THE METALINGUISTIC AWARENESS OF PHONOLOGICALLY DISORDERED AND NORMALLY DEVELOPING CHILDREN: A COMPARATIVE STUDY

by

Janet Howell

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Abstract:

Studies in normal child language acquisition show that young children have an awareness of certain properties of language, including phonology. The purpose of this study was to determine if metalinguistic awareness is less well established in phonologically disordered children relative to normally developing children.

Five metalinguistic tasks concerned with the phonological aspects of language were devised: rhyme recognition, phoneme segmentation, speech error recognition, choosing between novel possible and impossible words and talking about pronunciation. The tasks were administered to two groups of pre-school children, twenty one with disordered, and twenty one with normal phonological development. Admission to the respective groups was determined by a score of 85 or less or 100 or more on the Edinburgh Articulation Test.

Analysis of the results produced significant correlations between the articulation test score and both rhyming and segmentation task scores. The two groups of subjects obtained significantly different scores for these tasks, but not for the other three experimental tasks.

The rhyming and segmentation tasks were readministered twelve months after the first experiments. The subject groups showed equivalent development in both tasks and the patterns of significant correlations obtained in the initial experiments were repeated.

The results are discussed in relation to models of phonological acquisition and word production. Particular emphasis is given to the child's ability to pay attention to acoustic cues as a possible requirement for successful performance on rhyming and segmentation tasks and in the acquisition of phonology. It is suggested that therapeutic intervention directed towards developing metalinguistic awareness is an appropriate therapeutic strategy for the remediation of phonologically disordered children.

The association between metalinguistic awareness and phonological disorder found in this investigation suggest that it is an area worthy of more investigation and possible directions for further research are suggested.

CONTENTS

INTRODUCTION

The purpose of this study is to determine if metalinguistic awareness is less well established in phonologically disordered children compared to children whose phonology is developing normally. It is intended that the study will provide a contribution to understanding the nature of phonological disorder and as a consequence suggest new treatment procedures for this clinical population.

Previous research into phonological disorder has taken two main directions, a search for explanations of the problem and descriptions of the speech characteristics of these children. The search for explanations, although extensive has proved inconclusive. Attempts to establish causative factors suggest that phonologically disordered children are a heterogeneous group and investigations of their speech processing abilities have produced equivocal results. Descriptions of phonologically disordered speech characteristics show rather more consensus. There is general agreement that it is invariably rule governed systematic and predictable and has similar characteristics to that of younger normally developing children. It is this finding that has been largely responsible for the conceptualisation of the disorder as a linguistic rather than an articulatory difficulty.

Some basic principles of intervention have resulted from this linguistic conceptualisation of the disorder; Notably that intervention should be aimed at encouraging the child to make contrasts between speech sounds within a communicative context. Linguistic description is however of little assistance in determining what methods should be used to help children to make these contrasts.

Currently treatment methods are usually directed towards expanding the sound system through perception or production techniques. These are appropriate methodologies for children where this type of deficiency can be demonstrated, but the use of such methods for the rest of this population is more doubtful. Alternative methods may be more suitable but these should be based on continued investigation of the nature of the problem.

A study of the metalinguistic awareness of phonologically disordered children provides a new research direction which has the potential for providing alternative treatment procedures. Metalinguistic awareness is a particularly appropriate topic for investigation. There has been little previous investigation of this phenomenon in this population, but the research which has been carried out, both in relation to phonological disorder and other types of developmental language disorder, suggests that metalinguistic awareness is less well developed in such children compared to children with normal language development.

The role of metalinguistic awareness in normal language acquisition is also a current topic of interest. A role for such awareness would appear to be particularly relevant to cognitive theories of language acquisition where an active role for the language learning child is postulated. An association between metalinguistic awareness and reading difficulties has been demonstrated and links between delayed language development and reading problems are also known to exist. Extending the investigation of metalinguistic awareness in relation to phonological disorder would therefore be a logical direction for further research.

A considerable amount of literature about the metalinguistic awareness of normally developing children has been amassed, but because there is no consensus about the specific nature of the phenomenon developmental norms do not exist. Consequently the present investigation will compare the performance of phonologically disordered and normally developing children on a series of tasks designed to assess different aspects of metalinguistic awareness.

The thesis consists of the following chapters. Chapter 1 is a review of the relevant literature pertaining to phonological disorder. This chapter covers research into possible aetiological factors, and speech processing ability and describes the speech characteristics which are typical of the disorder. Chapter 2 examines the metalinguistic awareness literature in relation to a series of questions which are considered to be pertinent to the relationship between the phenomenon and phonological disorder. Chapter 3 introduces the present investigation and describes the pilot study carried out to devise the metalinguistic tasks used in the main investigation. Chapter 4 outlines the main investigation and concentrates specifically on the subjects chosen for the study. This chapter contains the results of a series of assessments carried out before the metalinguistic experiments to assess variables, such as non-verbal intelligence and language comprehension, variables which may influence metalinguistic awareness. This chapter also describes the phonological characteristics of the subjects.

Chapters 5 to 9 are concerned with the main investigation. Each of these chapters is devoted to the method, results and discussion of one of the five experiments which comprise the main investigation.

These experiments tap various aspects of metalinguistic awareness; rhyming, segmentation, pronunciation acceptability, knowledge of phonological constraints and the abilty to talk about aspects of language.

Chapter 10 describes a follow up study undertaken a year after the main investigation. Phonological ability was reassessed and two of the metalinguistic tasks were readministered in this study. Chapter 11 forms the conclusion to the thesis. It reviews and brings together the results and discussion of each experiment, discusses implications for intervention and makes suggestions for further research.

CHAPTER 1
PHONOLOGICAL DISORDER

1.1 INTRODUCTION

This chapter reviews the literature concerned with phonological disorder and the characteristics of phonologically disordered speech. It will discuss studies which have attempted to explain and understand the nature of the disorder, in particular those which are relevant to the possible relationship between metalinguistic awareness and phonological disorder.

Phonological disorder is arguably the communication disability most frequently referred to speech therapists and, in the short history of the discipline, they have a long history of diagnosing and providing remediation for this disorder. Bernthal & Bankson (1984) say that it is also the disorder that speech therapists feel most comfortable and competent to deal with. In spite of this the explanation of the disorder remains elusive despite extensive research and speculation.

