present Progressive	0
Determiners	3
Pronominalisation	1
Particle Movement	2
Subcategorisation	1
Auxiliaries	1
Yes/No Questions	1
Wh-Questions	0
Word Order	1

Table of Means, Percentage of Errors made Native English Speakers on the Grammaticality Judgement Task (as used in experiment 1)

Appendix F

Experiments 2 and 3: Description of Video Stimuli

Videos were used in experiments 2 and 3 and have been reported on in chapters 4, 5 and 6. The videos used to present the stimulus for each child's narration are described below in the following sequence:

1. Videos used in both experiments 2 and 3 which contain two peripheral characters and were moving.
2. Videos used in experiment 2 which contained two peripheral characters and were still.
3. Videos used in experiment 3 which contained one peripheral character and were moving.

F.1 Videos which contain Moving Characters and Two Peripheral Characters, used in Experiments 2 and 3

F.1.1 Video 1

Main Character: Frog

Peripheral Characters: Teddies

Target Object: Tins

Frog enters the shop and waves. He then inspects the shop and leaves the shop (behind a shelf display intended to indicate that he has gone to the shop storeroom). He comes back carrying a small blue tin which he puts in the centre of the counter carefully. He then goes out of the shop again. He comes back carrying another small blue tin which he puts next to the previous blue tin. He then goes out of the shop again. He does this three more times constructing a pyramid display. The sixth tin which he brings in is orange, and he places this one on top of the pyramid display to complete it. He looks at the display he has constructed an leaves the shop.

A teddy (not wearing a hat: "T1-") enters the shop from the other side of the shop (intended to imply coming in through the shop door). He looks around particularly at the pyramid display of tins. Then another teddy (wearing a hat "T2+") enters. The teddies shake hands and jump up and down, then T2+ leaves. T1- is left to look at the tins. The frog comes back in and waves at T1-. T1- points to the orange tin and then puts his money on the counter. The frog gets the tin from the display and puts it down by T1-, he then picks up the money. T1- picks up the tin while the frog puts the money in the till. They both wave good-bye to each other, T1- leaves with his tin while the frog goes to the store room.

T2+ enters, the frog returns and waves to T2+. T2+ points to a blue tin which the frog removes from the display and puts on the counter for T2+. T2+ then puts his money on the counter and picks up the tin. The frog puts the money in the till and then waves at T2+, they both leave the shop. The frog returns to inspect the display, rubs his hands and scratches his head. He goes to fetch another blue tin to replace the blue tin he has sold. He positions it carefully, checks the display, nods and leaves. He also replaces the orange tin but as he places it on top of the display he knocks the whole thing down. He shakes his head, puts his head in his hands and rushes off.

F.1.2 Video 2

Main Character: Rabbit

Peripheral Characters: Teddies

Target Object: Cakes

A Rabbit enters the shop and inspects the displays: five cakes in a row on the counter, some by the till, and some on the shelves. The rabbit then waves and leaves the shop. She returns with a duster and dusts the counter by the cakes and the shelves. She then leaves and returns to put two of the small cakes from the counter and the large cake on the bottom shelf. Two remaining small cakes are then put on the higher second shelf. She then leaves the shop.

A teddy (T1+) enters and waits for the rabbit to come back. She comes out and waves at T1+. T1+ nods and points to the cakes on the shelf. The rabbit nods, rubs her hands and fetches the large cake from the shelf which she takes to T1+. But T1+ shakes his head, the rabbit then shakes her head and T1+ point vigorously at the cakes on the shelf again. The rabbit goes back to get a small cake and takes it to T1+. T1+ puts his money on the counter, nods and claps. The rabbit nods and takes the money to the till. T1+ picks up the cake. The rabbit waves to T1+ as he leaves.

The rabbit waits for the next customer, rubs her hands and then waves to T2- who comes into the shop. T2- points to the cake shelf so the rabbit goes to get a small one which she puts on the counter by T2-. T2- then puts his money on the counter and nods. The rabbit takes the money to the till and waves at T2-. The T1+ returns and talks to T2- and then to the rabbit. The rabbit waves as both T1+ and T2- leave. The rabbit wonders what to do and then puts back the unwanted large cake on the shelf. She then goes out to fetch a small cake which she puts on the shelf. She then goes over to the empty counter, rubs her hands, and then leaves.

F.1.3 Video 3

Main Character: Owl

Peripheral Characters: Bunnies

Target Object: Jars

An owl comes into the shop to check the stock which he does by looking at the various displays, he then goes out. He comes back with a duster and dusts the counter, the till, and the counter by a line of jars. He knocks one of the jars, drops the duster, shakes his head, puts his head in his hands and goes out with the duster. He comes back into survey the damage and then decides to pick up one of the small jars. He puts it on the counter by the till positioning it carefully. He then repeats this for three other small jars. He then tries to move the large jar which is very heavy. He staggers across, he has to rest half way and wipes his brow. He carries on until he reaches the display, then positions the jar, nods, counts the jars and then goes out.

A bunny (B1+) comes in and browses at the jars. The owl comes back and waves to B1+, who points at the large jar, puts his money on the counter and beckons to the owl to bring the jar out of the shop for B1+. The owl picks up the jar and struggles to carry it out of the shop. The owl comes back, picks up the money from the counter and puts it in the till. He then rubs his hands and goes out.

Another bunny (B2-) comes into the shop and points to a small jar and then looks to see if the owl will come to serve him. The owl comes out and waves at B2-. B2- nods at the owl and points to a small jar. The owl taps a jar on the display to make sure that it is the one B2- wanted. B2- nods so the owl picks it up. B2- puts down his money on the counter and the owl puts down the jar on the counter next to B2-. B2- picks up the jar and the owl picks up the money and puts it in the till.

B1+ comes back into the shop and the owl waves. B1+ and B2- are pleased to see each other. They all wave at each other and then B1+ and B2- leave. The owl rubs his hands, looks at the displays, shakes his head, points to the "stock room" and then goes out. The owl returns with another small jar which he tries to place in the display but it falls over. He is angry and shakes his head and rubs his hands and then leaves.

F.1.4 Video 4

Main Character: Chicken

Peripheral Characters: Bunnies

Target Object: Sweets

A chicken comes out and waves. He has a looks at the shelves and nods, then looks at the till and nods. Then he moves over to the empty counter and sees a stray box of smarties so he tries to pick it up but some smarties fall out onto the counter and he shakes his head and rubs his eyes. He puts the box behind a sign on the counter and clears the smarties from the counter. He rubs his eyes again and goes out. He brings in various sweets which he puts on the shelf and then goes out.

A bunny (B1-) comes into the shop. The chicken comes out and waves to B1-. B1- points to some sweets, the chicken confirms the ones B1- wants. B1- nods so the chicken goes to fetch them. The chicken puts the sweets on the counter and B1- puts his money on the counter. The chicken picks up the money and puts it in the till. The chicken waves to B1- who then picks up the sweets and stands chatting to the chicken.

The B2+ enters and says hello to the chicken and to B1-. B2+ looks at the price list and tells the chicken which sweet he wants. The chicken points to a sweet on the top shelf and B2+ nods. The chicken points to the price and B2+ shakes his head. The chicken gets a sweet from the bottom shelf and puts it on the counter, the chicken and B2+ nod. The chicken then puts it by B2+ while B2+ puts the money on the counter. B2+ claps his hands and the chicken picks up the money and puts it in the till. B2+ picks up the sweets. B1- and B2+ wave and leave. The chicken looks at the money in the till and gets it all out. He counts it rubbing his hands and nodding his head vigorously, he then leaves.

F.2 Videos which contain Still Characters and Two Peripheral Characters, used in Experiment 2

F.2.1 Video 5

Main Character: Frog

Peripheral Characters: Teddies

Target Object: Tins

Picture 1 A frog stands in his shop with his arms folded and looks at his shelves of stock.

Picture 2 He then decides to construct a pyramid-shaped display so he brings in some tins, he carries in a third blue tin to build up his display.

Picture 3 The frog continues to build the display on the counter and carries in the sixth tin which is orange to put on to of the display to complete the pyramid shape.

Picture 4 Two teddies come into the shop and stand next to the display, they are pleased to see each other and embrace.

Picture 5 The frog and T1+ look at each other and wave. They both point at the orange tin on display because T1+ wants to buy it.

Picture 6 The frog gives T1+ the tin and T1+ puts down his money on the counter.

Picture 7 T1+ carries the tin away while the frog waves and puts the money in the till.

Picture 8 T1+ has gone, but another teddy (T2-) has come in to buy a blue tin which he points at.

Picture 9 The frog picks up the blue tin from the display to give to T2- who puts his money on the counter.

Picture 10 The frog puts the money in the till, T1+ returns and talks to T2-, they both have their tins.

Picture 11 The teddies leave and the frog is left by himself, he has gone to fetch another blue tin to put on the display to replace the one he has just sold.

Picture 12 Unfortunately, while he tries to put the blue tin on the pyramid he knocks the display over, frog stands and looks at the collapsed display with his head in his hands.

F.2.2 Video 6

Main Character: Rabbit

Peripheral Characters: Teddies

Target Object: Cakes

Picture 1 A rabbit dusts the shelves in her cake shop.

Picture 2 She then goes to fetch a small cake to put on the display shelves.

Picture 3 She then waves to a teddy (T1+) who comes in to buy a cake. T1+ points at a cake to tell the rabbit which one he wants.

Picture 4 The rabbit carries the large cake over to T1+, but T1+ looks worried and puts his hands over his face.

Picture 5 The rabbit goes to get another smaller cake which T1+ wants instead of the big cake. T1+ puts his money on the counter.

Picture 6 Both the rabbit and T1+ wave goodbye to each other now that T1+ has bought his cake. The rabbit puts the money in the till as he waves goodbye.

Picture 7 After T1+ leaves, the rabbit fetches the large cake and puts it back on the shelf.

Picture 8 Another teddy (T2-) comes in to buy a cake. He points to the cake shelf and the rabbit points to a small one to make sure it is the one T2- wants to buy.

Picture 9 The rabbit gets the small cake for T2- from the shelf and T2- puts his money down on the counter for the rabbit.

Picture 10 The rabbit picks up the money and puts it in the till. T1+ returns and both teddies stand and talk to each other in the shop now they have bought their cakes.

Picture 11 The rabbit waves to the teddies as they leave the shop

Picture 12 The rabbit decides to replenish his shelves so goes to get two small cakes which he puts on the shelves.

F.2.3 Video 7

Main Character: Owl

Peripheral Characters: Bunnies

Target Object: Jars

Picture 1 An owl is in a jar shop and looks at the display of jars on the counter.

Picture 2 The owl goes out to get a duster to dust the jars on display.

Picture 3 The owl decides to move the display and put it next to the till, so he starts by moving one of the small jars over to the till area.

Picture 4 He has nearly finished moving all the jars, but he has still got to move the large jar which seems very heavy for him and he leans back trying to carry it.

Picture 5 A bunny (B1+) enters the shop because he wants to buy the large jar which the owl has just moved. The owl waves at B1+ to say hello. B1+ points at the jar to tell the owl that it is the one he wants to buy.

Picture 6 The owl gets the large jar from the display while B1+ puts his money on the counter.

Picture 7 B1+ asks the owl to carry the jar out for him because it is so heavy, the owl struggles to carry it out for B1+.

Picture 8 The owl comes back and puts the money, which B1+ has left, in the till.

Picture 9 Another bunny (B2-) comes in. The owl waves to say hello. B2- points at a small jar which he wants to buy.

Picture 10 The owl gets the small jar for B2- and puts it on the counter next to him. B2- puts his money on the counter.

Picture 11 B1+ returns to the shop to fetch B2- and holds his hand. B2- is ready to leave because he has his small jar. The owl puts the money in the till.

Picture 12 The owl waves goodbye as both bunnies leave the shop.

F.2.4 Video 8

Main Character: Chicken

Peripheral Characters: Bunnies

Target Object: Sweets

Picture 1 A chicken in a sweet shop picks up a box of smarties but they all spill out onto the counter.

Picture 2 He then clears all the spilled smarties off the counter.

Picture 3 Then the chicken goes to fetch some more sweets to put on the shelves.

Picture 4 A bunny (B1+) comes in to buy some sweets, he looks at the shelves with the different sweets on them. The chicken comes in and waits to hear which sweets B1+ wants to buy.

Picture 5 Chicken goes to get the sweet for B1+ and gives it to him. B1+ puts his money on the counter.

Picture 6 Chicken takes the money and puts it in the till, B1+ watches him now he has his sweets.

Picture 7 B1+ waits while another bunny (B2-) buys some sweets. B2- points to the sweets, and the chicken looks at the shelves to see which ones he wants.

Picture 8 The chicken goes to show B2- the price list and holds him by the shoulder. B2- looks sad and B1+ looks concerned as well.

Picture 9 The chicken then goes to get some cheaper sweets from the shelf for B2-.

Picture 10 B2- puts his money on the counter to pay for the sweets, B1+ is still waiting for B2-.

Picture 11 The chicken puts the money in the till. The bunnies are leaving, B1+ has said goodbye and is going out of the shop, B2- is still waving to the chicken.

Picture 12 Now the bunnies have gone, the chicken counts all the money he has in his till which he puts on the counter after a busy day.

F.3 Videos which contain Moving Characters and One Peripheral Character, used in Experiment 3

F.3.1 Video 9

Main Character: Frog

Peripheral Character: Teddy

Target Object: Tins

A frog enters the shop, he scratches his chin and leaves. He returns with one blue tin which he puts over on the far side of the counter. He does this five more times and constructs a pyramid-shaped display, the top tin is orange. He stands back, scratches his chin and nods. He looks at the rest of the shop and then goes out. He comes back in with a large piece of card which he puts on the counter. He goes out to fetch a marker pen which he then uses to write something on the card. When he has finished writing he takes the pen out of the shop. When he comes back he moves the card and puts it next to the till. This reveals that he has written "Bargains" on the card. He positions it carefully and leans round the till to check that it is in the correct place—he nods.

The a teddy enters the shop who waves at the frog. The teddy points to the orange tin so the frog nods and retrieves it from the display. They both nod and the teddy puts his money on the counter. The frog picks it up and puts it in the till. The teddy picks up the tin, they both wave goodbye and the teddy leaves.

The frog looks at the display and goes out. He comes back with another orange tin and puts it on the display. But as he is doing so he knocks the whole display over. He shakes his head and hits his head with his hands and then goes out.

F.3.2 Video 10

Main Character: Rabbit

Peripheral Character: Teddy

Target Object: Cakes

A rabbit enters the shop with a duster. She dusts the shelves, the till, and the counter. She sees the cakes on the counter and looks at the shelves, then she leaves. She returns and goes over to move the cakes on the counter. She moves them individually—four small cakes and a large one. There is no room for the large cake on the lower shelves so she tries to reach the top shelf. But she cannot reach how ever much she tries.

Just then a teddy enters the shop so the rabbit puts the large cake down by the till. They both wave and the teddy puts his money on the counter. The rabbit goes to get the large cake but the teddy shakes his head and points to the small cakes on the shelf. The rabbit looks at the small cakes and nods. She goes to get one and puts it on the counter by the teddy. The teddy then picks it up and leaves while the rabbit is picking up the money. They wave goodbye.

The rabbit puts the money in the till and then turns round to look at the big cake which has been left on the counter. She leaves the shop and returns with a chair which she carefully positions by the shelf. She then goes to pick up the large cake and carefully climbs onto the chair so that she can reach to put the large cake on the top shelf. Once she has put the cake on the shelf she picks up the chair and puts it in front of the till. She yawns and then slumps down on the chair and falls asleep after her busy day.

F.3.3 Video 11

Main Character: Owl

Peripheral Character: Bunny

Target Object: Jars

An owl comes into the shop with a duster. He looks at the shelves and at the till. He dusts the till and nods. He then dusts the jars, displays, and the counter. He sees some jars on the counter, shakes his head and goes out to put his duster away. He returns and moves four small jars over to the display by the till. He struggles with the last large jar—he has to put it down to have a rest and mop his brow. He then decides to push it the rest of the way across the counter. He then goes out and returns with a drink which needs after his hard work.

Then a bunny enters and they wave at each other. The bunny points to the large jar and the owl nods. The owl goes out to put his drink away and then comes to get the jar from the display for the bunny. The bunny nods and puts his money on the counter. The owl waves goodbye as the bunny picks up the jar and leaves.

The owl puts the money in the till, looks around and then goes to get another large jar to replace the one he has just sold. He puts it down on the counter next to the small jars, then he leaves.

F.3.4 Video 12

Main Character: Chicken

Peripheral Character: Teddy

Target Object: Sweets

A chicken enters and inspects the wall behind the counter, the he goes out. He returns with a sign displaying the prices of the sweets. He sticks it on the wall and goes out. He comes back in and looks at the counter and sees a stray box of smarties. He shakes his head and picks it up. Some sweets fall out onto the counter—he drops the box and looks shocked. He then clears away the sweets, checks that he has removed all of them, nods, picks up the box and goes out.

A bunny comes into the shop, the chicken comes back and waves to the bunny. The bunny puts down his money and points to a pile of sweets on the counter. The chicken looks at the money, shakes his head, and points to the price tag. The bunny looks at the price tag and then buries his head in his hands crying. The chicken pats him on the shoulder to comfort him and points out a cheaper sweet. The bunny looks and nods so the chicken goes to fetch one for the bunny. The chicken puts the sweet down next to the bunny who picks it up, nods and leaves. The chicken nods and waves goodbye.

The chicken then picks up the money and puts it in the till and then goes out. He comes back with another sweet which he puts on the shelf and then goes out again. He comes back and opens the till. He gets out all the money in the till and puts it on the counter, counts it, rubs his hands, nods his head, and then leaves.