Phonological disorder, or disability, became the preferred term for the problem during the last decade. It was previously referred to as dyslalia in the United Kingdom (Morley, 1972) and functional articulation disorder, indicating ignorance of aetiology, in the U.S.A. (Shelton & McReynolds, 1979). Recently, the term phonologic syntactic syndrome has been preferred by some authors, notably Rapin & Allen, (1983) and Bishop & Rosenbloom (1987).

1.2 THE NATURE OF THE DISORDER

1.2.1 LINGUISTIC ORIENTATION

The term phonological disorder reflects what several authors see as the essential nature of the child's difficulty:

> "a linguistic disorder manifested by the use of abnormal patterns in the spoken medium of language" (Grunwell, 1981 p.9).

This view of the disorder is largely the result of professional linguists interest in speech and language disability. Grunwell (1981), for instance, argues that where the pathological cause is unknown linguistic characteristics are the only symptoms which can be used to identify the disorder. She adds that linguistic investigation can "illuminate" phonological disorder, which she describes as a "clinically perplexing disorder" (Grunwell, 1981, p.2).

It is generally recognised (see for instance Grunwell, 1982, and Weiner, 1984) that the publication of "Phonological Disability in Children" (Ingram, 1976) marked the beginning of the general use of this terminology and led to a change in the conceptualisation of the disorder as a linguistic rather than an articulatory difficulty.

Ingram drew together the work of authors such as Haas (1963) and Compton (1975) who had demonstrated the utility of using linguistic methods to analyse disordered speech, and Moskowitz (1972) Pollock & Rees (1972) and Oller (1973) who were concerned with the need to distinguish between phonetic and phonemic errors. Within this linguistic framework phonological disorder is believed to be essentially a phonemic/organisational problem rather than a phonetic/production difficulty. The child is seen as having difficulty in signalling contrasts between phonemes rather than in executing articulatory movements.

If it is accepted that the problem is one of signalling contrasts rather than articulatory control this has implications for remediation strategies. Supporters of this viewpoint suggest that remediation should be concerned with developing the child's knowledge of the structure and organisation of his native language. Grunwell (1983) suggests

> "...changes in speech production need to take place not so much in the mouth but in the mind of the child. The aim of treatment is to effect cognitive reorganisation rather than articulatory retraining."
>
> Grunwell, (1983, p. 167)

If this is the nature of the changes that are required it is also pertinent to consider what is to be changed in the child's mind. What, in other words, is the nature of the child's mental representation of the lexical items he is mispronouncing? (This will be discussed in 1.4.2).

1.2.2 ALTERNATIVE VIEWPOINTS

The dissenters from a linguistic interpretation of the disorder fall notably into two camps. There are those such as Van Riper & Emerick (1984) who accept linguistic analysis as a possible part of the assessment of these children and label them as phonologically disordered and/or use the terms articulation and phonological disorder interchangeably. However they still appear to explain the linguistic patterns as resulting from articulatory rather than linguistic difficulty.

Other authors such as Shelton & McReynolds (1979) and McReynolds & Elbert (1984) are critical of the linguistic interpretation of the disorder. They argue that phonological disorder is a misnomer for the problem as only one part of phonology is affected in these children, the development of a phonetic inventory and its patterning. Phonological theory they say is concerned with an abstract system of rules not with what a child is actually doing when he misarticulates. Shelton & McReynolds suggest that speech pathologists should consider

> "structural and developmental information within a framework that allows modification of delayed or deviant articulatory patterns, and processses through application of learning principles"
> Shelton & McReynolds (1979 p. 9).

They go on to suggest that insights from phonological research may be added to speech pathology theory but that physiological and acoustical variables to explain speech production and perception should also not be neglected.

These authors conceptualise disordered articulation as involving "articulatory movements that fail to approximate required target steady state positions" (p. 11).. This failure they believe

> "...may reflect a phonetic inability to produce the required movements or a phonological patterning failure. The disorder may relate to many variables and it may involve delay or deviancy in articulation development...." (Shelton & McReynolds, 1979, p. 11).

In short their critical evaluation arises from a remediation orientation, an orientation which essentially is concerned with external observable factors and involves learning new physiological skills.

McReynolds & Elbert evaluate the term phonological disorder and the concept of phonological processes by examining the data from studies which have analysed the error patterns of mistarticulating children. They conclude that there is insufficient evidence to justify a phonological interpretation of articulation errors and recommend caution in the use of the term to describe or explain such errors until further research has been carried out. However they see linguistic analysis of articulation errors as a useful research tool that can lead to a better understanding of phonology and phonological development.

In contrast to McReynolds and her colleagues, Stoel-Gammon & Dunn (1985) believe that phonological disorder is the more appropriate term for these children. Articulation, they say, refers only to the physical movements involved in speech production whereas phonology refers to

> "...the organisation and classification of speech sounds that occur as contrastive units ... and ...it is used as a general term to cover all aspects of the study of speech sounds including speech perception and production as well as cognitive and motor aspects of speech ..."
> (Stoel-Gammon & Dunn, 1985, p.3-4)

These preferences for differing terminologies reflect both different orientations towards the nature of the disorder and the acceptance and interpretation of the available evidence. Elbert, Shelton and McReynolds await more convincing proof that the problem is primarily linguistic in nature and imply, wrongly, that the adoption of a linguistic orientation necessitates abandonment of attention to individual differences and consideration of the learning process in the therapeutic situation.

Stoel-Gammon & Dunn, in company with Grunwell and Ingram and many other linguists and speech pathologists believe, on the basis of evidence already available, that the term phonological disorder or disability more accurately reflects the nature of the children's difficulties. The current study subscribes to this view.

1.2.3 OTHER LINGUISTIC CHARACTERISTICS

Concern with the phonological versus articulatory dimension of this disorder has tended to overshadow discussion of whether the children's problems are restricted to the phonological aspects of language or whether they are part of a wider spectrum of linguistic difficulties. This latter possibility is reflected in the use of the term syntactic phonological syndrome (p. 7).

Several studies examine the relationship between phonological disorder and other language abilities and disabilities. Stoel-Gammon & Dunn reviewing the available literature, state that conclusive results have not emerged on this relationship. Such difficulties, they say, may co-exist in many children but not all. Comprehension is not often affected whilst syntactical defects occur alongside phonological problems more frequently than defects in other language abilities.

Ingram suggests that the "deviant phonology may be not just a phonemic disorder but a more global linguistic one" (1976, p. 122). In her review of the literature Grunwell (1981) concludes that studies consistently indicate depressed scores on other language abilities for children with phonological disability.

Shriberg and his co-authors carried out an exhaustive descriptive and diagnostic classification of developmental phonological disorders in a series of papers (Shriberg and Kwiatkowski, 1982 a, b & c, and Shriberg, Kwiatkowski, Best, Hengst & Terselic-Weber, 1986). They found that between 20% and 30% of the 114 children in the 1986 investigation had some problems in language comprehension as measured by a variety of tasks such as the Peabody Picture Vocabulary Test and the Auditory Reception sub-test of the Illinois Test of Psycholinguistic Abilities. Similar percentages of the children had difficulties with some expressive aspects of language. For example, 30% had problems with lexical retrieval and 25% had a greater than one year delay in the development of syntax. Their earlier investigations showed similar results. These authors conclude that many if not most speech delayed children have some degree of language involvement.

Smit & Bernthal (1983) carried out a comparative study of the perceptual and expressive language abilities of three groups of children, a group described as "syllable reducers" (seen as the more severe disorder) a group of "sound substituters" and a normal control group. They found significant differences between the normal and the disordered subjects in imitation of language, as measured by the Carrow Elicited Language Inventory (C.E.L.I), but no significant differences in perceptual ability, measured by the Test of Auditory Comprehension of Language (T.A.C.L). Howell, Skinner, Gray & Broomfield (1981) used a series of standardised language assessments to compare children referred for speech therapy with a group of normally developing children. A significant correlation was found between scores on the Edinburgh Articulation Test (E.A.T) and other language assessments, including the C.E.L.I., and the T.A.C.L. for the normal children. But the only significant relationship between the scores of the language disordered children was between the C.E.L.I and the E.A.T, results which are comparable to those obtained by Smit & Bernthal.

The research cited above is concerned with children whose predominant problem is with the phonological aspects of language and starts from an assumption that they constitute a distinct group. But this is perhaps an oversimplified view. In the light of increasing knowledge about language impairment (see Bishop & Edmundson (1987) for an extensive investigation) and the research cited above it is probably most constructive to consider phonological disorder as part of a spectrum of developmental language disorders. Some children with phonological problems will have accompanying articulation difficulties, some will have other language difficulties to varying degrees and a proportion will have, as far as can be determined, a specific phonological difficulty. It is this group which are the concern of the present study.

Before leaving this discussion it is appropriate to consider the possible cause and effect relationships between aspects of language impairment. Two general possibilities exist; some underlying factor may affect several levels of language, or alternatively, impairment at one level may interact with and disturb other levels of language. For instance Panagos and his colleagues (Hambrecht & Panagos, 1980 and Panagos, Quine & Klich, 1979) suggest that there is a relationship between grammatical complexity and articulatory production. He puts forward the hypothesis that if one assumes a single hierachical complexity including all aspects of language the competing demands of handling more complex grammatical structures may consequently lead to a loss of the precise control of articulation at the phonetic level. Such a proposition is compatible with the test results obtained by Smit & Bernthal and Howell et al. See also Crystal (1987) for a more wide ranging discussion on this point.

Aram & Kamhi (1982) suggest three theoretical perspectives which may assist in the search for further knowledge about the relationship between phonological and other language difficulties. These are:

1. A linguistic perspective which postulates a generalised difficulty with rule formation or categorisation.

2. A cognitive perspective which suggests difficulties with problem solving and hypothesis testing.

3. An information processing framework to investigate discrimination, storage and retrieval of language.

These perspectives provide useful pointers for discussion of the nature of language disorder and they will be employed to varying extents throughout this thesis to investigate the relationship between metalinguistic awareness and phonological disorder.

1.3 SPEECH CHARACTERISTICS OF CHILDREN WITH PHONOLOGICAL DISORDER

Analysis of phonologically disordered speech demonstrates that it is invariably rule governed, systematic and predictable and that it has an internal system and organisation but one that is different from the adult system of the language. Several methods have been used to describe phonologically disordered speech. These include analysis of distinctive features, generative rules, contrastive capabilities and phonological processes. These analytical studies are discussed in detail by Grunwell (1981 & 1982) and the main findings are summarised by Stoel-Gammon & Dunn (1985). The following descriptions draw on these authors but are supplemented by reference to more recently published research when this is available.

1.3.1 PHONETIC CHARACTERISTICS

The reported phonetic characteristics of phonologically disordered children are listed by Grunwell (1981) and include the following:

1. Restriction in the number and variety of phonetic segments used.

2. Restriction in the range of feature combinations available. Fricatives are usually confined to one

place of articulation and are used rarely. Affricates are frequently absent.

3. The phonotactic structure of syllables tends towards CVCV.

Stoel-Gammon & Dunn draw together the findings of several published studies and show a similar picture of restricted sound systems, with the systems of individual children consisting of approximately half the adult inventory. Although these data samples contain a variety of sound classes, stops predominate, over half the samples contain all stops, fricatives /f/ & /s/ and nasals /m/ & /n/. However differences are also revealed, most of the individual data samples also contain one or two other English or non-English phonemes which are different from the general pattern of occurrence. Simple syllable shapes of CV and CVC predominate, but some consonant clusters are used by the children who are most intelligible. Stoel-Gammon & Dunn found that these characteristics were essentially similar to those in data they collected from three normal children aged between 11 and 17 months.

1.3.2 PHONOLOGICAL CHARACTERISTICS

This review of the phonological characteristics of phonologically disordered children will concentrate on investigations which have used process analysis because this is currently the most commonly used analysis system for disordered phonology. (More information on process analysis can be found in 4.6).