Appendix G

Experiment 2: Transcripts of Narratives

A sample of transcripts of narratives produced by subjects in experiment 2. Each subject narrates four videos. Each sample indicates which video is being narrated, including the video type and the characters included. The subject is identified only by gender and age.

Any unintelligible speech and annotations—used to place narration in context—are indicated in square brackets. Prompts by the experimenter are shown in italics.

There are four samples from children with Down's syndrome, and two from each age group of typically developing children.

G.1 Experiment 2: 5 Year Olds

G.1.1 Subject: A, Sex: M, Age: 5

Video 1 (Owl/Jars)
Video Type: Still
Listener: Watching

who's this—it's an owl and he's in a jam shop—what else is happening
A: he's looking at me, he's standing up and looking that way
what's happening now
A: holding something
what's happening now
A: a rabbit's came—to share the jam
what's happening now
A: the rabbit's lying down
what's happening now
A: the owl's getting the rabbit—he's getting his wings out, the rabbit's came again, rabbit's still there, another rabbit's came and the owl's looking at the rabbit, one's looking that way and one's looking that way, it's just back behind now,
what's happening now
A: making faces

Video 2 (Frog/Tins)
Video Type: Still
Listener: Not Watching

who's this
A: a frog—taking one of those tins and now he's picking up an orange tin, now two rabbits came and they're fighting
what else is happening
A: the frog's came again, one rabbit's still there, I think the—now the frog's given the rabbit the orange tin, now he's going and he forgot to pay for the money, now he's—the frog's got another one and a little bear's came, now he's giving another tin, he's got a blue tin now, and now the frog's gone to sleep,now he's got it—he's got another tin, I think he was doing a trick, now his tin's knocked down

Video 3 (Rabbit/Cakes)
Video Type: Moving
Listener: Not Watching

who is it
A: a fox came—actually a rabbit
do you know where he is
A: in the shop
yes—do you know what sort of shop it is
A: a jam shop—no not a jam shop
do you think it might be a little cake shop
A: he's came back again now and he's wiping the thing, now he's gone away again, now he's came back,
what's happening now
A: he's picking up the bun and then put it on there, now he's put another one on there, now he's taking some eggs, now he's he's get one more bun in and he's put it on the

wood on there, now he just shook his head up and down, now he's put the last bun on there, except them,
I think they're a display
A: now somebody's coming—a bear, he said hello to the bear now—the shop keeper, oops he dropped it—it's upside down, he's got one now he wants another one, now he's said yes,
what's happening now
A: now he's paid for it and he forgot one
what's happening now
A: he's come back in and he wants another two, now he's got the money, another bears came, now they gone, the shop keeper's putting that last bun back—he's gone now

Video 4 (Chicken)
Video Type: Moving
Listener: Watching

A: oh a duck—he said hello, I think he saw me now—tidying up the mess,
is it a sweetie shop—what else is happening
A: now he's got something in his hands, now he's put it on there,
what's happening now
A: I think he's going to have one
what's happening now
A: he's giving a bear he's giving him some money,
what's happening now
A: another rabbit's came, now he wants one,
what's happening now
A: I think he's giving him one of those,
what's happening now
A: now he's gone away

G.1.2 Subject: L, Sex: F, Age: 5

Video 1 (Chicken/Sweets)
Video Type: Still
Listener: Watching

who's this
La: it's a duck
and where is he
La: he's looking in the shelf
I think he might be in a sweetie shop
La: yes he is
what's happening now
La: he picking up some sweets
what's happening now
La: tidying up, putting his sweets away, rabbit's came along
I wonder why, what's happening now
La: they're speaking to each other
what's happening now
La: duck's behind his counter
what's happening now
La: he's walking out behind his counter
what else is happening there
La: rabbit's came along
what's happening now
La: they're all holding hands
now what's happening
La: they're talking again
what's happening now
La: duck's behind his counter—rabbit's going back
what's happening now
La: duck's all on his own
what's he doing
La: counting his sweets

Video 2 (Rabbit/Cakes)
Video Type: Still
Listener: Not Watching

La: he's stacking the shelves
who is it this time
La: it's a rabbit
where is he
La: egg shop—bear's came along,
what's happening now
La: they're talking, the bear's down on his knees, he's doing up his bow, his hat's on one eye—it's got a bobble on the top, a rabbit's stacking his shelf again, bear's came along again, he's talking again while he's stacking his shelf, he's looking at the bear but not looking what he's doing, now they're talking again, bear's came along,
what's happening now
La: rabbit's behind his counter, the other two bears have gone off talking, rabbit's on the side of his shelf—he's got eggs in his hand

Video 3 (Owl/Jars)
Video Type: Moving
Listener: Watching

who's this
La: cat's coming along
and where is he do you think
La: in a shop—a jam shop
what's happening now
La: it's got a duster in his hand and he's duster a box—counter and the jars, he's put it away now, he's coming back out looking up and down,
what's happening now
La: he's got one of the jars, he's got another jar, he's counting them, he can't lift it up, he's done it now, going behind the shelf again, rabbit's came, he's waving to the rabbit, rabbit's looking down at his shelf, now he's picking up the big jar,he's gone, he's back up now, he's sweeping away, he's behind his counter, he's clapping his hands, he's gone behind his shelf again, rabbit's came, she's wondering where he is, they're both looking down, he's moving a jar, she's buying the jar, rabbit's came again, he's gone behind his shelf again, came back out with another jar, he's dropped it

Video 4 (Frog/Tins)
Video Type: Moving
Listener: Not Watching

La: there's a frog
and where is he
La: in a shop
and what sort of shop is it
La: a beer shop
what's happening now
La: he's stacking the—he's gone behind the thing, he's came back out with another ...
is it a tin
La: tin, he's gone behind his shelf again, he's behind his counter with another tin, he's come out with another tin, came out with another tin and he's put it on top, came out with another tin and put it on top again, he's gone behind again, he's got a yellow tin this time and he's put the yellow one right on top, a bear's come, and another bear's come, frog's came back out behind the shelf—he's clapping his hands,
what's happening now
La: he's sweeping the money away, he's putting it behind the till, he's waving now at bear, and bear's going, he's gone behind his shelf again, bear's came,—or dog, yes it's bear, and it's took a blue one and frog's gone behind his counter again, he's clapping his hands, he's going back behind the shelf, he's gone back behind, he's got another blue tin, he's got a yellow one, he's knocked it over

G.2 Experiment 2: 7 Year Olds

G.2.1 Subject: J, Sex: F, Age: 7

Video 1 (Owl/Jars)
Video Type: Still
Listener: Watching

who's this
J: mrs owl
where is she
J: she's in a kitchen
do you think she might be in a jam jar shop
J: yeah
what else is happening
J: she's picking up some jam
what's happening now
J: she's picking up another one, the rabbit's come into the shop and picking up some more jam,
what else is happening
J: the bunny rabbit's giving her some money,
what's happening now
J: the owl's giving her the jam, she's at the till, she's got some more jam, she's giving the bunny rabbit some jam, there's a lady bunny rabbit, and there the same, they're going to buy something, she's got some more jam and now she's dropped it

Video 2 (Frog/Tins)
Video Type: Still
Listener: Not Watching

who is it
J: it's a frog
and where is he
J: he's in a shop, he's picking up some tea, he's putting some tea down, there's two bears a lady and a man, the frog's greeting the bear and now he's giving him some tea and the bear's giving him some money for the tin, he's at the till and the bear's going home with the tea, has the bear got some tea? yeah he's got some tea now, the frog's giving the bear some tea, and the bear's giving him some money for the tea, and now they've got two tins of tea and the frog's at the till, and now he's picking up the tin, he's dropped all the tea

Video 3 (Chicken/Sweets)
Video Type: Moving
Listener: Watching

who's this
J: it's a duck and it's a sweet shop, he's picking up the sweets, he's dropped the sweets, he's putting the sweets back 'cause he's dropped them, now he's at the till and he's looking at all the sweets, he's gone out, now he's come back with some more sweets and put them down with the other ones, he's got some more sweets and he's putting them down where he dropped them, the bunny rabbit's come into the shop and he's behind the till, and he's giving him some sweets, he's going to give him some money, and there's a lady bunny rabbit, she's asked him for some sweets as well, and the bunny rabbit's going to give him some money, the bunny rabbit's taking the sweets, saying

bye, he's gone over to the till, got some money, he's pressing all the buttons on the till, he's getting some more money

Video 4 (Rabbit/Cakes)
Video Type: Moving
Listener: Not Watching

who's this
J: the bunny rabbit's in a cake shop, he's gone behind the shop—he's come back with something to clean with, he's cleaning all the shelves and table, he's gone behind the shelf again, he's come out now he's taking a cake and he's putting it on the shelf, he's taking another cake, he's taking all the cakes now, he's gone behind the shop now, and a teddy bear's come into the shop, they're saying hello, and the bear wants a cake, he's giving one to the bear—that's not the one he wants, he's getting the one he wants now, he's giving him the money, he's put the money in the till and the bear's picking up the cake, there's another bear that's come and that bear wants a cake as well, and he's giving that bear the same cake and he's giving him the money, now he's saying bye and there's another bear in the shop and that's the bear that had his bun and now they're going off again, and he's just picking up the bun and he's putting it on the shelf, he's gone behind the shop

G.2.2 Subject: D, Sex: M, Age: 7

Video 1 (Frog/Tins)
Video Type: Moving
Listener: Watching

who's this
D: a frog—he's saying hello
he's in a tin shop isn't he
D: yeah—he's going behind the tins now, I suppose this is like blind people—he's putting a tin down on the shelf, he's going back again, he's putting another tin on, he's going back again and he's going to put another tin on—what's he doing that for? he's building a tower, and another one, there's a bear, there's another bear,
what's happening now
D: he's going to put another ... they're arguing, he's taking the orange one off, putting that there, now he's put—he's over by the till—he's paying, he's gone behind there again, now she's come back, now she's buying something, here he comes again building another tower—they all fall down

Video 2 (Rabbit/Cakes)
Video Type: Still
Listener: Watching

D: there's another character
yes can you see what it is
D: rabbit?
what shop are they in
D: the bakers
what else is happening
D: look at that—they just turned the page over—he's just saying something to that over there, now the bear's there—he's holding some sausages—holding a cake, now rabbit's back at the till and the bears paying, now he's going back to the shelf, now the bear's coming again—he's turned his head, now he's doing something again—paying and holding a cake, the two bears and he's hiding behind the till—he's doing this
what's happening here
D: they're going away—waving bye bye

Video 3 (Owl/Jars)
Video Type: Moving
Listener: Not Watching

who's this
D: well there's an owl and a shop that sells jam, he's going behind the jars, he's cleaning up,
what else is happening
D: he's holding a cloth and going back behind the counter, now he's coming back again and picking the jar up, now he's putting it by his till, now he's going to fetch another one and put it by his till, now he's going to fetch another one, and the biggest one—he's too clumsy—he dropped it, he's put it back, now he's counting them and nodding his head, now here comes a rabbit, now he's there again waving, and giving the biggest jar to the rabbit, the rabbit's got more shopping, now he's going back behind the till, now the rabbit's come in again and here comes mr owl he's giving one to the rabbit—I think the other one was a hare, now he's coming to get the jar and taking it away, now he's going back to the till, now another rabbit's come—I think it's a hare,

what's happening now
D: the two rabbits are going home, mr owl's waving and he's being clumsy again with one of the jars—he is he dropped one on the counter

Video 4 (Chicken/Sweets)
Video Type: Still
Listener: Not Watching

D: there's a duck and he's in a chocolate shop—sweetie shop, he's just looking be the shelf at the moment, now he's counting his smarties, now he's putting his head inside the smartie packet, now he's eating up all the smarties, now he's put those on the shelf, now he's back by the shelf, now there's that rabbit coming again and he's turning his back, now he's turned to him and the rabbit kneeling down, now he's back at the till paying, now he's turning his head like that—now he's doing like that, going to the shelf again, there's another rabbit—two rabbits, now he's saying bye bye to the two rabbits, now he's looking at the two rabbits, one's got the smarties and one hasn't, now the other one's got a packet of smarties, now they're going, now he's at the till, now he's counting all the money up all left in the till—only about thirty pence—bye bye

G.3 Experiment 2: 10 Year Olds

G.3.1 Subject: G, Sex: M, Age: 10

Video 1 (Frog/Tins)
Video Type: Still
Listener: Watching

who's this
G: looks like Kermit really
he's in a tin shop—what's happening now
G: looks as if he's eating something—is he—I don't know—saying hello, selling some tins I think, he's striking a bargain, from the looks of it he's passing a tin and the other one's going like that, I think the teddy's just paid, looks like that one doesn't like the smell—he's going like that, looks as if that one doesn't want that tin he wants that one, that one they think ther teddies are probably talking about the tin, that one's enjoying himself—probably going to eat it now, knocked the tins over—hope the food doesn't come out.

Video 2 (Owl/Jar)
Video Type: Still
Listener: Not Watching

what's happening
G: the owls probably looking at the tin of syrup and ...
what sort of shop is it
G: bargains
is it a jam shop
G: yeah probably, that one's wondering whether to buy or not and he's looking at the till—bet he's a thief—nicking it, it looks as if he wants to nick it—that one's trying to sell it, that one's counting out the money, I think the teddy doesn't want to have it but the shop keeper wants him to so he's pushing him around, gone now—looks a bit annoyed—all the tins are still there—no sale today, he's trying to sell a tin to a different teddy now, he's probably striking another bargain—by giving him the tin the other one's going to give him the money, the owl's probably shaking hands with the other one but he doesn't want to, and the other one's wondering what's going on, they both don't like each other now it looks like they want to do a draw—back to back, still no sale,
what's happening now
G: he's looking at the tins

Video 3 (Rabbit/Cakes)
Video Type: Moving
Listener: Watching

who's this
G: checking where all his stock is I suppose, and saying hello
what sort of shop is it
G: cakes—lets put it so it's not so basic—let's say it's a bakery, he has to clear up the place—always clear up the place before you put the stuff down, oh dear have all that dust underneath the cakes and that,
what's happening now
G: he's put them on the shelf for show
what's happening now

G: he's still putting them on the shelf for show, here's a customer—old scottie, say hello, he's saying what do you want, and he's just tipped the cake over, probably he doesn't want all the decorations messed up, anyway they're dum old puppets so I can expect that to happen, wants to buy another one—don't run out of stock what ever you do, pressing the till down and he's going to give him the money—oh no he has already, another one, that's all he wants, gives him the cake, I wonder when he's going to buy the other one he's tipped over, oh good he's put it the right way up this time, he's paying already—didn't even tell him the price, probably don't like the cakes—look at their eyes, oh dear, well at least he's honest enough not to scoff it down,

Video 4 (Chicken/Sweets)
Video Type: Moving
Listener: Not Watching

G: special offers—probably a sell out
is it a sweet shop do you think
G: yeah, smarties, probably wants one and knocked them all over the floor—pay for it first, I don't see why he should do it's his money anyway, he looks as if he's being dishonest there—hid them, I think he's thinking of an excuse
what's he doing now
G: I think he's getting some more stock—do you know the answer to this video?
there's no correct answer—just whatever you think is happening—what's happening
G: trying to sell him—looks like fizzy chewits, the packet does anyway,
what's happening now
G: they agreed—for once someone agreed in this video—and in all the others,
what's happening now
G: he asked for some sweets—that one asked which one he wants, he goes do you want that one and he goes yes
what's he doing now
G: having a chat with the shop keeper I think—oh he's paid, taken it he said goodbye, and stopped for a chat? he's counting out his money—a successful shopkeeper unlike all the others

G.3.2 Subject: E, Sex: F, Age: 10

Video 1 (Owl/Jar)
Video Type: Moving
Listener: Watching

what's happening on here
E: the owl's come on and it look's like he's in a shop and he's looking around to see what there is and he's just gone off again and he's wiping the top off with a duster and he's just knocked some jars, and he's going off and he's just come on again and it looks like he's carrying something and he's just come on and he's moving the jars around and he's picking up another jar and he's moving it to the other side he's moving them and he's done the smaller jars and there's a bigger jar left and he's picking that one up and it looks like it's a bit heavy for him to move he's having a bit of a problem with moving he's managed to get it back to the other side and then he's just gone off and a rabbit's come on the other side and he's looking at all the jars and the owl's come on and it looks like they're talking to each other and the owl's showing the rabbit the bigger jar and the rabbit's just gone off and the owl's followed him with the big jar and now the owl's just come on again and he's just picked up the money and he's taking it to the till put it in the till and it looks like he's happy that he's got some money and he's just gone off and the rabbit's just come on again and he walked on the table to see if the owl would come out again and then they're just talking to each other and the rabbit's just put some money down and the owl's giving the rabbit the smaller jar and the rabbit's taking it away and the owl's just picked up the money and put it in the till and the other rabbit's just come on and both rabbits are talking to each other and the owl's talking—they're all talking and the two rabbits have just gone off again and the owl's just looking at his jars that are left and he's just gone now and come on again and he's just knocked over one of the jars

Video 2 (Frog/Tins)
Video Type: Still
Listener: Watching

who is it
E: it's a frog by the till and there's a sign saying end of day sale and there's two pens on the side and he's holding one and he's and there's two more and he's holding an orange one and the rest of them are blue and there's three on the bottom row two on the row above and it looks like he's just about to put down the orange one, he's put down the orange one and there's a bear and it looks like there's two bears and it looks like they're fighting over something or just talking and the frogs come back again and one of the bears is still there, I think the bears going to buy something from the frog the frog's giving the bear the orange carton and I think the bears put some money on the side, and the bear's got the carton and he's turned to go off and the frog's by the till and he's doing something and the frog's come on and the other bears come on now and he's asking for one of the other cartons and he's the frog's picked one up and he's just about to give it to the bear and the bear's put down the money on the side, and the other bear's come on and the frog's at the till again and the bear that just came on still had the orange thing and the frog's holding a blue carton and there's still four blue cartons on the side and he's just knocked over all the other cartons with the one that he had as though he dropped it on them

Video 3 (Rabbit/Cakes)
Video Type: Moving
Listener: Not Watching

who's this
E: it's a rabbit and he's got some cakes or something on the side and there's a bigger one beside the four little ones and there's three big ones by the till and the rabbit's got a duster and he's just wiped off the side and he's wearing an apron and now he's dusting the shelf and he's dusting the other shelf and he's dusting the side again and he's just gone off with the duster and he's just come on to take one of the cakes over to the shelf and put it on the shelf and then he's gone back to get another cake picked it up taking it over and putting it on the thing, and picking up the bigger cake that was beside them and putting it on the bottom thing and he's picking up another one and putting it up and putting the last one up there and a bear's come on and the rabbit's talking to him and the rabbit's going to get the bigger cake and he's just taking it and knocked it over upside down and the bear doesn't want it anymore 'cause he's mucked it up and he's just getting a smaller one and he's putting that one down for the bear and the bear's put down the money and he's—the rabbit's picked up the money and putting it in the till and the bear's taking the smaller cake and the rabbit's just looking around as if he doesn't know what to do now and another bear's come on—it's a different one this time and the rabbit's gone to get another cake and taking it over and giving it to the bear and the bear's looking at it as if to say ooh ok I'll have that one and he's just put down the money and the rabbit's picking it up and putting it in the till and the bear's taking the cake and the other bears looking back and they're both talking to the rabbit with their cakes and they're just going off together and the bear's just turned the cake up the right way and taking it over and putting it on the shelf he's going behind the thing

Video 4 (Chicken/Sweets)
Video Type: Still
Listener: Not Watching

who's this
E: a duck and there's some things on the counter and he's just picking up something or he's dropped some money or something on the counter, there's lots of sweets on the shelf and he's picked up something and he's taking it somewhere and he's putting them on the shelf and there's also lots of other things and the rabbit's come on and they're looking at the duck and they're talking and I think the rabbit's put down some money and the duck's putting it in the till and the rabbit's just stood there and another rabbit's coming on and the rabbit that was already there is holding something and the other rabbit's tapping on the till and the duck is getting something and taking it over to the rabbit and the duck's holding on to something and it looks like there's a price list already on the counter and the rabbit's taking something away and the duck's putting something in the till and he's about to pick up something or he's just dropped it and ....