Stoel-Gammon & Dunn (1985) use a phonological process framework to compare the relationship between disordered phonological production and the adult system. They examined the findings of eight different studies containing the data from over 120 children aged between 2.08 and 13 years. Although the studies use different subject criteria, data collection and analysis procedures, the authors say that it is possible to identify common occurrence of phonological processes in these studies.

Nine processes occur more frequently than others. They include:

Three structure simplifying processes: Cluster Reduction, Final Consonant Deletion and Unstressed Syllable Deletion.

Four substitution processes: Stopping, Velar and Palatal Fronting and Liquid Simplification.

Two sound change processes: Assimilation and Voicing.

Although there are variations across the studies in frequency of occurrence of processes general trends emerge. Cluster Reduction occurs most often, followed by

Assimilation and Voicing changes. The occurrence of the other four processes is much more variable.

Although it is possible to discover general characteristics in the data examined by Stoel-Gammon & Dunn they point out that many other processes also occur and that there is great variability between the patterns of individual children. This data is once again similar to that collected from younger normally developing children. Other studies have found similar patterns of general occurrence and individual differences.

Moss (1985) investigated the use of phonological processes by fifteen phonologically disordered Scottish children aged between 3.07 and 6.06. She found that all her subjects used a selection of all the processes observed in normal children and that these occurred more commonly than unusual or non-normal processes. However all these subjects also exhibited between one and seven processes not commonly found in normal development. Eleven of them used a non-normal process of Backing, a finding which does not appear to have been reported elsewhere. She suggests that this process might be specific to phonologically disordered children.

Although the majority of studies report that most of the simplifying processes used by phonologically disordered children are similar to those used by younger normally developing children most authors, in common with Moss, also report processes which have rarely or never been documented in the normal language acquisition literature. These are termed unusual or idiosyncratic processes and include for example gliding of fricatives, stopping of liquids and unusual cluster simplification patterns (for example the retention of the approximant rather than the stop: green -> /win/ rather than green -> /gin/). Grunwell cautions that the interpretation of these processes as unusual or idiosyncratic should be tentative because of the small amount of data available from both normal and disordered children (see 4.6.3. for further discussion). Further descriptions of disordered phonological patterns can be found in Shriberg et al (1986) and Shriberg & Kwiatkowski (1982 a,b & c). Phonological data collected from the children in the present investigation was found to be comparable to that described in the studies cited above. (Details can be found in 4.6.3).

In determining the effect of a process on the child's communicative ability the frequency with which it occurs must be considered. Dunn & Davis (1983) analysed the frequency of occurrence of phonological processes in the data of nine disordered children.

They found that although most processes occurred in all the samples there were considerable differences in the extent to which they were used by individual children and therefore on the potential effect they had on intelligibility. Moss found that the majority of processes were used optionally by her subjects, and might be used either alternatively with the adult target, or another developmental or atypical process.

McReynolds & Elbert (1981) in a critical evaluation of the use of process analysis demonstrate that the application of specific quantitative criteria, (i.e. a certain percentage occurrence) can lead to considerable variations in the presumed severity of a child's problems dependent upon the threshold chosen to determine whether processes are operating. Currently there appears to be little attempt to use quantitative criteria and where such criteria are adopted they appear to be arbitrarily chosen (but see Hill, Howell & Dean, in preparation).

1.3.3. DELAY OR DISORDER?

Analysis of disordered phonology shows that in many respects it is comparable with but not identical to normally developing phonology. General characteristics can be observed across the disordered population but there are also considerable differences between the children. In an attempt to describe these characteristics more systematically Grunwell (1982) classifies three types of differences between normal and disordered child speech on the basis of their use of processes. These are:

Persisting normal processess, the pronunciation patterns found in normal development. These are symptomatic of arrested or severely delayed development, early pronunciation patterns which have stabilised and failed to progress.

Chronological mismatch is the co-occurrence of early simplifying processes with pronunciation patterns characteristic of later stages of development. Grunwell provides as an example of this the occurrence of developed clusters and fricatives alongside velar harmony.

Unusual and Idiosyncratic processes. (These were touched upon earlier (p. 21) and see also 4.6.3).

Examining the varying patterns of phonological behaviour that have been reported for individual children it does not appear possible to make a clear distinction between phonological delay and deviance. Moss says that on the basis of process analysis, only one of her subjects can be truly described as delayed. In the current state of knowledge we can only say that each phonologically disordered child presents with a unique pattern of phonological behaviour, and that this behaviour approximates to normal phonological development to varying degrees.

1.3.4 PROBLEMS AND LIMITATIONS OF LINGUISTIC DESCRIPTION.

A considerable amount of descriptive information has been amassed about the speech characteristics of phonologically disordered children. Interpretation of these characteristics however must be approached with caution. Process analysis provides an attractive descriptive format and is currently much favoured, but more studies are required of both normal and abnormal data and comparisons across languages.

Problems with the nature of the populations investigated, the data and the analysis methods used must also be considered. Data used for analysis may consist of single words or continuous speech samples, it may be elicited or spontaneously produced in different situations. These are all factors which can have different effects on production capabilities and data collected in experimental situations may not reflect normal speech realisations. Analysis is also dependent on the quality of data transcription, this is a highly skilled, but necessarily subjective, activity and the available data may not always be explored to the full.

Stoel-Gammon & Dunn (1985) raise what is possibly the most serious limitation in relation to data analysis. Typically data is collected only at one or a very few points in time, and this after the child has failed to develop normally. Therefore the data analysis represents only the product not the process of development. Very little information is available about the prelinguistic and early linguistic periods of development or about changes in production over time of these children. (See however Vihman (1986) and Menyuk, Liebergott & Schultz (1986)). Weeks (1974) is able to provide some information about the relationship between aspects of developing language, possible predictors of delay and strategies of acquisition as the result of a longitudinal study of a single child with "slow speech development."

1.4 EXPLANATIONS OF PHONOLOGICAL DISORDER

1.4.1. AETIOLOGICAL FACTORS.

The current tendency in the investigation of phonological disorder is to concentrate on the linguistic characteristics of the problem, but between the 1940's and the 1960's the search for variables which might help to explain phonological disabilities was considerable (Stoel-Gammon & Dunn, 1985). Winitz (1969) provides the most extensive review of these studies. These are either correlational and compare articulatory performance with other variables in the disordered population or they compare normal and articulatory disordered children. On the whole the findings from this research are inconclusive and have generally failed to determine characteristics which can be ascribed to the group as a whole or assist in determining sub-groups.

Shelton & McReynolds (1979) devote some time to discussing the possible reasons for the unproductive nature of these investigations. They suggest that this is a heterogeneous population, that the disorder probably results from several sources and, in addition, for any individual child a variety of causative factors may have interacted, or be interacting. They also suggest that the wrong variables may have been investigated, that investigatory methods may be at fault or that the measures used may be too crude to identify subtle deficiencies.

Bernthal & Bankson (1984) extend this discussion by pointing out that correlational studies are limited in that they do not allow for the establishment of cause and effect relationships. They suggest that a more profitable line of enquiry would be to look at possible relationships between phonological disorder and clusters of variables. The few studies of this kind that have been attempted, for instance, Arndt, Shelton, Johnson & Furr, (1977) have generally been unable to provide enlightenment about the nature of the problem. But Bernthal and Bankson quote studies by Elbert & McReynolds (1978), Panagos (1974), Prins (1962) and Renfrew (1966) where a particular type of error pattern, syllable structure reduction, appears to be associated with adverse psychological, neurological and socio-economic factors and a poor response to remediation.

In their series of papers Shriberg & Kwiatkowski (1982 a, b, & c) have revived the search for causal factors. They propose a diagnostic classification system which incorporates both aetiological and phonological analysis characteristics. They divide the causal factors into three major areas and ninety sub-categories. The three major areas are:

1. **Mechanism.** This includes observation of hearing difficulty and middle ear infection, speech, feeding history and aspects of oro-pharyngeal examination and speech mechanisms.

2. **Cognitive-Linguistic** functions. This includes comprehension measures and learning attainment.

3. **Psychosocial functions.** These are factors as varied as parental attitudes and play behaviour.

The authors applied their classification retrospectively to information collected on a group of 43 children. They found that over 60% had some hearing and/or speech mechanism involvement, 30% some language comprehension involvement and 90% some language production involvement. Approximately 40% to 60% had problems in the psychosocial domain.

Shriberg and his colleagues (Shriberg et al 1986) have continued to develop and assess the usefulness of this diagnostic classification system. In a series of three further studies they utilised data on 114 additional subjects, adopting a revised version of the original sub-categories and a more detailed analysis procedure. Among other findings they discovered that 40% of the children had a history of frequent middle ear infection and that less than 15% had speech mechanism involvement. Significant cognitive-linguistic deficits occurred in 30% of children, these deficits included some degree of language involvement and/or learning problems.

The authors acknowledge that interpretation of their findings is difficult because of the lack of norm referenced data for some sub-categories, the lack of matched control groups and the use of subjective assessments for some categories. These factors must be seen as a drawback in the interpretation of these results, for example the incidence of middle ear disease is also known to be frequent in the normally developing population. The authors also suggest that factors may have been reported which might be ignored in other children because of greater concern and attention from care givers and health workers.

Shriberg and his colleagues suggest that there is a need for continued research and that this should be directed towards further "discovery and detection of etiologically based sub-groups within developmental phonological disorders" (1986 p.239). They believe that effective intervention depends on the early identification of relevant individual differences of this kind.

Despite the inconclusive nature of this search for causes, and the difficulties of investigating some variables, most authors, regardless of their conceptualisation of phonological disorder, for instance, Grunwell (1981) Ingram (1976) Stoel-Gammon & Dunn (op. cit.) and Van Riper & Emerick (1984) would agree with Shriberg in recommending the continued investigation of possible causative and other variables as essential for planning effective remediation.

1.4.2 SPEECH PROCESSING EXPLANATIONS

In the search for an explanation of the disorder the auditory perceptual and the oral motor components of the speech processing mechanism have received considerable attention, particularly from speech pathologists. However, considering the postulated nature of the disorder, there has been comparatively little investigation of the possible nature of the lexical representations of this population.

a. Auditory Perceptual Abilities

Studies of these abilities are extensive, auditory discrimination has received most attention but auditory memory and auditory sequencing have also been investigated. Winitz (1969) and Grunwell (1981) provide extensive reviews. Winitz concludes from his survey that the results are equivocal; they suggest that some, but not all, phonologically disordered children have some difficulty with auditory perception. Grunwell concludes from the available findings that auditory deficit does not underlie phonological disability. But she does say that some speech defective children, especially those with severe difficulties do have problems distinguishing minimally distinct sound sequences.

Two recent studies have not assisted in clarifying the position. Supple (1983) compared the auditory discrimination, auditory memory and articulatory abilities of 60 phonologically disordered 4 year olds. She found no significant relationship between auditory discrimination ability and the number and type of articulation errors, but a positive, but low correlation between memory for phonemes and articulatory ability. In a comparative study of the auditory discrimination abilities of pre-school and school aged speech impaired children with two normal control groups Morgan (1984) found that both groups of normal speaking children made significantly fewer errors than the speech impaired children. In discussing her findings she does not imply a causal relationship but suggests that discrimination ability may be developing more slowly in the experimental group. She also says that it is not possible to determine whether errors result from failure to discriminate or from lack of attention.

This difficulty in determining the reasons for failure is only one of the problems that complicates investigation in this area. Winitz also discusses problems of interpretation, suggesting that perceptual problems may result from rather than cause the phonological difficulties. Grunwell and Supple in common with most other authors point to the several problems which hinder comparison between the various studies. Identifying the populations studied is a major drawback and it is doubtful if all the subjects could be strictly diagnosed as specifically phonologically disordered. Morgan's population for instance is described as having "primarily" articulation problems, but it includes some moderately mentally handicaped children.