G.4 Experiment 2: Children with Down's Syndrome

G.4.1 Subject: B, Sex: M, Age: 9

Video 1 (Rabbits/Cakes)
Video Type: Moving
Listener: Watching

who's this
B: rabbit—rabbit, it's rabbit—what's that, another rabbit, he scrubbing, look gone, look on the floor
are they cakes, is he a shopkeeper in a cake shop
B: yeah, the rabbit, a mouth gone, oh no fell over, he getting up,
what's he doing now
B: um, cleaning them, there's a rabbit
what's that
B: rabbit talking, the mouth gone, an chin and nose
what does the teddy want
B: cakes
what's happening now
B: gone, oh it's that—teddy again
why's the teddy there
B: the rabbita pay, more teddy,
what's happening now
B: rabbit gone and teddy gone

Video 2 (Owl/Jar)
Video Type: Still
Listener: Not Watching

B: there's owl
what's happening
B: owl, walking, no legs, owl, there's teddy, buy paint—no, jars, see it
what's happening
B: owls again, and bear—a hug him, a friends rabbit
what's happening
B: the owl doing, there's a rabbit again, he have some syrup—no carrot, owl—huh—two rabbits
what's happening
B: yeah want syrup, um owl hand up—oh no drop it now

Video 3 (Chicken/Sweets)
Video Type: Moving
Listener: Not Watching

who's that
B: umm
it's a chicken in a sweet shop
B: yeah I know
what's he doing
B: teddy coming, want this one—sweets, gone, there he is, owl—chicken, gone, there he is, chicken take it this way gone off, gone, there's rabbit—sweets, that one sweet, it's chocolate, go a home to eat it—him, it's gone now, ooh teddy, that one have sweet,
what's happening now

B: that rabbit have chocolate as well
what's the chicken doing
B: he's buy some, he's buy
what else is happening
B: a more there, more, he gone, the table, teddy's come back

Video 4 (Frog/Tins)
Video Type: Moving
Listener: Watching

B: oh a frog
he's in a tin shop
B: oh gone ah there he is, oh gone again, he's here, oh gone, a tin, two tins, oh gone again, hey frog stop, oh he's here, a more now, oh gone again, who's that, oh a teddy, oh frog gone, here's the frog, has come back, he's the tins the teddy, a gone now, oh gone again back in a minute, oh more teddy, a frog now teddy gone the frog coming oh a gone now oh there he is, oh more—fall down.

G.4.2 Subject: R, Sex: M, Age: 16

Video 1 (Chicken/Sweets)
Video Type: Moving
Listener: Watching

R: oh no he's gone and he go back, he got smarties I think, there some more there, he's gone, and back again, and ooh what's it called ... I like crunchies ... he's gone again, Rabbit hello,
what's happening
R: I don't know, he gonna buy some, he go to the till in the money, they said there's the change for him ooh another rabbit—two rabbits he buy the smarties, oh dear, smarties, they said goodbye, go to their home, he got a bit of money, oh no more money—three moneys, oh not another money, he's gone

Video 2 (Owl/Jar)
Video Type: Moving
Listener: Not Watching

Who is it
R: An owl then he thumping the jar ... oh he's gone, oh look he dusting the place, oh no oh he's gone, he's back, oh look the jam the jam, he pats them the jam, it too heavy cause it got jam in it, he's gone, oh no it's the rabbit, it's the same as there, oh no it too heavy, the owl come back, he's gone oh no the rabbit the same one owl come back, and he wants to buy something the jam he pay some money, the other rabbit come back, a owl was a silly, he's gone, more jam he's done that to it, it crashed oh it finished.

Video 3 (Rabbit/Cakes)
Video Type: Still
Listener: Watching

R: oh that piece of cake it's a rabbit, a bear teddy bear,
what's happening now
R: he get a cake, oh it full of cream oh no piece of cake,
what's happening now
R: oh no the rabbit back again with a piece of cake,
what's happened
R: he's gone down there he get the money ooh he's gone, a bear—another piece of cake please oh no rabbit got another piece of cake,
what's happening
R: he's got the money, oh no another one teddy bear, they get one another cake,
what's happening now
R: he's gone home, ... he's gone

Video 4 (Frog/Tins)
Video Type: Still
Listener: Not Watching

R: it's kermit the frog, oh no he's got a drink in his hand
now what
R: it's cups
now what
R: oh no its teddy bear, he's gone, it's kermit the frog gone oh he's back, oh no whoops it's red cup, he took the drink

ERROR: undefined
OFFENDING COMMAND:

STACK:

what's happening now
R: he pay the money, oh no it's teddy bear back he want the cup, what's that say?
it says end of day sale
R: ooh wow!
what's happening
R: oh no another teddy bear back, oh no not again
how many are there now then
R: two, oh no he's gone, it's kermit the frog his cups away, oh no it falled over

G.4.3 Subject: C, Sex: F, Age: 7

Video 1 (Rabbit/Cakes)
Video Type: Moving
Listener: Watching

what's happening
C: the bed and a chair the mice and the rabbit—what's he doing? waving say hello, now what's he doing, ha he's gone, he's gone already, he's gone get some more stuff, now he's getting the ball down on the thing, now he's move the apple
what's that
C: it's a cake, now what's he doing—oh look at him
what is he doing
C: he's got a cake still, now look
is he putting them on the shelf
C: yeah, now look at him he's got another cake, oh now what he going to do—oh hahaha
what's he doing
C: he's gone again—oh ummah hello what's he doing here, oh look out what's he doing now?
I'm not sure
C: oh look out he's gone bye-bye
is he going to go
C: oh he's not I don't know—oh yeah, he is going look watch out oh hey where's he gone now
who's that
C: him there's no—oh here's there's the rabbit oh ok, he's got a cake, he's got a cake, oh it's a sweet isn't it, there's another going oh no look it's him, look is he come is he? now what's he looking at?
the penny
C: oh haha he has to pay for it, oh look he's gone, now what's he going to do now? oh what's that—rabbit oh look out oh haha he's got a cake, now what's he doing, you stupid rabbit, he have to pay for that, oh now what, what's he doing?
What's happened now
C: he's gone now—oh what about him, he's cleaning up now, what now, oh he's going inside it, he have the cake, oh he's gone, oh it's finished, it has finished, oh no it's him, look it's him again, hello mr....oh what would he like? oh him again he take him back in again hey bye bye, oh he gone on again

Video 2 (Frog/Tins)
Video Type: Moving
Listener: Not Watching

who is it
C: a boy he likes doing, a frog in tin shop—ooh he's got a toy, he's got a toy look, got a toy, oh a duck oh no he's gone, frog has gone, now where is he, hello duck, he's got another toy
do you think it's a tin
C: a tin yeah, it's a nice frog, oh no now where's he going now? is it finish already is it oh no, he's got another pot, is he getting another pot is he?
he's got quite a few

C: he's got a few yeah, oh oh look he's gone, haha he's got it already look oh no he got the tins, he's going out, he's get some more—another one, here he is a frog he's put it there, is there any more left?
how many are there now
C: I don't know—one two three four
oh there are a couple more left yet then
C: oh look here it goes he's got a car oh a brick I think oh no he's gone look at that, hey it's him look the frog has gone where's the frog gone?
I'm not sure
C: he's gone oh can see him again
what's he got now
C: a duck oh look, he's getting his things off, look—see that, oh he's lie now what's he going to do? haha he's gone, ah he's lie that frog again he's taken it home, he has to pay for it first, oh look at that he's gone and the frog's gone, is that it then? oh no it's him again
who is it
C: it's him the rabbit and there's the froggy hello, here he is oh no look he's speaking ...oh he's gone and the frog's gone look now what's he going to do? ha there he is
who is it
C: I don't know it's a frog, oh he's gone again oh it's finished
I think something else might happen—what's he doing
C: he's got another tin, I think it's finished isn't it?
ooh I don't know—look
C: ooh he here comes ooh he's knock them over, now he's gone

Video 3 (Owl/Jar)
Video Type: Still
Listener: Watching

this is an owl in a jam jar shop—you tell me what you think he might be doing.
C: oh? hey? it's not moving
no it's like a story book. what's he doing now
C: he's getting that jam jar, now what now?
what's he doing now
C: he's got a box
do you think he's got one of those
C: yeah
what's he doing with it
C: I don't know
is he putting it over here somewhere
C: yeah, he's emptying it all out
ooh now what's he doing
C: he's emptying it all out
now what
C: animal this one
what do you think he wants
C: don't know ...I thought a box
oh what's happened now
C: oh he's getting for him, he's on the table he's lying on the table, he's going and he's got a bag
who's going
C: a dog
now what

C: oh that
is he doing the till
C: yeah a till, there's another rabbit
what does he want
C: he wants a cat food, oh no he's going now, oh no he's getting a tin for the rabbit and now he's got friends now, now he's getting the rabbit to pay for it, and he's moving the thing look, him I don't know what he's doing
is he going
C: yeah, the owl saying bye bye to self, now what—oh he hurt his-self

Video 4 (Chicken/Sweet)
Video Type: Still
Listener: Not Watching

C: oh look
what's happened now
C: oh he's making a sweety, he's getting a sweet is he ... he's going to put something on the top shelf, ooh that
who's that then
C: animal, oh he's looking, he likes this one, he's paying, now what oh no he put the sweet back up again, he's got the sweet already, he's going home now—nice isn't it, oh he looks sad that rabbit, he can't have the sweeties, he hasn't got the sweet, oh he's surprised, oh he's going, chicken's...oh no he's doing....?
can you see what this is
C: umm no
he's counting his money
C: that's it

G.4.4 Subject: K, Sex: F, Age: 15

Video 1 (Owl/Jar)
Video Type: Moving
Listener: Watching

this is an Owl and he's in a jam jar shop
K: is he?
yes look at all these jars—what's happening then
K: cleaning up
what's happening now
K: taking the jam jar, he took another one, he took another one, took the little one, took the big one,
what's happening now
K: there's a rabbit
what's happening now
K: taking the jam jar—cause I think he's going to eat it
what's that then
K: a little bit of butter
do you think it's money
K: yeah money
what's the owl doing
K: he's washing his hands, that's the rabbit, he took another jam jar and paid for it, there's money and putting it in the till, and another puppet rabbit come
what's happening now
K: jam jar is fallen over

Video 2 (Rabbit/Cakes)
Video Type: Still
Listener: Watching

What's happening here then
K: the bear comes along and he wants some cakes and he ends up paying for it and then take it
what's happening now
K: there's the cake shop—the shelf, the two that side and cakes there and he might take five and he might spend five, paid for it,
what's happening now
K: he goes to the till and put the money in the till and he took the cake, he's looking to see if there's any more cakes for sale, he's back again, he wants more cakes, he paid for it and then he took the cake, he giving the cake to him, then he put the money in the till and he give him his change, he might have some more—oh he's gone
now what
K: there's the shelf but with the cakes still on it, counting how many cakes is there

Video 3 (Frog/Tins)
Video Type: Still
Listener: Not Watching

you tell me what's happening
K: there's some pots and there's a frog got the towel in his hands and then the tins go over that side and then someone might come along and then might pay it, there's more jam jars, there's some tins with tea bags in, there's someone come along to pay for it

who

K: sooty—he paid for it and he might take it, then he put the money in the till, then he will take it and then he might come back for more, he put the money in the till then he took it, then he comes back for more and then he might pay it and then take it, an then he might come back for more

what's he doing now

K: money

anything else happening

K: he took some more change and then he paid for it, the frog put the money in the till,

what's happened now

K: he put the tins in the porch and so someone will come and pay for it, it's the boxes

Video 4 (Chicken/Sweets)
Video Type: Moving
Listener: Not Watching

can you tell me what's happening

K: it's sooty on the tell

is it a chicken in a sweet shop

K: yeah

what's he doing

K: he's getting all the sweets together and hope that someone comes along to pay for it, he getting sweets ready for the person to come and pay it, smarties, mars bars, twix

what's happening now

K: he's getting the sweets ready, is that it? he might get some sweets and put them on the shelf, he get more sweets and put them on the shelf,

what's happening now

K: look there's a rabbit on there

what does he want

K: some sweets—getting the twix out, cause he likes twixs and then he paid for it with his money, he put in the till then he gives him his change then he takes and then another bear come on an then he wants some sweets, might have some m and m's and then he might pay for it, giving him the sweets and then he pays for it, he putting it in the till and see how much change it comes to, picking it up,

what's happening now

K: all the rabbits gone, he play with the change to see how much it comes to

Appendix H

Experiment 2: Total Number of References Used

The tables which follow indicate the total number of references which were used by each subject group in each condition for both the main character and the peripheral characters. From these figures differences in performance can be seen for each subject group. The following letters are used in the tables to identify the reference types:

A	Proper Name
B	Indefinite Noun Phrase
C	Definite Noun Phrase
D	No Determiner in Noun Phrase
E	Pronoun
F	Nominal Substitute
G	Zero Anaphora
H	Pointing
I	No Reference

Subject	Listener	Video	A	B	C	D	E	F	G	H	I
D	N	M	1	22	27	73	148	0	130	1	0
D	N	S	8	36	13	69	89	0	70	2	1
D	Y	M	1	16	17	52	161	0	131	0	0
D	Y	S	3	21	15	53	96	1	49	0	2
5	N	M	0	24	16	11	244	0	24	0	0
5	N	S	0	25	11	13	132	0	7	0	0
5	Y	M	0	5	10	8	209	0	34	0	0
5	Y	S	3	11	3	17	118	0	15	0	0
7	N	M	10	38	11	6	250	0	38	0	0
7	N	S	8	43	10	20	141	0	16	0	0
7	Y	M	5	11	8	7	161	0	29	0	0
7	Y	S	3	35	7	10	98	0	5	0	0
10	N	M	2	87	16	5	267	1	111	0	0
10	N	S	1	83	13	4	130	2	25	0	0
10	Y	M	3	78	14	3	315	0	83	0	0
10	Y	S	9	88	12	0	124	1	26	0	0

Total number of each reference type used for the main character across all conditions.

Subject	Listener	Video	A	B	C	D	E	F	G	H	I
D	N	M	3	25	34	55	80	6	52	0	0
D	N	S	2	16	35	75	71	3	32	0	5
D	Y	M	1	12	29	55	54	2	41	0	0
D	Y	S	1	12	23	75	70	5	49	0	2
5	N	M	0	25	26	12	93	3	5	0	0
5	N	S	0	26	34	11	82	4	8	0	0
5	Y	M	0	8	16	10	64	7	2	0	0
5	Y	S	0	23	26	13	49	12	10	0	0
7	N	M	3	50	31	12	76	3	6	0	0
7	N	S	1	62	37	9	84	8	3	0	0
7	Y	M	2	37	29	8	60	1	6	0	0
7	Y	S	4	43	20	6	63	3	8	0	0
10	N	M	1	95	21	1	84	3	17	0	0
10	N	S	2	89	32	4	86	9	13	0	0
10	Y	M	2	70	34	0	107	2	12	0	0
10	Y	S	0	88	24	1	85	10	6	0	0

Total number of each reference type used for the peripheral characters across all conditions.