The studies also use different test procedures and tasks. Auditory discrimination tasks usually involve discriminating between minimal pair words, but may utilise different experimental methods. Locke (1980) provides an exhaustive critical evaluation of these tests. Auditory memory tasks are more variable and may require activities such as memorising digits, phonemes, words or sentences. Some of these tasks may bear little relation to the processes required in acquiring phonology and they may be linguistically irrelevant (Rees, 1973). The present phonologically disordered subjects were not, as a group, significantly different from their normal controls in auditory discrimination or auditory memory ability. (see also Chapter 4).

b. Oral Motor Characteristics

Oral motor characteristics have been assessed both by tests of oral form perception and by non speech oral repetition tasks (diadochokinesis). Reviewing the oral form perception studies Grunwell concludes that although they reveal that the clinical population is significantly poorer at performing such tasks "there is insufficient evidence, however, to regard this as a major explanation of phonological disability" (Grunwell, 1981 p.38). Phonologically disordered children have also been found to perform more poorly on non-speech sound repetition tasks, but Stoel-Gammon & Dunn (1985) point out that the children's inability to speak normally and their history of failure may disadvantage them in such tasks. They conclude that a proportion of these children have some kind of motoric immaturity or deficiency but there is no empirical evidence to identify the nature of this deficit. The oral motor characteristics of the present subjects were not investigated. See Waters (in press) for some preliminary results of an instrumental investigation of the speech motor control of phonologically disordered children.

c. Lexical Representation

Until recently it was assumed that the lexical representations of phonologically disordered children are essentially adult like, that these children perceive and store words correctly (Stoel-Gammon & Dunn, 1985). This assumption has recently been questioned, in particular by Dinnsen from a generative theoretical standpoint. A full review of his work in this area appears in Dinnsen (1984) where he defines under lying lexical representations as:

> "comprising the meaning and all idiosyncratic, learned phonological properties of a morpheme" (Dinnsen, 1984 p.5)

Mental representations represent the children's tacit knowledge of their language, they are not directly observable and must therefore be determined from observable behaviour. Research concerned with the nature of lexical representation during the process of normal language acquisition will be reviewed briefly as a preliminary to discussing the possible nature of the mental representations of phonologically disordered children.

Lexical representation in normal children.

Three sources of evidence have been used in the construction of hypothetical models of mental representation in normal children; perception and discrimination ability, production forms and the nature of change in the child's system (Maxwell, 1984).

According to Maxwell there are two distinct opposing theoretical positions. The first postulates that lexical representations are in all cases identical to adult surface forms. This view is supported by Braine, (1974), Donegan & Stampe (1979), Ingram (1976), Menn (1978) and Smith (1973). The alternative suggestion is that the child's underlying representations are not always identical to adult surface form and may be unique to the child's own system. Braine (1976), Dinnsen (1984), Macken (1980) and Maxwell & Weismer (1982) among others subscribe to this view. Maxwell (1984) provides a detailed and critical evaluation of the theoretical variations of the major proponents of the two opposing views.

Comparison of these theoretical accounts is difficult because they use different types of evidence including consideration of the influences of perceptual and production capabilities and the interpretation of observed linguistic rule systems. In addition they are based on a variety of different theoretical models, many of which have been adopted from research into adult language processing.

Lexical representation in phonological disorder.

Studies which have been concerned with determining the nature of lexical representation in phonologically disordered children appear to have been exclusively concerned with utilising aspects of phonological production data. It has generally been assumed that it is not possible to adequately evaluate perceptual skills for this purpose (Elbert & Gierut, 1986). Most of these studies have been carried out by generative phonologists. Dinnsen and his co-workers have compared children's realisations in specific phonetic contexts and have used this evidence to demonstrate the extent of the children's knowledge of specific phonemes.

Dinnsen (1984) for instance compares realisation of stops in word final positions and in the inflected forms of the same words. For example if a child produces "dog" as [dɒ] and "doggie" as [dɒgi] rather than [dɒi] it is concluded that he has some "productive knowledge" of /g/, his underlying representation is considered to be adult like with regard to this phoneme in this context. Dinnsen believes that it is possible to use this type of empirical evidence to distinguish different types of phonological disorder, which can be characterised by the nature of the child's underlying representation. He suggests from this analysis that phonologically disordered children have different kinds of representation, some have underlying representations which correspond to that of the adult language whilst others lack adult like representations to varying extents. Maxwell (1984) gives a detailed description of possible types of phonological disorder using this theoretical construct and Elbert & Gierut (1986) give detailed procedures for assessing productive knowledge from analysis of the child's speech production and provide consequent suggestions for intervention procedures.

Smit (reported in Maxwell, 1984) also analysed production evidence in a comparative study of phonologically disordered "syllable reducers", phonologically disordered "substituters", normal children and adults. She concludes from her investigation that some phonologically disordered children have adult like, whilst others have unique or only partially correct underlying representation.

From a different theoretical standpoint Hughes (1983) investigated production of pluralisation forms by three phonologically disordered children. She found that the children's representations were closer to the adult form than their own surface forms but it was not possible to determine whether they were exactly equivalent. Chiat (1983) examined the Velar Fronting process in relation to stress and word boundaries using data from a single phonologically disordered child. Her basic purpose was to utilise this data to expand knowledge about language processing generally but she is also able to demonstrate that, at least for this type of error, the problem can be located at the lexical representational level.

Any discussion on the nature of lexical representations both in normal and phonologically disordered children must take place in relation to linguistic theory or specific models of language processing. The work of Dinnsen and his co-workers is based on Generative phonological theory. Chiat explains the production forms of her subject in relation to the logogen model, (Morton & Patterson 1980), which proposes separate input and output lexicons. Description and critical evaluation of these theoretical models is outside the scope of this study, but consideration of the possible nature of lexical representations is essential in investigating the association between phonological disorder and metalinguistic awareness. Selected models are used later in this volume particularly in Chapters 7 & 8 during the discussion of the results of the present investigation.

In the studies cited above inferences have been drawn from analysis of children's productions. But any general discussion about lexical representation must also consider the perceptual awareness of these subjects. Stoel-Gammon & Dunn (1985) use the available literature to suggest the following relations between perceived and stored forms:

1. The adult word is perceived correctly and stored in the adult form.

2. The adult word is perceived correctly but stored in simplified form.

3. The word is perceived incorrectly and stored in that form.

4. The child may have two representations, the adult form for comprehension and a production form based on his own pronunciation.