Subject	Listener	Video	A	B	C	D	E	F	G	H	I
D	N	M	1	1	9	24	3	0	1	0	0
D	N	S	3	4	6	17	5	0	2	1	0
D	Y	M	0	2	8	21	5	0	3	0	0
D	Y	S	3	2	8	16	5	0	5	0	0
5	N	M	0	0	12	2	1	0	0	0	0
5	N	S	0	0	8	3	4	0	0	0	0
5	Y	M	0	0	7	6	2	0	0	0	0
5	Y	S	1	0	2	3	9	0	0	0	0
7	N	M	2	3	9	1	0	0	0	0	0
7	N	S	2	0	10	2	1	0	0	0	0
7	Y	M	2	0	7	3	3	0	0	0	0
7	Y	S	1	1	7	3	3	0	0	0	0
10	N	M	0	2	11	0	2	0	0	0	0
10	N	S	0	3	10	0	2	0	0	0	0
10	Y	M	0	3	11	0	0	0	1	0	0
10	Y	S	2	2	11	0	0	0	0	0	0

Total number of each reference type used for the main character as an initial reference.

Subject	Listener	Video	A	B	C	D	E	F	G	H	I
D	N	M	1	7	21	23	5	0	0	0	0
D	N	S	0	3	13	32	4	0	0	0	1
D	Y	M	0	1	17	29	2	1	2	0	0
D	Y	S	1	3	10	31	4	2	1	0	1
5	N	M	0	5	18	3	1	0	0	0	0
5	N	S	0	2	16	2	3	0	0	0	0
5	Y	M	0	5	13	7	1	1	0	0	0
5	Y	S	0	1	15	3	1	1	1	0	0
7	N	M	0	5	21	3	0	0	0	0	0
7	N	S	1	6	22	2	0	0	0	0	0
7	Y	M	0	7	17	3	0	0	0	0	0
7	Y	S	1	11	13	2	1	0	0	0	0
10	N	M	1	11	14	0	1	0	0	0	0
10	N	S	1	7	19	0	0	1	0	0	0
10	Y	M	0	7	23	0	0	0	0	0	0
10	Y	S	0	8	19	0	1	1	0	0	0

Total number of each reference type used for the peripheral characters as an initial reference.

Subject	Listener	Video	A	B	C	D	E	F	G	H	I
D	N	M	0	5	7	20	73	0	68	0	0
D	N	S	1	4	1	6	32	0	34	0	1
D	Y	M	1	4	6	11	95	0	65	0	0
D	Y	S	0	1	1	10	37	1	25	0	1
5	N	M	0	5	3	3	120	0	5	0	0
5	N	S	0	3	2	1	48	0	1	0	0
5	Y	M	0	2	1	0	114	0	15	0	0
5	Y	S	0	1	0	2	54	0	8	0	0
7	N	M	4	5	2	0	117	0	18	0	0
7	N	S	1	4	0	2	62	0	7	0	0
7	Y	M	0	0	1	0	69	0	10	0	0
7	Y	S	0	8	0	2	38	0	2	0	0
10	N	M	0	17	5	2	145	0	60	0	0
10	N	S	1	10	3	3	55	1	16	0	0
10	Y	M	1	18	3	3	161	0	46	0	0
10	Y	S	4	16	1	0	51	0	15	0	0

Total number of each reference type used for the main character as a further reference without an intervening reference to another character.

Subject	Listener	Video	A	B	C	D	E	F	G	H	I
D	N	M	0	1	5	9	22	3	19	0	0
D	N	S	1	2	6	11	25	2	15	0	1
D	Y	M	1	0	6	6	18	1	23	0	0
D	Y	S	0	0	5	16	31	2	16	0	0
5	N	M	0	7	6	3	40	3	4	0	0
5	N	S	0	10	6	2	42	3	3	0	0
5	Y	M	0	0	1	1	26	3	1	0	0
5	Y	S	0	6	2	6	23	4	7	0	0
7	N	M	2	10	5	1	24	2	3	0	0
7	N	S	0	13	11	3	42	4	2	0	0
7	Y	M	1	8	4	1	24	1	2	0	0
7	Y	S	2	10	1	0	30	3	6	0	0
10	N	M	0	21	2	0	36	2	10	0	0
10	N	S	1	24	5	1	52	6	9	0	0
10	Y	M	2	13	5	0	49	2	8	0	0
10	Y	S	0	30	4	0	45	7	4	0	0

Total number of each reference type used for the peripheral characters as a further reference without an intervening reference to another character.

Subject	Listener	Video	A	B	C	D	E	F	G	H	I
D	N	M	0	16	11	29	72	0	61	1	0
D	N	S	4	28	6	46	52	0	34	1	0
D	Y	M	0	10	3	20	61	0	63	0	0
D	Y	S	0	18	6	27	54	0	19	0	1
5	N	M	0	19	1	6	123	0	19	0	0
5	N	S	0	22	1	9	80	0	6	0	0
5	Y	M	0	3	2	2	93	0	19	0	0
5	Y	S	2	10	1	12	55	0	7	0	0
7	N	M	4	30	0	5	133	0	20	0	0
7	N	S	5	39	0	16	78	0	9	0	0
7	Y	M	3	11	0	4	89	0	19	0	0
7	Y	S	2	26	0	5	57	0	3	0	0
10	N	M	2	68	0	3	120	1	51	0	0
10	N	S	0	70	0	1	73	1	9	0	0
10	Y	M	2	57	0	0	154	0	36	0	0
10	Y	S	3	70	0	0	73	1	11	0	0

Total number of each reference type used for the main character as a further reference after an intervening reference to another character.

Subject	Listener	Video	A	B	C	D	E	F	G	H	I
D	N	M	2	17	8	23	53	3	33	0	0
D	N	S	1	11	16	32	42	1	17	0	3
D	Y	M	0	11	6	20	34	0	16	0	0
D	Y	S	0	9	8	28	35	1	32	0	1
5	N	M	0	13	2	6	52	0	1	0	0
5	N	S	0	14	12	7	37	1	5	0	0
5	Y	M	0	3	2	2	37	3	1	0	0
5	Y	S	0	16	9	4	25	7	2	0	0
7	N	M	1	35	5	8	52	1	3	0	0
7	N	S	0	43	4	4	42	4	1	0	0
7	Y	M	1	22	8	4	36	0	4	0	0
7	Y	S	1	22	6	4	32	0	2	0	0
10	N	M	0	63	5	1	47	1	7	0	0
10	N	S	0	58	8	3	34	2	4	0	0
10	Y	M	0	50	6	0	58	0	4	0	0
10	Y	S	0	50	1	1	39	2	2	0	0

Total number of each reference type used for the main character as a further reference after an intervening reference to another character.

Appendix I

Experiment 2: Details of Analysis for References to Characters

Tables providing full details of the Analysis of Variance performed on the data obtained in experiment 2 are provided. Each analysis assesses the proportion of full references used by each subject group for each of the referential contexts. Tables of Means are also included for each analysis and each subject group.

I.1 Initial References

Age	Character	Listener	Video Type	Mean
5	Main	Not Watching	Moving	93.3
			Still	73.3
		Watching	Moving	86.6
			Still	40
	Peripheral	Not Watching	Moving	96.6
			Still	86.6
		Watching	Moving	93.3
			Still	80
7	Main	Not Watching	Moving	100
			Still	93.3
		Watching	Moving	80
			Still	80
	Peripheral	Not Watching	Moving	100
			Still	100
		Watching	Moving	100
			Still	96.6
10	Main	Not Watching	Moving	86.6
			Still	86.6
		Watching	Moving	93.3
			Still	100
	Peripheral	Not Watching	Moving	93.3
			Still	100
		Watching	Moving	100
			Still	90

Table of Means, Proportion of Full References used as Initial References by Typically Developing Children.

Character	Listener	Video Type	Mean
Main	Not Watching	Moving	87.5
		Still	75
	Watching	Moving	77.5
		Still	72.5
Peripheral	Not Watching	Moving	86.6
		Still	93.3
	Watching	Moving	88.8
		Still	81.3

Table of Means, Proportion of Full References used as Initial References by Children with Down's syndrome.

Effect	df Effect	MS Effect	df Error	MS Error	F	p-level
1. Subject Group	3	6755	81	1570	4.3	0.007
2. Character Type	1	14370	81	922	15.6	0.0001
3. Listener Position	1	4753	81	1030	4.6	0.03
4. Video Type	1	7347	81	1080	6.8	0.01
1*2	3	696	81	922	0.8	0.5
1*3	3	1556	81	1030	1.5	0.2
2*3	1	852	81	1040	0.8	0.4
1*4	3	3355	81	1079	3.1	0.03
2*4	1	1580	81	1289	1.2	0.3
3*4	1	1043	81	991	1.1	0.3
1*2*3	3	1268	81	1040	1.2	0.3
1*2*4	3	980	81	1289	0.7	0.5
1*3*4	3	379	81	991	0.4	0.8
2*3*4	1	557	81	591	0.9	0.3
1*2*3*4	3	1018	81	591	1.7	0.2

Analysis of Variance Table of Results, Proportion of Full References used as Initial References by Typically Developing Children and Children with Down's syndrome.

I.2 Further References Without Intervening References

Age	Character	Listener	Video Type	Mean
5	Main	Not Watching	Moving	7.2
			Still	11.7
		Watching	Moving	2.4
			Still	5.6
	Peripheral	Not Watching	Moving	23.2
			Still	23.5
		Watching	Moving	10
			Still	26.7
7	Main	Not Watching	Moving	10
			Still	6.7
		Watching	Moving	1.3
			Still	11.8
	Peripheral	Not Watching	Moving	44.2
			Still	46.1
		Watching	Moving	36.6
			Still	23.2
10	Main	Not Watching	Moving	10.8
			Still	19.6
		Watching	Moving	9.2
			Still	15.9
	Peripheral	Not Watching	Moving	29.4
			Still	36.3
		Watching	Moving	35.9
			Still	50.4

Table of Means, Proportion of Full References used as Further References Without an Intervening Reference by Typically Developing Children.

Character	Listener	Video Type	Mean
Main	Not Watching	Moving	13
		Still	10.8
	Watching	Moving	12.7
		Still	13.6
Peripheral	Not Watching	Moving	13.7
		Still	21.3
	Watching	Moving	14
		Still	23

Table of Means, Proportion of Full References used as Further References Without an Intervening Reference by Children with Down's syndrome.

Effect	df Effect	MS Effect	df Error	MS Error	F	p-level
1. Subject Group	3	4852	81	995	4.9	0.003
2. Character Type	1	48430	81	681	71	0.000001
3. Listener Position	1	691	81	574	1.2	0.3
4. Video Type	1	2929	81	678	2.3	0.08
1*2	3	5504	81	681	8.1	0.0001
1*3	3	1095	81	574	1.9	0.1
2*3	1	0.07	81	655	0.0001	0.9
1*4	3	574	81	678	0.8	0.5
2*4	1	110	81	698	0.2	0.7
3*4	1	306	81	541	0.6	0.5
1*2*3	3	867	81	655	1.3	0.3
1*2*4	3	617	81	698	0.8	0.5
1*3*4	3	88	81	541	0.2	0.9
2*3*4	1	6	81	642	0.009	0.9
1*2*3*4	3	789	81	642	1.2	0.3

Analysis of Variance Table of Results, Proportion of Full References used as Further References Without an Intervening Reference by Typically Developing Children and Children with Down's syndrome.

I.3 Further References After Intervening References

Age	Character	Listener	Video Type	Mean
5	Main	Not Watching	Moving	14.6
			Still	29.9
		Watching	Moving	7.7
			Still	31.4
	Peripheral	Not Watching	Moving	30.6
			Still	44
		Watching	Moving	16.2
			Still	55.2
7	Main	Not Watching	Moving	23.4
			Still	39
		Watching	Moving	18.4
			Still	36.3
	Peripheral	Not Watching	Moving	53
			Still	59
		Watching	Moving	51.6
			Still	49
10	Main	Not Watching	Moving	29.4
			Still	51.7
		Watching	Moving	23.9
			Still	44.9
	Peripheral	Not Watching	Moving	54.6
			Still	65.8
		Watching	Moving	46.3
			Still	58

Table of Means, Proportion of Full References used as Further References After an Intervening Reference by Typically Developing Children.

Character	Listener	Video Type	Mean
Main	Not Watching	Moving	26.5
		Still	49.9
	Watching	Moving	20.8
		Still	32.6
Peripheral	Not Watching	Moving	31.7
		Still	33.1
	Watching	Moving	29.6
		Still	36.9

Table of Means, Proportion of Full References used as Further References after an Intervening Reference by Children with Down's syndrome.

Effect	df Effect	MS Effect	df Error	MS Error	F	p-level
1. Subject Group	3	9109	81	2544	3.6	0.02
2. Character Type	1	30497	81	958	31.8	0.000001
3. Listener Position	1	3342	81	759	4.4	0.04
4. Video Type	1	31684	81	817	38.7	0.000001
1*2	3	5454	81	958	5.7	0.001
1*3	3	127	81	759	0.2	0.9
2*3	1	202	81	613	0.3	0.6
1*4	3	1309	81	817	1.6	0.2
2*4	1	2258	81	747	3.02	0.09
3*4	1	240	81	744	0.3	0.6
1*2*3	3	644	81	613	1.05	0.4
1*2*4	3	826	81	747	1.1	0.4
1*3*4	3	795	81	744	1.07	0.4
2*3*4	1	367	81	565	0.6	0.4
1*2*3*4	3	441	81	565	0.8	0.5

Analysis of Variance Table of Results, Proportion of Full References used as Further References After an Intervening Reference by Typically Developing Children and Children with Down's syndrome.

Appendix J

Experiment 3: Photograph Prompts for Video Questions

The photographs which were used to prompt children when answering questions about each video seen in experiment 3 are shown below. They are divided into four categories:

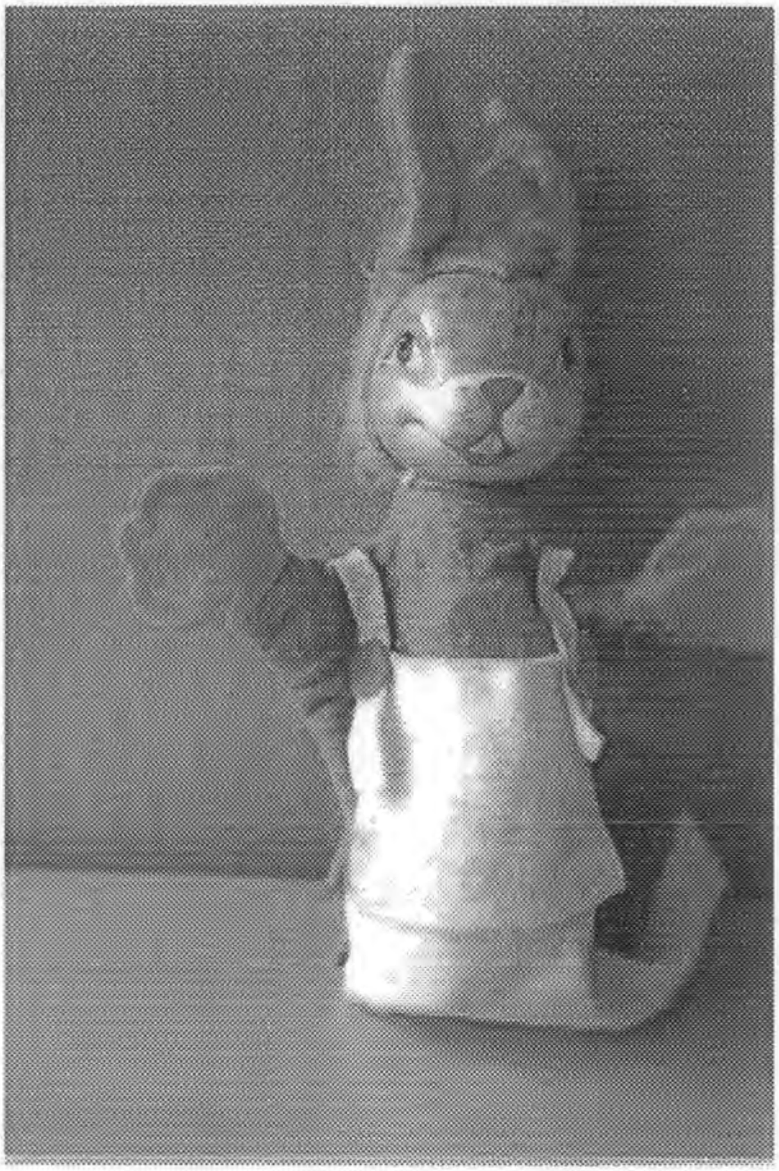
1. Main characters who appear in the videos.

2. "Dummy" main characters who do not appear in any video.

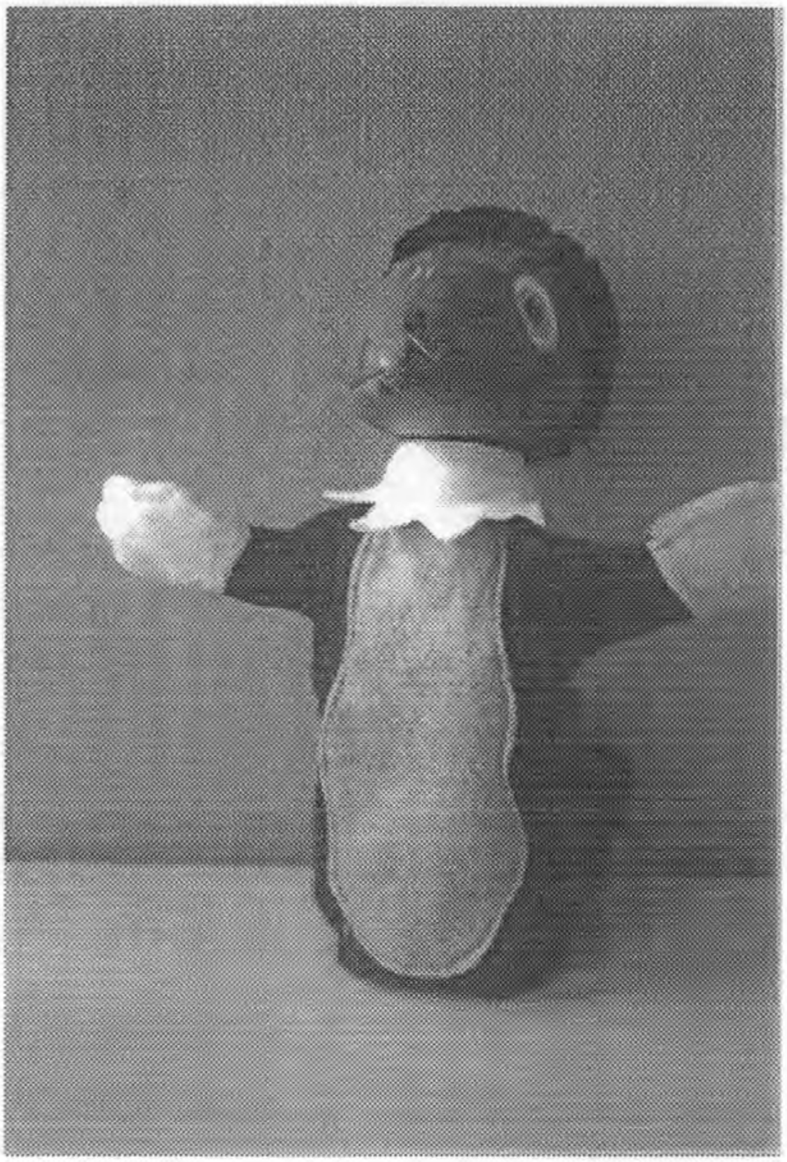
3. Peripheral characters who appear in the videos.

4. "Dummy" peripheral characters who do not appear in any video.

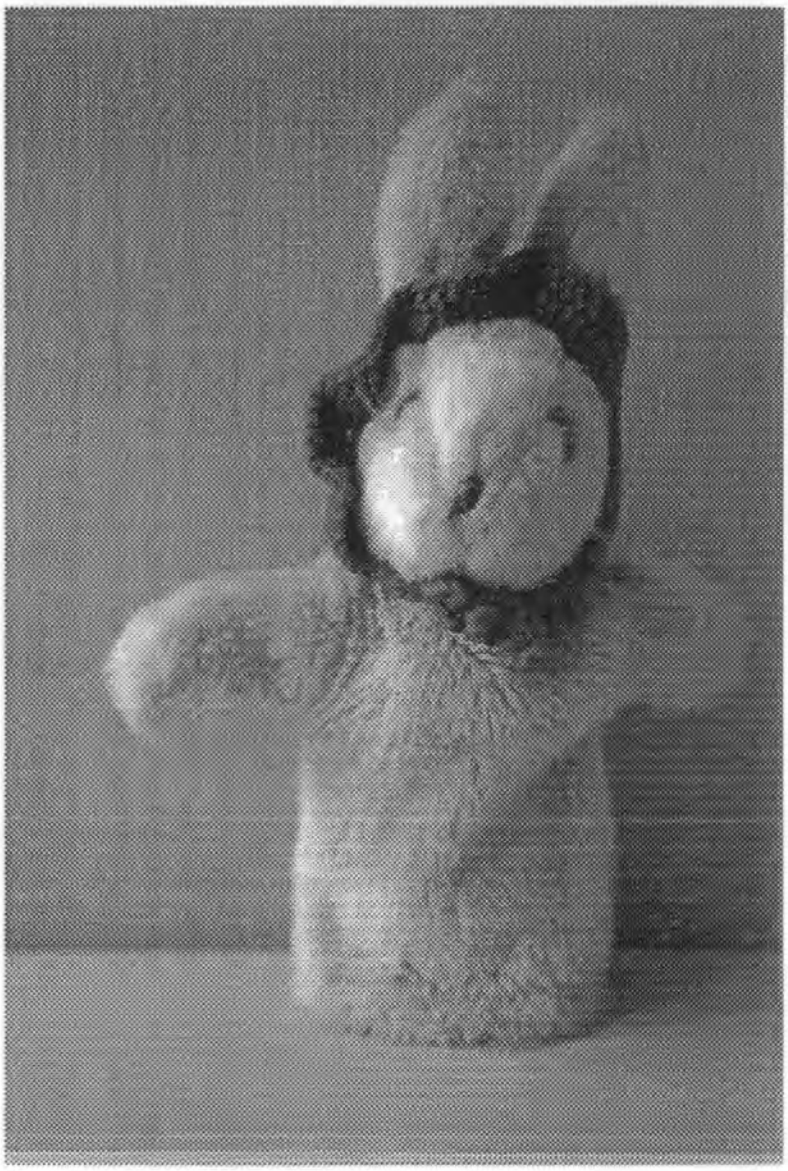
J.1 Genuine Main Characters

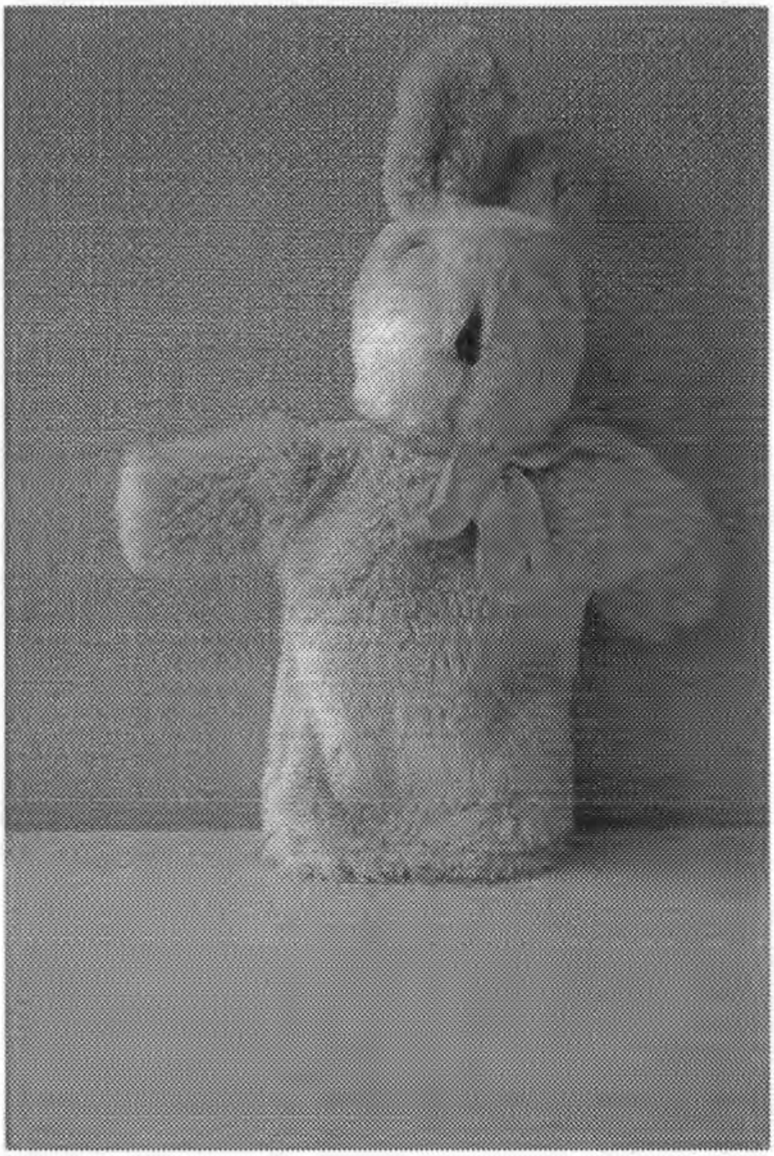


J.2 Dummy Main Characters

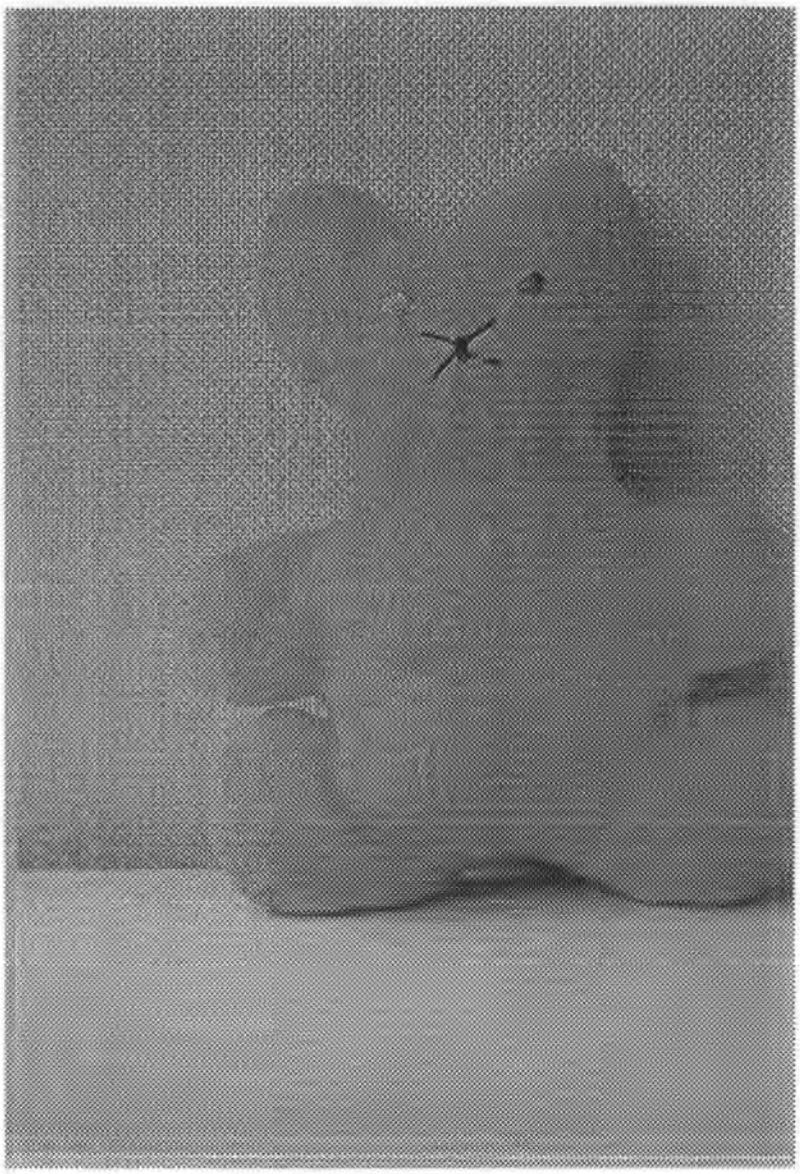


J.3 Genuine Peripheral Characters





J.4 Dummy Peripheral Characters




Captain

Appendix K

Experiment 3: Transcripts of Narratives

A sample of transcripts of narratives produced by subjects in experiment 3. Each subject narrates four videos. Each sample indicates which video is being narrated, including the video type and the characters included. The subject is identified only by gender and age.

Any unintelligible speech and annotations—used to place narration in context—are indicated in square brackets. Prompts by the experimenter are shown in italics.

There are four samples from children with Down's syndrome, and two from each age group of typically developing children.

K.1 Experiment 3: 5 Year Olds

K.1.1 Subject: D, Sex: M, Age: 5

Video 1 (Rabbit)
1 Peripheral Character
Listener: Not Watching

D: puppet—rabbit, he's cleaning—cleaning the shelf, wiping the counter, wiping the buttons, wiping the table,
what's happening now
D: picking it up and putting it on the shelf
what's happening now
D: putting it on the shelf
what's happening now
D: can't reach it
what's happening now
D: a man came, a snowman came
what's happening now
D: he's putting it down, he's going to get them, he's going to get them, he's got another one, he's taking it, he's giving him some money, shutting the till, and off he went, he's getting a chair for him to sit on, he's putting the chair up by the shelf, putting the cakes —he can't reach, yes—he done it—he just stand up on the chair
now what's happening
D: he's putting the chair back, oh where's he putting the chair—oh on there. He's laying back.

Video 2 (Chicken)
2 Peripheral Characters
Listener: Watching

what's happening here
D: he's walking and he's waving—saying hello. He's trying to think of something he's got to get, he's got to walk—sweeping it up
what's happening now
D: picking it up, put it back, why's he nodding his head, what's he doing, why's he going out?
what's happening now
D: rabbit—he wants a sweet. He's giving a sweet to him, and he's giving him some money. He's putting it in his till and the light's on. Oh two rabbits
what's happening now
D: he wants a sweet. he's saying no, he said he wants that one. he 's giving him some money. he's waving goodbye, what's he going to do now? he's taking too long, there's some money—he forgot it, he didn't
what's happening now
D: he put some money on the counter, and he's put some more money on the counter, he's saying yes.

Video 3 (Frog)
1 Peripheral Character
Listener: Watching

D: shop keeper and it's a frog, and that says "cheap"—everything's all cheap
what's happening now

D: he's getting some more wine, where's he going now, he's getting some more tins, he's got two tins, he's come back again, he got a piece of paper, what's he doing now, he's getting a pen to write, what's he writing —he might turn it around. mind he doesn't draw on the till. he is going to turn it around—what does it say

it says bargains

D: what's "bargains"?

bargains means cheap as well

D: look there's a bear—he wants one, he wants the top one. He's putting it down and he's saying yes and he's giving him some money, putting it in the till, and he's saying goodbye

what's happening now

D: another tin—the same tin, oh it all fell down, he'll come and pick it up

Video 4 (Owl)
2 Peripheral Characters
Listener: Not Watching

D: it's a owl

what's happening now

D: he's going to get something, he's sweeping the jam jar, holding it, he's picking it up, he's going to put it on the shelf, he's got two, he's got three,

now what's happening

D: he's putting the jam there and he's put it with the others. rabbit, he's going to snatch it and not pay, no it isn't—he wants one, he's gone off, and he's gone off, he did pay, he's going to put it in the till and here the rabbit comes again, it's funny, he's getting—he wants that jar, he got it and he's got the money, he's going to put it in the till, and they said goodbye, what is he going to do now? he's getting another jar —oh it falled over

K.1.2 Subject: E, Sex: F, Age: 5

Video 1 (Rabbit)
1 Peripheral Character
Listener: Watching

what's happening
E: a bird
what's happening
E: brought a letter in, he's putting it up
what's happening now
E: he's picking up the sweets, he moved them out—he falled them out
what's happening now
E: putting them on the floor
what's happening now
E: he's putting it away, a rabbit comed in,
what's happening now
E: he's ... the rabbits nodding his head, he wants some sweets, he's got some sweets again, he's got some money, he's putting it on the table, he's put some more money on the table, more money, getting more money and putting it on the table, and more and more, he's counting the money

Video 2 (Owl)
2 Peripheral Characters
Listener: Watching

what's happening
E: a owl, he's walking away, he's come back again with a flannel, he's wiping, shaking his head, gone away, oh he's coming back, now he's putting the jam jar there, oh I bet he wont be able to carry that one, he can't, a little bit heavy—he did it—he must be strong, a rabbit comed in, he wants the jam, he's giving him the jam, poor owl's got to lift it all up, he's walking away,
what's happening now
E: a rabbit comed in, wants some jam,
what's happening now
E: he's getting jam for the rabbit, he's picking up, now the other rabbit's come back in he wants some jam
what's happening now
E: now he's flapping his wings

Video 3 (Frog)
1 Peripheral Character
Listener: Not Watching

what's happening
E: a frog waved, he's got a jar, lots of jars, he's making something, he's putting even more on the top, and more, he put a piece of paper in it, he got a pen, he's put something on the box, he went away with the pen, he put it over there,
what's happening now
E: a teddy comed in, he wants a tin, he's having that off the top, he's giving it to him, he hasn't bought the tin yet, he's got the tin and going away with it, getting more tins, he wants to put it on the top, he broke them

Video 4 (Rabbit)
2 Peripheral Characters
Listener: Not Watching

E: its a wolf, and he waved to me, he put a ....
what's happening
E: he's put them in a line and then taking them, he's putting them all on there, a teddy bear, he wants a cake and he took a cake, he's so hungry for cake and he's not going to pay for it and he's going to eat it when he's not watching, he's eating something,
what's happening now
E: he got a cake, now he paid for it, now he picked it up and gone away with it, and now a teddy bear comed in and he wants a cake, and the wolf is getting a cake, and he's ..., and he's ...., and he's got the cake
now what's happening
E: that teddy bear comed back and they've gone away, I think it is the end, putting the cake there and now gone away

K.2 Experiment 3: 7 Year Olds

K.2.1 Subject: A, Sex: F, Age: 7

Video 1 (Rabbit)
2 Peripheral Characters
Listener: Not Watching

what's happening
A: there's this like puppet and he's walking up and down, it's like a rabbit, it's in a cake shop, he's cleaning the walls,
what's happening now
A: he's moving the cakes onto the shelf, there's a customer's came to buy something and he's telling him what he wants, and then the customer's paying and he's buying another cake, paying for that one, then he's getting his change, and the customer is gone now, and then he's come back and he's buying some more cake, and then he's getting his change and then he's going, and then another customer's come in and they're talking to each other, and then they're going back again, and then the rabbit is putting some more cakes on the shelf