To date there appears to have been little investigation to determine which of these possibilities is most likely, but they offer considerable opportunity to extend investigation into where breakdown may occur in the language processing of phonologically disordered children. Meanwhile the knowledge that phonological disordered children may have varying lexical representations and that the nature of these can be determined at least to some extent has both clinical and theoretical implications. Dinnsen believes that learning tasks in the clinical situation will vary according to the nature of children's underlying representations, Whilst Hughes sees this type of information as being of prognostic value and of assistance in planning where to start intervention.

1.5. CONCLUSION

This review has shown that the speech of phonologically disordered children shares many characteristics with that of normally developing younger children but it may also display characteristics which have rarely been documented in normal data. Although as a group these children share many phonological processes with each other and with normal younger children they have their own unique combination of these processes.

Efforts to explain the disorder remain inconclusive. Despite considerable research there has been a general failure to relate the problem to any specific aetiological factors, however individual children may present with perceptual difficulties or other accompanying linguistic problems. Investigations of the nature of these children's lexical representations, whilst offering new insights into the disorder, continue to reveal individual variations rather than general characteristics for this clinical group. The research cited in this chapter indicates that one should treat with caution the following list of characteristics of phonological disorder taken from Grunwell (1981)

> "(i) almost completely unintelligible spontaneous speech, resulting primarily from consonantal deviations;
> (ii) over four years of age, i.e. past the age at which speech is normally intelligible to persons from outside the child's immediate

social environment....
(iii) normal hearing for speech;
(iv) no anatomical or physiological abnormalities of the speech producing mechanisms;
(v) no detectable neurological dysfunction relevant to speech production;
(vi) intellectual abilities adequate for the development of spoken language;
(vii) comprehension of spoken language appropriate to mental age;
(viii) apparently well developed expressive language abilities in terms of range of vocabulary and utterance length..."
(Grunwell, 1981, p. 4)

Nevertheless a large proportion of the clinical population do have difficulties which are apparently confined to the phonological aspects of language who conform to most if not all of the characteristics listed above. It is these characteristics which were used as a general basis for selecting the subjects used in the current study.

The small amount of information which is available about the metalinguistic awareness of phonologically disordered children will be discussed in the next chapter.

CHAPTER 2

METALINGUISTIC AWARENESS

2.1. INTRODUCTION

Metalinguistic awareness is a broad and not well defined concept. It is considered that the following questions, which will be addressed in this chapter, are those which are most pertinent to providing a framework for the study of the metalinguistic awareness of phonologically disordered children.

1. How has metalinguistic awareness been described and defined?

2. What is known about the metalinguistic awareness of speech and language disordered children?

3. What are the limitations of metalinguistic awareness in relation to

   a. Chronological age ?

   b. Language production?

4. What is the relationship between metalinguistic awareness and other aspects of behaviour?

5. Is metalinguistic awareness influenced by environmental factors?

6. What theoretical models exist to account for metalinguistic awareness?

An examination of current definitions and descriptions of metalinguistic awareness both in normal and language disordered children is a logical starting point for discussion and should assist in determining ways of assessing the phenomenon. A consideration of the limitations of metalinguistic awareness will clarify definition and description. Examining metalinguistic awareness in relation to other skills and abilities within an age related framework, and in relation to environmental factors will provide indications of possible affecting variables common to both phonologically disordered and normally developing children.

2.2 DEFINITION AND DESCRIPTION OF METALINGUISTIC AWARENESS

Cazden (1972) defines metalinguistic awareness as

> "The ability to reflect upon language as well as comprehend and produce it"
>
> Cazden (1972, p. 303)

Dale (1976) and Pratt & Grieve (1984) provide similar definitions

> "The ability to think about language and to comment on it"
>
> Dale (1976, p. 127)

> "Metalinguistic awareness may be defined at the general level as the ability to think about and reflect upon the nature and functions of language"
>
> Pratt & Grieve (1984a, p2)

These authors are in general agreement that metalinguistic awareness is concerned with the ability to think about language. But their definitions do little to clarify the nature and limitations of the phenomenon. The general character of these definitions is a reflection of the current state of knowledge about metalinguistic awareness. Pratt & Grieve suggest that this stems in part from the present inability of psychologists to provide a well articulated account of concepts such as awareness and consciousness. As a result, terms such as awareness, ability, knowledge, consciousness and reflection, prefaced by metalinguistic appear to be used interchangeably and indiscriminately.

However a taxonomy of metalinguistic awareness devised by Clark (1978) does attempt to relate the phenomenon to underlying cognitive abilities. This taxonomy (reproduced as Table 2.1) will be used as the basis for a description of the data which has been cited as evidence of metalinguistic awareness. Further details of different types of metalinguistic awareness will also be provided in later chapters.

Clark uses metacognitive skills as the starting point for her taxonomy. These are characterised as knowledge of one's own cognitive processes and the way in which this knowledge is used to self monitor one's own learning and attention. (See Clark for a brief review of work, on metacognition).

Clark has isolated six metacognitive skills which she believes are necessary for certain types of metalinguistic awareness. Table 2.1 lists the skills and the different types of metalinguistic awareness for which each is a prerequisite. The skills are listed in rough order of development, and within each group there is a tentative ordering of metalinguistic awareness from simple to more complex. For example the ability to monitor one's own ongoing utterances is required both to repair one's own speech and for the more complex activity of adjusting speech to the needs of the listener.

This taxonomy provides the most comprehensive categorisation system so far available to describe metalinguistic awareness. Grieve, Tunmer & Pratt (1983) use a simplified version of this system. Slobin (1978) categorises the metalinguistic development of his daughter using categories of metalinguistic awareness similar to Clark's and adds a further category - "Explicit questions about speech and language".

Other authors categorise metalinguistic awareness in relation to the levels of language that can be reflected upon. For instance Tunmer, Pratt & Herriman (1984) discuss word, syntactic and pragmatic awareness, and Van Kleeck (1984) uses the terms metalinguistic,

TABLE 2.1 METACOGNITIVE SKILLS AND AWARENESS OF LANGUAGE (from Clark 1978, p. 34)

1. MONITORING ONE'S ONGOING UTTERANCES
   a. Repairing one's own speech spontaneously
   b. Practicing sounds words and sentences
   c. Adjusting one's speech to the age and status (and language spoken) of the listener.