Video 2 (Owl)
1 Peripheral Character
Listener: Not Watching

A: there's an owl and he sells loads of jams and he's cleaning everything, the tins and the jams, and he's still cleaning everything, he's cleaning the table at the moment, then he's gone away and then he's coming back again, he's moving the jams to the other side, he's having trouble moving one of them so he's pushing it instead, now he's drinking something, and then a customer come in and buys something, buying some jam, then owl is having trouble moving the jam again, and then the rabbit is paying, and then he's getting his change and then he's going off again, and he's coming back with some more jam from behind the cupboard, he's had a struggle carrying that one

Video 3 (Chicken)
2 Peripheral Characters
Listener: Watching

A: there's a duck and he's in a sweet shop, he's dropped the chocolate
what's happening
A: he's sweeping off the table, and he's gone behind the shelf, he's coming back again with the chocolate, then if he eats quite a bit of it he will be quite greedy, he's saying yes, then he's coming back again, there's a customer come in, it's a rabbit, then he's saying what do you want and then he says what he wants and then he's giving it to him, and then he's paying, he's getting his change, well the duck's getting his change out of the till I should say, then he's getting his change and then he's going away, and then there's another rabbit come in and he wants something and then he got it and then he's paying, and the duck's getting the change for the second rabbit, and then the rabbit's getting his change, and then they go away, and then the duck's cleaning the table again, he's counting the money

Video 4 (Frog)
1 Peripheral Character
Listener: Watching

what's happening

A: it's a frog, and he sells tins, and it's a very clean shop, then he's going behind the counter and he's coming back again with his two tins—no one, and now he's got four tins, and then there's five, and he goes behind the thing again and he comes out with a different colour tin, then he comes out with card—triangle card, and then he's coming out with a purple pen and he's writing something on it, I don't know what he's writing, then he's going away with the purple pen, and it said—bargains, and a customer's come in—it looks like a teddy bear, and he wants the brown tin, then he's paying for it—this little cute teddy bear, he's getting the tin and the frog's waving to him and then he's going away, then he's going away, and then he's getting another tin, and all the tins come crashing down

K.2.2 Subject: S, Sex: M, Age: 7

Video 1 (Owl)
2 Peripheral Characters
Listener: Not Watching

what's happening
S: it's an owl and he's at the shop, he's gone he's come in again, now he's cleaning up, cleaning up the cans and jars,
what's happening now
S: he's taking—picking up the jars and putting them down beside the till, he puts the second jar down, goes to get another one, picks up the other one, and takes it to the till and puts it in order in a straight line, then he takes another one, puts it down, then four, then he goes to get the big jar and it's too heavy for him, he keeps wobbling about, there we are he's done it, now a rabbit comes along, then the owl comes along, then they talk to each other, then he buys the jar, then he takes up the money, and puts it in the till, then the owl goes away and the rabbit comes back, and he buys another jar, and there's two rabbits come and they walk off together, and owl drops a jar

Video 2 (Chicken)
1 Peripheral Character
Listener: Not Watching

what's happening
S: he's taking a sign and he's putting it —then he's sticking it on the wall, then he's nodding his head and walking back to his study, then he walks back again, and he drops a packet and all the counters—sweets come out, he puts them on the floor, then he takes the rubbish to the bin, then rabbit comes along and gives him a penny, then he shows what he can buy, then he says no, then he shows the smarties to him and he buys a packet of smarties, buys a packet of sweets and runs off, then he puts the money into the counter, and walks back to his study, then he brings back a packet of jaffa cakes and puts them on the pile, then he walks away and he comes back, opens the till, takes—puts a 50p on the table, he's counting the money—two pounds, three pounds, four pounds, he's counting the money, looking at them, nodding his head

Video 3 (Rabbit)
2 Peripheral Characters
Listener: Watching

what's happening
S: here comes little wolf and it's a bakery shop, goes behind the counter, comes back, brings back a dolly, he cleans up with the dolly, cleans up with a cloth, and walks off, comes back, and he takes the pies, puts them on the shelves, that's one, two, he takes the cake puts it on the shelf, then a teddy bear comes along, he buys—he buys the cake, says no, and brings back a pie, he says yes, then teddy bear comes along again, and buys another pie, picks up the money and puts it in the till, then two teddy bears come along, buy it and then run off, and then puts it back on the shelf—the cake,

Video 4 (Frog)
1 Peripheral Character
Listener: Watching

what's happening
S: it's a frog, brings some pots round, he's got coffee tins, he goes back and gets another pot of coffee, three coffees, five coffees six coffees, and brings back a green sign, now he's going to write on it, comes back, moves the sign round, it says bargains, then teddy bear comes along and buys the tin, he says bye and goes off, he goes off to his study, then he brings back another pot of tea, and the pile falls down

K.3 Experiment 3: 10 Year Olds

K.3.1 Subject: F, Sex: M, Age: 10

Video 1 (Chicken)
2 Peripheral Characters
Listener: Not Watching

what's happening
F: the chicken is near a till, there's a sign at the back saying special offers, he's got a sign at the front with like say jammy dodgers on it for about 50p, he's picking up the biscuits and he's—left them alone, he's shaking his head, he's picked up the packet of biscuits and one fell out, he's nodding his head, he looks like a rooster, he's sweeped all the mess onto the floor so that nobody can see it, now he's shaking his head saying yes—yes, he's gone behind the screen and he's stayed there for about 5 minutes and he's come out with another packet of biscuits, he's put them on the shelf, now he's gone behind the screen again, out he comes but this time he has got another packet of biscuits, so he's going to put them on the shelf again, he pushes them on, they nearly fell off, they've fallen off, and mr rabbit comes along, he's wearing a red tie and he's asking —this chicken with a great big massive smile on his face whether he can have a packet of biscuits, and the rabbit gives him a quid, and the chicken takes it and puts the till, now the rabbit is just standing there, and then he picks up the biscuits and the rabbit's still there talking, but another rabbit comes along and they're talking and its like they're man and wife, and she's asking for a packet of biscuits too—ginger bread ones this time though, they're having an argument over the price, and now she doesn't go for the ginger ones she goes for the chocolate ones instead, and now she gives him another quid again, so she's clapping his hands and for some reason the other rabbit has lost his biscuits, but now he's got them back again, he put them on the side, now they've both gone away, so the chicken goes and he's going diving behind the green sign, and he's found another 50p lying on the side, so he's opened the till to get some more out, he's thieving from his own shop, he's got 50p, one pound, and 55p, and another 50p which is 2 pound 5p, now he's laughing, and he was waving his wings to see whether he could fly

Video 2 (Owl)
1 Peripheral Character
Listener: Not Watching

what's happening
F: he's selling marmite this time and syrup and jam—the owl is, it's home made jam, not home made syrup or marmite though, he's clearing up the till with a towel—dusting it, he's dusting the tins of syrup, and the jam, now he's dusting the shelves, he's going over to the side and sweeping up the side, and he's just realised that he had another 5 jars of jam, so he's just gone behind the screen again, and he's come out with nothing, except his clothes, so he takes one of his pots of jam and puts it right next to the till just a little way away from the marmite, then he gets another one which looks like apricot jam and puts it next to the other jar—just in front in fact, then he gets another jar which is his third jar and puts it behind so it's going in a zigzag line, then he gets another jar, walks along and puts it in front, a little further away though this time so it's got a gap in a zigzag line, he can't lift the big jar, he's dropping it—it's too heavy for him, so he has to push it along, you can see the sweat coming out of his head, now he's come along with this orange thing, it's a cup of water because he's so thirsty, I think it's slimfast—well he needs it, he's stood still, now a rabbit comes along, he's

wearing a head warmer—what are they called balaclava, and she's asked for a jar of —he's gone behind the screen, and she's asked for the biggest jar of jam, he can't lift it, he dropping it, he's pecking it with his beak, now she's going yes yes yes, and he's saying that's it I'll push it from here, she gives him a pound that was stuck to her paw for a second, and now it's stuck to his paw with superglue on it, and she's walked off, she must be stronger than him because she can lift it easy peasy, it just goes to show some women are stronger than men, some men that is, and he comes out with another big jar of jam—it could be marmite—no it's jam, he's flying around going twit twoo

Video 3 (Frog)
2 Peripheral Characters
Listener: Watching

what's happening
F: he's come out with a yellow pair of mittens, he's got a jar—he's got a grey box, I reckon he's going to go behind the scene and get another grey box now, yep he does, and another one, he's nodding—very happy with himself, he's come out with another one, put it next to the other two—they are all in a straight line now, he comes out with another one and another one, and now he comes out with a brown one and puts it on top, and now the rabbit comes and buys the brown one, the teddy bear comes along buys a brown one, and another teddy bear comes along and buys one, but he runs off and while the frog's behind the scene the teddy bear that came in first buys a blue one, and just whilst the frog goes to get it—no he buys the brown one like I said, but then frog takes the money, pushes the teddy bear out the way from getting his jar, and then puts it in the till, now he goes behind the scene and gets another brown box, and then a teddy bear —the second teddy bear that came earlier on has come, but he forgot to get the brown box so he gives her the blue box instead, now she gives him the money, he picks up the money—headbuts her, and then puts the money in his till, she doesn't look very happy about that though, they're waving goodbye to each other, now he goes behind the scene, goes behind the scene again, gets another box, goes behind the scene and gets another brown box and knocks them all over

Video 4 (Rabbit)
1 Peripheral Character
Listener: Watching

what's happening
F: this rabbit has come along and dusting all her tea cakes, end of day sale she's got, and it's fresh baked cakes only for 50p a piece—it's a bargain I'd say, but then she knocks them—they all knock into each other now, now she picks one up to eat one, she goes over and puts it on the shelf—on the second shelf, where the tea cups should be, she gets another one and puts it there next to the other one, she goes and picks another one up and puts it on the bottom shelf, and gets another one and puts it on the bottom shelf again, then she walks back to get the big chocolate one, but she's put the cake upside down so nobody's going to want to buy that one, now she goes and gets the big one—she can't lift it—yes she can, and she puts it on the very top shelf—no she can't reach, she can't get up there, struggling, then mrs teddy bear comes along, now she picks up the biggest cake there was, and the teddy bear gives her a quid because the big ones cost a pound, which is a bargain I'd say, and she gets a little one, so that's one pound 50, struggling a bit but she managed, leaves the big one behind, and the rabbit doesn't realise, she's got a chair, I reckon she's going to eat the pie, she's putting the chair for sale, she's putting the chair there so she can get up to the top shelf with the big pie, she knocks the chair, tries to get the chair but she can't, she puts the chair in front of the till and she lies on it

K.3.2 Subject: M, Sex: F, Age: 10

Video 1 (Rabbit)
2 Peripheral Characters
Listener: Watching

what's happening
M: this is a rabbit and he's just looked at the bun and he's gone to the till, and he's waving, he's gone over to the shelf and he's gone off, he's come back on with a cloth and he's dusting the counter, and he's he's dusting the shelf, he's gone off again, and he's picked up the buns, and he's going to put them on the shelves, he's gone back to get the rest, he's putting them on the shelves as well, he's got a bigger cake and he's putting it on the shelf as well, he's getting the rest of them and put them on the shelf as well, he's nodding, he's gone back to get the last bun, he's carrying it over to the shelf, he's gone off, and a teddy bear comes on, and the rabbit's got one of the big cakes and he's giving it to the teddy bear, the teddy bear shakes his head, the rabbit goes back and gets a small one, the teddy bear gives him some money and they're nodding their heads, the rabbit's gone to put the money into the till, he's pressing the till numbers, he's waving and the teddy bear goes, the teddy bear comes back without his hat on, the rabbit goes over and gets a bun, gives the bun to the teddy bear, the teddy bear puts the money on the counter, the rabbit puts the money in the till, the teddy bear takes the bun, and there's another teddy bear there, and they're banging heads and nodding, the bears go off, and the rabbit puts the bigger bun on the shelf with the others, he goes off

Video 2 (Owl)
1 Peripheral Character
Listener: Watching

what's happening
M: here's an owl and he's got a cloth in his hand and he's dusting the till, he's nodding his head, he's gone over and he's dusting a tin of syrup, he's dusting the counter and he's gone over to these jars, there's a sign on the wall saying home made jam, he's got a jar and he's put it down beside the till, and he's pushed it over by this marmite jar, he's got another jar, picked it up and he's going to put it by the other jar, he's got another jar and put it there, and got all the other jars and put it there, now he's got a big jar, it's too heavy for him to lift up, he's got it a little way across, he thinks it's really heavy, in the end he gets it there, pushes it over with the others, he walks over to the shelf and goes off, comes back on with a cup of something, he's leaning against the till and drinking it, rabbit comes on and he nods to rabbit, he comes back and gives her a big jar of jam, the rabbit nods her head and the owl put it front of the rabbit, the rabbit helped the owl to move it across, the rabbit puts some money on the table, and the owl is going to put it in his till, the rabbit goes with the big jar of jam, the owl shuts the till and is nodding his head, he goes off, he's comes back on with another big jar of jam, he wipes his head because he was tired from the jam, he goes off

Video 3 (Frog)
2 Peripheral Characters
Listener: Not Watching

what's happening
M: this is a frog with yellow gloves on, and he's waving, and he's gone off, he's come back with a tin of something or a box, and he's nodding his head, and he's going off, he's got another tin exactly the same, puts it beside the other one, he's put lots more

beside them and piling them up, there's three at the bottom, two at the top and one orange one at the very top, two teddy bears come along and they're dancing, they're waving and talking to each other, one of them goes off, the teddy bear looks at the pile of them, and then the frog comes on, and he says hello and waves, the teddy bear gives the frog some money and the frog gets one of the boxes from the pile, and it's the orange one, he takes the money and he puts it in the till, and the teddy bear goes, and frog waves goodbye, the other teddy bear comes back on and he says he wants one of the blue tins, the frog takes one of the tins and gives it to the bear, the bear gives him some money and the frog goes and puts it in the till, the teddy bear goes, and the frog goes and comes back with another tin to take the place of the of the blue tin that he just took, the frog goes back off, he comes back with another orange tin to go on the top, and he knocks them all down, he's angry with himself, he goes back

Video 4 (Chicken)
1 Peripheral Character
Listener: Not Watching

what's happening
M: this is about a chicken, he';s got a sign and he's going to put it on the wall, and it says smarties and the price next to it, and caramel and the price next to it, the chicken comes and picks up a pack of biscuits and he's spilt it on the table, he sweeps it all off the counter, he's sweeping it onto the floor, he looks around and pushes the box and picks it up, and he goes off and puts it away, the rabbit comes on and the chicken comes back and waves to him, the rabbit gave him some money, and he shows the chicken that he wants this pack of things which is 50p, the rabbit's shaking his head as if he's forgotten how much they were and he didn't have enough money, the chicken shows him something that's 20p and the rabbit nods his head because he's got enough money for them, the chicken gives one of the packs of biscuits to the rabbit, rabbit takes it, nods his head and goes, the chicken waves goodbye, he picks up the money and puts it in the till, the chicken goes off, he comes back with this other pack—it looks like a chocolate bar, he puts it on the bottom shelf, he goes off again, he comes back and opens up the till and gets some of the money, puts it on the counter, he gets some more money, he looks as if he's counting it, he's got all the money and put it on the counter, he's counting it, he nods his head and rubs his hands together as if his rich

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K.4 Experiment 3: Children with Down's Syndrome

K.4.1 Subject: R, Sex: F, Age: 12

Video 1 (Chicken)
1 Peripheral Character
Listener: Watching

what's happening
R: the chicken,
what's happening
R: he's sticking a sign on the wall, he's coming back, smarties, ooh, clearing it all off, naughty chick, a rabbit came by,
what's happening now
R: and the chicken said that's 20p, 50p, 20p, then he hurried back to his smarties, then the rabbit buy it, and off he goes again, and the he puts the money in the till, close it all up, then he came back, put it on the shelf, then he came back, pick up the money, put it there, counting up all the money, he is a big supermarket chicken, then he nod his head, then he went back behind his shelf

Video 2 (Rabbit)
1 Peripheral Character
Listener: Not Watching

what's happening
R: a rabbit, he cleaning his shelf, and rubbing his till, and rubbing his counter, and he went back, pick up the cake and put it on the shelf, then he pick up another cake, he put it on the shelf next to the big one, and the last cake with the icing on and put it next to that thing, after that he went back to get another cake and put it up high, and he can't put it up high, here comes the bear, baking the big cake,. and then he went back to get a little cake and the bear is so greedy, he says thanks to him, then he went back again, then close up the till, and went back to the shelf, then he came back with a chair and put it in front of the shelf, on the counter really, picking the cake, and then he get up on the chair and put it next to the little one, then he went back down again, and pick up the chair, I think he's turning it round, up it goes, and put it on the counter in front of the till, and then he sits down to have a sleep

Video 3 (Owl)
2 Peripheral Characters
Listener: Watching

what's happening
R: the owl, the owl was in the counter, went over to his till, and then past the till and into that ...., and then he came back with a duster and scrub it, moved all the tins of jam away, that's a naughty one, and then picking that jar of jam and put it next to the till, and then pick up another jar of jam and put it next to that , and then he went off again, and picked a other jam of jar and then he went back to get a other little jam of jar, and after that, last of all it's the big jar of jam, careful not to drop it, it's soo heavy and he put it next to it, and count it up again, and he went into there, and here comes mrs bunny, he said hello to her, hand him money, and he went out, counter boy, and he come back again, and he pick up the money, and put it in the till, then he rub his hands together, and then mr bunny came, and the owl came out, and pick up the jar of jam, the bunny put the money down, then the owl put the jar down, he pick it up, then the owl picked up the money, and owl went to till, and put it in and close it,

mrs rabbit came back in, then they all left, then mr owl went back to his shelf, behind the shelf, and he come out with a other pot of jam and drop it,

Video 4 (Frog)
2 Peripheral Characters
Listener: Watching

what's happening
R: oh a frog this time, a frog picked up ... behind the counter, he came back to get some more pot of honey—put it there, and went back behind the shelf, and he came back to get some more, put it there, it's two eyes, and then he's getting more, but no eye, and then he get a other one, and this time it got a eye ball on it, then here comes another tin, and there's no eye—oh, then he pick up the wrong colour tin, and he went back behind the shelf again,
what's happening now
R: a bear, mr bear this time, and mrs bear came, and saw the orange tin, then the frog came out and he waved, he say hello, then he went back down slowly, then put it there—beside that money, took it over to the counter and put it in, and then he waved goodbye to him, and then other bear came walking out the shelf, and saw the jar as well with a eye ball on it,
what's happening now
R: then the frog put the money in the till, the bear went away to his home, and then the frog came out again behind that shelf, and he went back behind the shelf, and then he came out with another jar—no eyeball, then he got another wrong colour, whoops he dropped it on the two blue ones

K.4.2 Subject: L, Sex: F, Age: 11

Video 1 (Rabbit)
2 Peripheral Characters
Listener: Watching

what's happening
Li: there's a rabbit, and he get the tissue wipe,
what's happening now
Li: they got tissue, oh yeah pick up the jar, there's he's doing...., he get the thing with a hat on and cleaning, oh there's a bear walk in, say hello, he's talking, he's doing a ...., he get a cake, there's teddy, he give a cake for the teddy bear, he's walking away, he pick it up and put it on the side

Video 2 (Frog)
1 Peripheral Character
Listener: Watching

what's happening
Li: it's a frog, he doing a walk away, he's doing a box, he put it down, frog going and getting box again, another one, and another one, and another one, frog was walk away, he get a big—bit of paper, he gets the pencil and he's writing on the card, walk away, pick up card, put it in there, there's teddy said hello the frog, he's get the box to give to teddy bears, he give coin for money, he give teddy bears, he put it in, now he got them away, now he got another box, all falled down the box

Video 3 (Chicken)
1 Peripheral Character
Listener: Not Watching

what's happening
Li: a hen, he got, he's counting, he got a butchers, it's sweet, dropped, he's put it on the floor, and they all go away, there's rabbit, he wants some money, give 20p, he got—he can't reach, he got him the box he give the rabbit, he walked away, now he press buttons and put in there, shut the door, and walk away, he give him chocolate, she open drawer and get money, and money again, and another one, and another one, and another one, he say yes, walk away

Video 4 (Owl)
2 Peripheral Characters
Listener: Not Watching

what's happening
Li: that's a owl, he's doing walk away, he get tissue—clean, he doing ...., he's walk away, and he get tin, and put them by side, and another one, and again, and he's getting jam, it's heavy, he's saying yes, he saying yes, and he walk away, there's rabbit, get a tin, he say hello with the rabbit, it's heavy, he walk away, and money, he's put the pound—put it away, he walk away, here's rabbit, he want a tin, there's owl, says hello the rabbit, he's talking, and tin—give the rabbit, and give him money, he say thank—you, owl put away, there's two rabbits, they said goodbye, he walk away, he back again, he get a tin, and drop, walk away

K.4.3 Subject: A, Sex: M, Age: 9

Video 1 (Chicken)
2 Peripheral Characters
Listener: Not Watching

what's happening
A: duck got sweets, put it on the shelf,
what's happening
A: rabbit get the sweet, pat money, duck put it in till, rabbit comes for more sweets, duck talking, rabbits go home to eat the sweets, duck brings more sweets, puts the money on the table

Video 2 (Frog)
1 Peripheral Character
Listener: Watching

what's happening
A: frog, he's got a block, he put it on the table, got another block, and another, got lots, making a tower, got a piece of paper, drawing on it, put it there, teddy comes, gets a block, gives the money, says bye, frog gets another block they knock over

Video 3 (Owl)
2 Peripheral Characters
Listener: Watching

what's happening
A: a owl do the cleaning, moving the jam, moving more jam, big jam too heavy, did it now, rabbit came, wants the big jam, owl give the big jam, get the money, other rabbit came, have a small jam, give the money, rabbit comes back, they talking, gone now, owl's got another jam, dropped it

Video 4 (Rabbit)
1 Peripheral Character
Listener: Not Watching

what's happening
A: rabbit, sweeping up, he got the cakes, he put the little one on the shelf, can't reach the shelf, oh teddy comes, rabbit gives the big cake, teddy wants more cakes, rabbit takes the money, teddy forgot the cake, rabbit got a chair put it next to shelf, put the cake on shelf, move the chair, sit on it

K.4.4 Subject: A, Sex: M, Age: 9

Video 1 (Owl)
2 Peripheral Characters
Listener: Not Watching

what's happening
A: a little boy, dancing around,
what's happening
A: little boy jumping,
what's happening
A: a little boy dancing around, boy hiding away, he's gone away, he's come back, the boy come back,
what's happening now
A: he's gone away,
what's happening now
A: it's girl
what's happening now
A: they got tin, he's gone away
what's happening now
A: he buy something else
what's happening now
A: girl come, boy clapping around

Video 2 (Owl)
2 Peripheral Characters
Listener: Watching

what's happening
A: this is a boy, got gloves on, an owl, a jug and a pan,
what's happening now
A: little boy moves it that way
what's happening now
A: walking around, now he put it over here, a rabbit try get up,
what's happening now
A: boy wack the teddy, they're going in the shop to buy one
what's happening now
A: the boy gave it to him, rabbit going up to him
what's happening now
A: a boy goed away

Video 3 (Frog)
1 Peripheral Character
Listener: Not Watching

what's happening
A: a frog, frog a go back, walking around, frog in the shop, he's walking away, he go get away, painting pots, frog put it over this way
what's happening now
A: a frog a blue tin, gone back, put it down,
what's happening now
A: he's walking around waving her hands, frog put it over there
what's happening
A: making a house

what's happening
A: frog put name on house
what's happening
A: frog give it to teddy bear, frog—that one asked for tin, and he went away, got another one, it fell down

Video 4 (Rabbit)
1 Peripheral Character
Listener: Not Watching

what's happening
A: a rabbit, bag shop, cake shop, a rabbit, goes round back,
what's happening
A: rabbit in teddy bear,
what's happening now
A: they're in a teddy bear, and a rabbit carrying the paper, and rabbit picked up the cake, rabbit got a chair in the shop, standing on it, put it away, rabbit put it away
what's happening now
A: rabbit sit down

Appendix L

Experiment 3: Total Number of References Used

The tables which follow indicate the total number of references which were used by each subject group in each condition for both the main character and the peripheral characters. From these figures differences in performance can be seen for each subject group. The following letters are used in the tables to identify the reference types:

A	Proper Name
B	Definite Noun Phrase
C	Indefinite Noun Phrase
D	No Determiner in Noun Phrase
E	Pronoun
F	Nominal Substitute
G	Zero Anaphora

Subject	Listener	Video	A	B	C	D	E	F	G
D	1	N	0	12	20	69	150	0	239
D	1	Y	0	18	18	49	135	0	251
D	2	N	2	22	20	74	142	0	191
D	2	Y	3	35	22	67	147	0	215
5	1	N	0	8	7	6	186	0	51
5	1	Y	0	4	11	3	164	0	41
5	2	N	0	10	11	9	136	0	37
5	2	Y	0	15	12	5	146	0	39
7	1	N	0	13	11	9	254	0	39
7	1	Y	0	19	14	2	246	0	38
7	2	N	6	27	15	2	207	0	37
7	2	Y	0	29	12	6	134	0	42
10	1	N	1	26	9	4	217	0	64
10	1	Y	1	27	13	0	279	0	95
10	2	N	1	60	11	6	191	0	54
10	2	Y	4	55	12	4	162	0	80

Total number of each reference type used for the main character across all conditions.

Subject	Listener	Video	A	B	C	D	E	F	G
D	1	N	0	13	12	41	27	2	42
D	1	Y	1	11	14	37	26	0	34
D	2	N	10	25	26	66	41	0	72
D	2	Y	16	24	28	65	42	0	80
5	1	N	0	9	13	1	28	0	1
5	1	Y	0	12	12	6	30	0	3
5	2	N	0	18	26	5	54	1	4
5	2	Y	0	19	22	5	51	1	6
7	1	N	0	18	14	2	37	1	6
7	1	Y	0	20	15	2	49	0	4
7	2	N	1	42	26	6	76	2	4
7	2	Y	0	28	20	11	62	1	7
10	1	N	2	23	10	6	35	0	9
10	1	Y	2	20	10	3	33	0	6
10	2	N	2	58	21	2	56	0	9
10	2	Y	2	58	20	1	54	3	12

Total number of each reference type used for the peripheral characters across all conditions.

Subject	Listener	Video	A	B	C	D	E	F	G
D	1	N	0	4	14	22	0	0	1
D	1	Y	0	3	12	22	1	0	1
D	2	N	0	3	10	25	1	0	1
D	2	Y	0	4	16	17	1	0	2
5	1	N	0	5	6	4	1	0	0
5	1	Y	0	1	9	3	1	0	0
5	2	N	0	0	10	4	0	0	0
5	2	Y	0	2	11	1	2	0	0
7	1	N	0	1	11	1	1	0	0
7	1	Y	0	1	14	1	0	0	0
7	2	N	2	1	13	0	1	0	0
7	2	Y	0	0	11	3	0	0	0
10	1	N	1	2	9	1	2	0	0
10	1	Y	1	1	12	0	1	0	0
10	2	N	1	1	10	1	2	0	0
10	2	Y	2	0	12	0	1	0	0

Total number of each reference type used for the main character as an initial reference.

Subject	Listener	Video	A	B	C	D	E	F	G
D	1	N	0	4	8	27	0	1	2
D	1	Y	1	4	9	22	2	0	0
D	2	N	6	2	21	41	0	0	0
D	2	Y	11	1	21	37	0	0	0
5	1	N	0	1	12	1	2	0	0
5	1	Y	0	1	10	3	0	0	0
5	2	N	0	1	21	4	0	0	0
5	2	Y	0	3	21	4	1	0	0
7	1	N	0	2	12	1	0	0	0
7	1	Y	0	2	13	1	0	0	0
7	2	N	1	4	22	0	1	0	0
7	2	Y	0	5	17	5	0	0	0
10	1	N	2	2	10	1	0	0	0
10	1	Y	2	0	10	1	2	0	0
10	2	N	2	5	21	1	0	0	0
10	2	Y	2	8	19	1	0	0	0

Total number of each reference type used for the peripheral characters as an initial reference.

Subject	Listener	Video	A	B	C	D	E	F	G
D	1	N	0	4	5	29	121	0	223
D	1	Y	0	9	5	17	110	0	232
D	2	N	0	6	9	18	119	0	170
D	2	Y	0	6	4	21	123	0	191
5	1	N	0	0	1	1	157	0	49
5	1	Y	0	1	2	0	137	0	38
5	2	N	0	3	1	1	107	0	30
5	2	Y	0	3	1	2	105	0	31
7	1	N	0	4	0	2	234	0	36
7	1	Y	0	4	0	1	226	0	35
7	2	N	1	6	1	0	170	0	36
7	2	Y	0	3	1	0	121	0	37
10	1	N	0	5	0	0	195	0	62
10	1	Y	0	9	1	0	252	0	94
10	2	N	0	14	1	1	169	0	54
10	2	Y	0	11	0	0	140	0	76

Total number of each reference type used for the main character as a further reference without an intervening reference to another character.

Subject	Listener	Video	A	B	C	D	E	F	G
D	1	N	0	1	3	7	17	0	36
D	1	Y	0	0	5	6	16	0	31
D	2	N	2	10	5	14	27	0	66
D	2	Y	2	7	5	15	23	0	74
5	1	N	0	1	1	0	13	0	1
5	1	Y	0	5	2	1	20	0	2
5	2	N	0	6	4	1	37	1	3
5	2	Y	0	2	1	1	24	0	6
7	1	N	0	6	2	0	28	1	6
7	1	Y	0	8	2	1	38	0	4
7	2	N	0	14	2	2	62	2	4
7	2	Y	0	10	2	5	47	1	6
10	1	N	0	9	0	3	21	0	9
10	1	Y	0	4	0	0	22	0	3
10	2	N	0	21	0	0	41	0	9
10	2	Y	0	22	0	0	30	3	12

Total number of each reference type used for the peripheral characters as a further reference without an intervening reference to another character.

Subject	Listener	Video	A	B	C	D	E	F	G
D	1	N	0	4	1	18	29	0	15
D	1	Y	0	6	1	10	24	0	18
D	2	N	2	13	1	31	22	0	20
D	2	Y	3	25	2	29	23	0	22
5	1	N	0	3	0	1	28	0	2
5	1	Y	0	2	0	0	26	0	3
5	2	N	0	7	0	4	29	0	7
5	2	Y	0	10	0	2	39	0	8
7	1	N	0	8	0	6	19	0	3
7	1	Y	0	14	0	0	20	0	3
7	2	N	3	20	1	2	36	0	1
7	2	Y	0	26	0	3	13	0	5
10	1	N	0	19	0	3	20	0	2
10	1	Y	0	17	0	0	26	0	1
10	2	N	0	45	0	4	20	0	0
10	2	Y	2	44	0	4	21	0	4

Total number of each reference type used for the main character as a further reference after an intervening reference to another character.

Subject	Listener	Video	A	B	C	D	E	F	G
D	1	N	0	8	1	7	10	1	4
D	1	Y	0	7	0	9	8	0	3
D	2	N	2	13	0	11	14	0	6
D	2	Y	3	16	2	13	19	0	6
5	1	N	0	7	0	0	13	0	0
5	1	Y	0	6	0	2	10	0	1
5	2	N	0	11	1	0	17	0	1
5	2	Y	0	14	0	0	26	1	0
7	1	N	0	10	0	1	9	0	0
7	1	Y	0	10	0	0	11	0	0
7	2	N	0	24	2	4	13	0	0
7	2	Y	0	13	1	1	15	0	1
10	1	N	0	12	0	2	14	0	0
10	1	Y	0	16	0	2	9	0	3
10	2	N	0	32	0	1	15	0	0
10	2	Y	0	28	1	0	24	0	0

Total number of each reference type used for the main character as a further reference after an intervening reference to another character.

Appendix M

Experiment 3: Details of Analysis for References to Characters

Tables providing full details of the Analysis of Variance performed on the data obtained in experiment 3 are provided. Each analysis assesses the proportion of full references used by each subject group for each of the referential contexts. Tables of Means are also included for each analysis and each subject group.

M.1 Initial References

Age	Character	No. of PCs	Listener	Mean
5	Main	1	Not Watching	93
			Watching	93
		2	Not Watching	100
			Watching	87
	Peripheral	1	Not Watching	93
			Watching	93
		2	Not Watching	100
			Watching	97
7	Main	1	Not Watching	87
			Watching	100
		2	Not Watching	93
			Watching	100
	Peripheral	1	Not Watching	100
			Watching	93
		2	Not Watching	97
			Watching	100
10	Main	1	Not Watching	87
			Watching	93
		2	Not Watching	87
			Watching	93
	Peripheral	1	Not Watching	100
			Watching	87
		2	Not Watching	100
			Watching	100

Table of Means, Proportion of Full References used as Initial References by Typically Developing Children.

Character	No. of PCs	Listener	Mean
Main	1	Not Watching	98
		Watching	95
	2	Not Watching	95
		Watching	93
Peripheral	1	Not Watching	93
		Watching	93
	2	Not Watching	100
		Watching	98

Table of Means, Proportion of Full References used as Initial References by Children with Down's syndrome.

Effect	df Effect	MS Effect	df Error	MS Error	F	p-level
1. Subject Group	3	190	81	686	0.3	0.8
2. Character Type	1	1342	81	603	2.2	0.1
3. No. of PCs	1	926	81	458	202	0.2
4. Listener Position	1	31	81	331	0.09	0.8
1*2	3	266	81	604	0.4	0.7
1*3	3	16	81	458	0.03	0.9
2*3	1	781	81	291	2.7	0.1
1*4	3	396	81	331	1.2	0.3
2*4	1	781	81	408	1.9	0.2
3*4	1	3	81	521	0.006	0.9
1*2*3	3	200	81	291	0.7	0.6
1*2*4	3	735	81	408	1.8	0.2
1*3*4	3	297	81	521	0.6	0.6
2*3*4	1	781	81	488	1.6	0.2
1*2*3*4	3	235	81	488	0.5	0.7

Analysis of Variance Table of Results, Proportion of Full References used as Initial References by Typically Developing Children and Children with Down's syndrome

M.2 Further References Without Intervening References

Age	Character	No. of PCs	Listener	Mean
5	Main	1	Not Watching	1
			Watching	3
		2	Not Watching	4
			Watching	3
	Peripheral	1	Not Watching	10
			Watching	16
		2	Not Watching	22
			Watching	14
7	Main	1	Not Watching	2
			Watching	1
		2	Not Watching	4
			Watching	2
	Peripheral	1	Not Watching	19
			Watching	24
		2	Not Watching	23
			Watching	27
10	Main	1	Not Watching	1
			Watching	2
		2	Not Watching	6
			Watching	5
	Peripheral	1	Not Watching	24
			Watching	9
		2	Not Watching	32
			Watching	34

Table of Means, Proportion of Full References used as Further References Without Intervening References by Typically Developing Children.

Character	No. of PCs	Listener	Mean
Main	1	Not Watching	9
		Watching	9
	2	Not Watching	12
		Watching	11
Peripheral	1	Not Watching	17
		Watching	11
	2	Not Watching	22
		Watching	23

Table of Means, Proportion of Full References used as Further References Without Intervening References by Children with Down's syndrome.

Effect	df Effect	MS Effect	df Error	MS Error	F	p-level
1. Subject Group	3	808	81	1181	0.7	0.6
2. Character Type	1	35533	81	474	74.9	0.000001
3. No. of PCs	1	4122	81	487	8.4	0.005
4. Listener Position	1	99	81	419	0.2	0.6
1*2	3	1864	81	474	3.9	0.01
1*3	3	282	81	487	0.6	0.6
2*3	1	1404	81	385	3.6	0.059
1*4	3	129	81	419	0.3	0.8
2*4	1	30	81	436	0.06	0.8
3*4	1	0.5	81	489	0.001	0.9
1*2*3	3	169	81	385	0.4	0.7
1*2*4	3	200	81	436	0.4	0.7
1*3*4	3	354	81	489	0.7	0.5
2*3*4	1	128	81	438	0.3	0.6
1*2*3*4	3	306	81	438	0.7	0.6

Analysis of Variance Table of Results, Proportion of Full References used as Further References Without Intervening References by Typically Developing Children and Children with Down's syndrome.

M.3 Further References After Intervening References

Age	Character	No. of PCs	Listener	Mean
5	Main	1	Not Watching	10
			Watching	10
		2	Not Watching	31
			Watching	18
	Peripheral	1	Not Watching	27
			Watching	39
		2	Not Watching	41
			Watching	31
7	Main	1	Not Watching	33
			Watching	34
		2	Not Watching	36
			Watching	53
	Peripheral	1	Not Watching	40
			Watching	27
		2	Not Watching	61
			Watching	36
10	Main	1	Not Watching	47
			Watching	36
		2	Not Watching	64
			Watching	63
	Peripheral	1	Not Watching	48
			Watching	54
		2	Not Watching	56
			Watching	48

Table of Means, Proportion of Full References used as Further References After Intervening References by Typically Developing Children.

Character	No. of PCs	Listener	Mean
Main	1	Not Watching	45
		Watching	39
	2	Not Watching	39
		Watching	45
Peripheral	1	Not Watching	27
		Watching	30
	2	Not Watching	28
		Watching	42

Table of Means, Proportion of Full References used as Further References After Intervening References by Children with Down's syndrome.

Effect	df Effect	MS Effect	df Error	MS Error	F	p-level
1. Subject Group	3	14184	81	3500	4	0.009
2. Character Type	1	600	81	1526	0.4	0.5
3. No. of PCs	1	11701	81	1721	6.8	0.01
4. Listener Position	1	400	81	1177	0.3	0.6
1*2	3	5571	81	1526	3.6	0.2
1*3	3	994	81	1721	0.6	0.6
2*3	1	1106	81	1433	0.7	0.4
1*4	3	870	81	1177	0.7	0.5
2*4	1	44	81	856	0.05	0.8
3*4	1	96	81	950	0.1	0.7
1*2*3	3	1665	81	1433	1.2	0.3
1*2*4	3	2600	81	856	3	0.03
1*3*4	3	1513	81	960	1.6	0.2
2*3*4	1	2173	81	1003	2.2	0.1
1*2*3*4	3	436	81	1003	0.4	0.7

Analysis of Variance Table of Results, Proportion of Full References used as Further References After an Intervening Reference by Typically Developing Children and Children with Down's syndrome.

Appendix N

Experiments 2 and 3: Details of Analysis for References to Objects

Tables providing full details of the Analysis of Variance performed on the data obtained for references to objects in experiments 2 and 3 are provided. Each analysis assesses the proportion of full references used by each subject group for each of the referential contexts. Tables of Means are also included for each analysis and each subject group.

N.1 Experiment 2

N.1.1 Initial and Continuing References

Age	Ref. Type	Video Type	Listener	Mean
5	Initial	Moving	NotWatching	80
			Watching	86.6
		Still	NotWatching	93.3
			Watching	86.6
	Continuing	Moving	NotWatching	16.6
			Watching	8.8
		Still	NotWatching	0
			Watching	3.3
7	Initial	Moving	NotWatching	100
			Watching	100
		Still	NotWatching	100
			Watching	100
	Continuing	Moving	NotWatching	6.6
			Watching	10.5
		Still	NotWatching	1.6
			Watching	0
10	Initial	Moving	NotWatching	100
			Watching	100
		Still	NotWatching	100
			Watching	100
	Continuing	Moving	NotWatching	11.9
			Watching	2.9
		Still	NotWatching	13.1
			Watching	0

Table of Means, Proportion of Full References used as Initial and Continuing References to Objects by Typically Developing Children.

Ref. Type	Video Type	Listener	Mean
Initial	Moving	NotWatching	77.5
		Watching	77.5
	Still	NotWatching	77.5
		Watching	80
Continuing	Moving	NotWatching	12.5
		Watching	18.3
	Still	NotWatching	15
		Watching	3.8

Table of Means, Proportion of Full References used as Initial and Continuing References to Objects by Typically Developing Children.

Effect	df Effect	MS Effect	df Error	MS Error	F	p-level
1. Subject Group	3	2796	81	1531	1.8	0.1
2. Ref. Type	1	988531	81	1583	624.4	0.000001
3. Listener Position	1	705	81	962	0.7	0.4
4. Video Type	1	412	81	632	0.6	0.4
1*2	3	9275	81	1583	5.8	0.001
1*3	3	61	81	962	0.06	0.9
2*3	1	2516	81	834	3.02	0.09
1*4	3	220	81	632	0.3	0.8
2*4	1	578	81	598	0.9	0.3
3*4	1	390	81	467	0.8	0.4
1*2*3	3	370	81	834	0.4	0.7
1*2*4	3	197	81	598	0.3	0.8
1*3*4	3	103	81	467	0.2	0.9
2*3*4	1	13	81	535	0.02	0.9
1*2*3*4	3	888	81	535	1.6	0.2

Analysis of Variance Table of Results, Proportion of Full References used as Initial and Continuing References to Objects by Typically Developing Children and Children with Down's syndrome.

N.1.2 Initial and Re-establishing References

Age	Ref. Type	Video Type	Listener	Mean
5	Initial	Moving	NotWatching	80
			Watching	86.6
		Still	NotWatching	93.3
			Watching	86.6
	Re-establishing	Moving	NotWatching	47.8
			Watching	58.7
		Still	NotWatching	58.3
			Watching	53.3
7	Initial	Moving	NotWatching	100
			Watching	100
		Still	NotWatching	100
			Watching	100
	Re-establishing	Moving	NotWatching	76.6
			Watching	61.4
		Still	NotWatching	83
			Watching	72.8
10	Initial	Moving	NotWatching	100
			Watching	100
		Still	NotWatching	100
			Watching	100
	Re-establishing	Moving	NotWatching	71.8
			Watching	83.2
		Still	NotWatching	81.5
			Watching	84.9

Table of Means, Proportion of Full References used as Initial and Re-establishing References to Objects by Typically Developing Children.

Ref. Type	Video Type	Listener	Mean
Initial	Moving	NotWatching	77.5
		Watching	77.5
	Still	NotWatching	77.5
		Watching	80
Re-establishing	Moving	NotWatching	55.3
		Watching	51.9
	Still	NotWatching	53.1
		Watching	53.9

Table of Means, Proportion of Full References used as Initial and Re-establishing References to Objects by Children with Down's syndrome.

Effect	df Effect	MS Effect	df Error	MS Error	F	p-level
1. Subject Group	3	24463	81	2328	10.5	0.0001
2. Ref. Type	1	94088	81	1308	71.9	0.000001
3. Listener Position	1	1384	81	1134	1.2	0.3
4. Video Type	1	13.7	81	1009	0.01	0.9
1*2	3	815	81	1308	0.6	0.6
1*3	3	183	81	1134	0.2	0.9
2*3	1	185	81	789	0.2	0.6
1*4	3	563	81	1009	0.5	0.6
2*4	1	55	81	768	0.07	0.8
3*4	1	367	81	947	0.4	0.5
1*2*3	3	315	81	789	0.4	0.8
1*2*4	3	571	81	768	0.7	0.5
1*3*4	3	644	81	947	0.7	0.6
2*3*4	1	9	81	471	0.02	0.9
1*2*3*4	3	64	81	471	0.1	0.9

Analysis of Variance Table of Results, Proportion of Full References used as Initial and Re-establishing References to Objects by Typically Developing Children and Children with Down's syndrome.

N.1.3 Continuing and Re-establishing References

Age	Ref. Type	Video Type	Listener	Mean
5	Continuing	Moving	NotWatching	16.6
			Watching	8.8
		Still	NotWatching	0
			Watching	3.3
	Re-establishing	Moving	NotWatching	47.8
			Watching	58.7
		Still	NotWatching	58.3
			Watching	53.3
7	Continuing	Moving	NotWatching	6.6
			Watching	10.5
		Still	NotWatching	1.6
			Watching	0
	Re-establishing	Moving	NotWatching	76.6
			Watching	61.4
		Still	NotWatching	83.1
			Watching	72.6
10	Continuing	Moving	NotWatching	11.8
			Watching	2.9
		Still	NotWatching	13.1
			Watching	0
	Re-establishing	Moving	NotWatching	71.8
			Watching	83.2
		Still	NotWatching	81.5
			Watching	84.9

Table of Means, Proportion of Full References used as Continuing and Re-establishing References to Objects by Typically Developing Children.

Ref. Type	Video Type	Listener	Mean
Continuing	Moving	NotWatching	12.5
		Watching	18.3
	Still	NotWatching	15
		Watching	3.8
Re-establishing	Moving	NotWatching	55.3
		Watching	51.9
	Still	NotWatching	53.1
		Watching	53.9

Table of Means, Proportion of Full References used as Continuing and Re-establishing References to Objects by Children with Down's syndrome.

Effect	df Effect	MS Effect	df Error	MS Error	F	p-level
1. Subject Group	3	4735	81	1859	2.5	0.06
2. Ref. Type	1	472670	81	1429	331	0.000001
3. Listener Position	1	168	81	871	0.2	0.7
4. Video Type	1	769	81	668	1.2	0.3
1*2	3	10718	81	1429	7.5	0.0002
1*3	3	341	81	871	0.4	0.8
2*3	1	4067	81	707	5.8	0.02
1*4	3	199	81	668	0.3	0.8
2*4	1	276	81	674	0.4	0.5
3*4	1	518	81	563	0.9	0.3
1*2*3	3	278	81	707	0.4	0.8
1*2*4	3	1330	81	674	1.9	0.1
1*3*4	3	87	81	563	0.2	0.9
2*3*4	1	0.4	81	702	0.0005	0.9
1*2*3*4	3	1145	81	702	1.6	0.2

Analysis of Variance Table of Results, Proportion of Full References used as Continuing and Re-establishing References to Objects by Typically Developing Children and Children with Down's syndrome.

N.2 Experiment 3

N.2.1 Initial and Continuing References

Age	Ref. Type	Video Type	Listener	Mean
5	Initial	1PC	NotWatching	93
			Watching	93
		2PC	NotWatching	93
			Watching	93
	Continuing	1PC	NotWatching	18
			Watching	5
		2PC	NotWatching	0
			Watching	5
7	Initial	1PC	NotWatching	93
			Watching	100
		2PC	NotWatching	100
			Watching	93
	Continuing	1PC	NotWatching	20
			Watching	7
		2PC	NotWatching	10
			Watching	6
10	Initial	1PC	NotWatching	100
			Watching	100
		2PC	NotWatching	100
			Watching	100
	Continuing	1PC	NotWatching	10
			Watching	7
		2PC	NotWatching	6
			Watching	8

Table of Means, Proportion of Full References used as Initial and Continuing References to Objects by Typically Developing Children.

Ref. Type	Video Type	Listener	Mean
Initial	1PC	NotWatching	85
		Watching	93
	2PC	NotWatching	100
		Watching	95
Continuing	1PC	NotWatching	23
		Watching	28
	2PC	NotWatching	21
		Watching	17

Table of Means, Proportion of Full References used as Initial and Continuing References to Objects by Children with Down's syndrome.

Effect	df Effect	MS Effect	df Error	MS Error	F	p-level
1. Subject Group	3	1889	81	833	2.3	0.08
2. Ref. Type	1	998660	81	935	1068	0.000001
3. No. of PCs	1	397	81	484	0.8	0.4
4. Listener Position	1	286	81	414	0.7	0.4
1*2	3	4565	81	935	4.9	0.004
1*3	3	272	81	484	0.6	0.6
2*3	1	2117	81	461	4.6	0.04
1*4	3	190	81	414	0.5	0.7
2*4	1	426	81	549	0.7	0.4
3*4	1	8	81	562	0.01	0.9
1*2*3	3	451	81	460	0.9	0.4
1*2*4	3	109	81	549	0.2	0.9
1*3*4	3	897	81	562	1.6	0.2
2*3*4	1	1272	81	587	2.2	0.1
1*2*3*4	3	235	81	587	0.4	0.8

Analysis of Variance Table of Results, Proportion of Full References used as Initial and Continuing References to Objects by Typically Developing Children and Children with Down's syndrome.

N.2.2 Initial and Re-establishing References

Age	Ref. Type	Video Type	Listener	Mean
5	Initial	1PC	NotWatching	93
			Watching	93
		2PC	NotWatching	93
			Watching	93
	Re-establishing	1PC	NotWatching	71
			Watching	71
		2PC	NotWatching	76
			Watching	83
7	Initial	1PC	NotWatching	93
			Watching	100
		2PC	NotWatching	100
			Watching	93
	Re-establishing	1PC	NotWatching	89
			Watching	88
		2PC	NotWatching	87
			Watching	94
10	Initial	1PC	NotWatching	100
			Watching	100
		2PC	NotWatching	100
			Watching	100
	Re-establishing	1PC	NotWatching	87
			Watching	87
		2PC	NotWatching	89
			Watching	92

Table of Means, Proportion of Full References used as Initial and Re-establishing References to Objects by Typically Developing Children.

Ref. Type	Video Type	Listener	Mean
Initial	1PC	NotWatching	85
		Watching	93
	2PC	NotWatching	100
		Watching	95
Re-establishing	1PC	NotWatching	70
		Watching	65
	2PC	NotWatching	70
		Watching	75

Table of Means, Proportion of Full References used as Initial and Re-establishing References to Objects by Children with Down's syndrome.

Effect	df Effect	MS Effect	df Error	MS Error	F	p-level
1. Subject Group	3	7011	81	977	7.2	0.0002
2. Ref. Type	1	32198	81	548	58.7	0.000001
3. No. of PCs	1	1623	81	708	2.3	0.1
4. Listener Position	1	137	81	645	0.2	0.6
1*2	3	2293	81	548	4.2	0.008
1*3	3	335	81	708	0.5	0.7
2*3	1	201	81	608	0.3	0.6
1*4	3	12	81	645	0.02	0.9
2*4	1	64	81	504	0.1	0.7
3*4	1	1.5	81	858	0.002	0.9
1*2*3	3	295	81	608	0.5	0.7
1*2*4	3	63	81	504	0.1	0.9
1*3*4	3	47	81	858	0.1	0.9
2*3*4	1	1579	81	534	2.9	0.1
1*2*3*4	3	265	81	534	0.5	0.7

Analysis of Variance Table of Results, Proportion of Full References used as Initial and Re-establishing References to Objects by Typically Developing Children and Children with Down's syndrome.

N.2.3 Continuing and Re-establishing References

Age	Ref. Type	Video Type	Listener	Mean
5	Continuing	1PC	NotWatching	18
			Watching	5
		2PC	NotWatching	0
			Watching	5
	Re-establishing	1PC	NotWatching	71
			Watching	71
		2PC	NotWatching	76
			Watching	83
7	Continuing	1PC	NotWatching	20
			Watching	7
		2PC	NotWatching	10
			Watching	6
	Re-establishing	1PC	NotWatching	89
			Watching	88
		2PC	NotWatching	87
			Watching	94
10	Continuing	1PC	NotWatching	10
			Watching	7
		2PC	NotWatching	6
			Watching	8
	Re-establishing	1PC	NotWatching	87
			Watching	87
		2PC	NotWatching	89
			Watching	92

Table of Means, Proportion of Full References used as Continuing and Re-establishing References to Objects by Typically Developing Children.

Ref. Type	Video Type	Listener	Mean
Continuing	1PC	NotWatching	23
		Watching	28
	2PC	NotWatching	21
		Watching	17
Re-establishing	1PC	NotWatching	70
		Watching	65
	2PC	NotWatching	70
		Watching	75

Table of Means, Proportion of Full References used as Continuing and Re-establishing References to Objects by Children with Down's syndrome.

Effect	df Effect	MS Effect	df Error	MS Error	F	p-level
1. Age of Child	3	1899	81	1287	1.5	0.2
2. Ref. Type	1	672222	81	1102	610	0.000001
3. No. of PCs	1	33	81	667	0.05	0.8
4. Listener Position	1	79	81	542	0.2	0.7
1*2	3	12263	81	1102	11.1	0.00001
1*3	3	63	81	667	0.09	0.9
2*3	1	3626	81	744	4.9	0.03
1*4	3	63	81	524	0.1	0.9
2*4	1	820	81	664	1.2	0.3
3*4	1	1360	81	550	2.5	0.1
1*2*3	3	209	81	744	0.3	0.8
1*2*4	3	289	81	664	0.4	0.7
1*3*4	3	289	81	550	0.5	0.7
2*3*4	1	17	81	875	0.02	0.9
1*2*3*4	3	631	81	875	0.7	0.5

Analysis of Variance Table of Results, Proportion of Full References used as Continuing and Re-establishing References to Objects by Typically Developing Children and Children with Down's syndrome.

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