2. CHECKING THE RESULT OF AN UTTERANCE
   a. Seeing whether the listener has understood or not and then repairing when necessary.
   b. Commenting on the utterances of oneself and others
   c. Correcting the utterances of others

3. TESTING FOR REALITY
   a. Deciding whether a word or description works or not (and if not trying another)

4. DELIBERATELY TRYING TO LEARN
   a Practicing new sounds, words and sentences
   b Role-playing and "doing the voices" for different roles

5. PREDICTING THE CONSEQUENCES OF USING INFLECTIONS, WORDS PHRASES OR SENTENCES
   a Applying inflections to new words out of context.
   b Judging, out of context, which utterance would be politer or which more appropriate for a specific speaker
   c Correcting word order and wording in sentences earlier judged silly

6. REFLECTING ON THE PRODUCT OF AN UTTERANCE
   a Identifying linguistic units (phrases, words, syllables, sounds)
   b Providing definitions
   c Constructing puns and riddles
   d Explaining why certain sentences are possible and how they should be interpreted

metacommunication and metapragmatics. Metalinguistic refers to reflecting on language form, metacommunciation is seen as an intrinsic part of using language and metapragmatics as conscious reflection on the use of language.

Observational and experimental data has been used as evidence of metalinguistic awareness. The observational data has been collected mainly but not exclusively from children under the age of five, whilst the bulk of the experimental data comes from children over five. The following examples are taken from those cited by Clark and other authors.

2.2.1 OBSERVATIONAL DATA

a. Monitoring ongoing utterances

This skill is a prerequisite for the type of metalinguistic awareness that occurs first in a developmental framework:

Spontaneous speech repair

This involves the spontaneous correction of one's own speech to ensure successful communication and has been observed from about 18 months of age. Clark says that young children will check to see if the listener has understood them and if not they will try again. She cites as an illustration Brenda, aged 17 months, persisting with and producing seven varied approximations of 'shoe' prior to her mother's recognition of the word (from Scollon, 1976).

Clark & Andersen (1979) provide more evidence of self monitoring and repair. They collected and analysed recordings of the spontaneous conversations of some children as they developed during their third and fourth years and some single recordings of older children aged between four and seven in role playing activities. This data shows that children make use of repair strategies throughout the language acquisition period, mainly to correct those elements of language which they are currently in the process of acquiring. Phonological repairs are said to be the first to occur, these decrease with age, and are replaced in turn with a predominance of morphological, lexical and finally syntactical repairs. See also Karmiloff-Smith (1986a+b) for examples of repairs from older children.

Ultimately observations of this kind show only that children can make changes to words and sentences when they repeat them. Attributing metalinguistic purpose to them is dependent upon the observer. But Clark and Andersen believe that these repetitions do represent self monitoring and as such play an essential role in language acquisition. (see also 5.3.3)

Practising sounds, words and sentences.

This also requires the ability to self monitor. A classic example is the following, frequently quoted monologue, from Weir(1962) recorded from her son Anthony (age 2.6)

> "Back please / berries ([bɛrIz]) /not barries ([bærIz]) /
> barries /barries / not barries / berries / ba ba"
>
> Weir (1962, p. 108).

Further reports from Weir (1966) suggest that different chidren vary in the amount of sound practise that they indulge in. She says that although her other sons, also practised sounds, they did not do this as frequently as Anthony. The literature is not confined to reports of practising sounds but also includes experimenting with sentence types and substituting different lexical items within a repeated structure (see also 5.1.1.).

Adjusting one's speech to the age and status of the listener

This is the final type of metalinguistic awareness which involves self monitoring. Clark provides several examples including a report from Shatz and Gelman (1973) who found that four year olds consistently used shorter, simpler sentences to two year olds than they did to other four year olds or adults.

b. Checking the result of an utterance

This includes:

Seeing whether the listener has understood or not (and then repairing where necessary).

This activity appears to be very similar to that reported above and it is difficult to see what aspects of behaviour can distinguish it from the spontaneous repair strategies described above.

Commenting on and correcting the utterances of others

This also involves checking the result of an utterance. Clark provides several examples, among them Anthony (age 5.6) commenting about the speech of his youngest brother

"Mike says only top instead of stop" Weir (1966).

Iwamura (1980) provides data collected from two three year old girls which includes comment on and correction of phonological, phonetic, syntactic and semantic features of each others speech. (see 7.1.1 for further details and examples).

b. Testing for Reality

Only one type of metalinguistic awareness appears under this heading.

Deciding whether a particular word or description works or not and if not attempting another.

Slobin (1978) provides examples from his daughter, Heida aged four. Whilst acquiring grammatical forms Heida would try out and contrast adult forms with her own often making over generalisations until she recognized these as errors. This type of activity again appears very similar to those categorised under self monitoring.

d. <u>Deliberately trying to learn</u>

Is a prerequisite for

Practising new sounds, words and sentences

The use of "deliberate" implies conscious activity, Weeks (1974) gives examples of, what she describes as, conscious practise and self monitoring of self selected target words by Leslie aged 2.07 a child described as having "slow speech development" For example <u>dress</u> was attempted three times as [defth deth dweshl (p57) in an apparent attempt to improve her pronunciation. This type of activity can possibly be distinguished from repair in that it appears to involve solitary practise, rather than correction for the purpose of being understood. But it is not clear how it differs from **1c Practising sounds words and sentences.** It appears to depend on the observer determining how deliberate and conscious the activity is.

Role play and "doing the voices"

Clark quotes an example from Andersen (1977) of 4 year old children adjusting their speech to differentiate between different roles when playing with puppets. There have been other reports of voice changes in role play from children as young as two (Dunn & Dale 1984, and Miller & Garvey, 1984). But in this case it could be argued that what is being learnt may not be exclusively linguistic but part of a more general socialisation process.

There are limitations in using the above data as evidence of metalinguistic awareness. The examples do not provide direct evidence of the phenomenon but are dependent upon the observer's interpretation. The underlying metacognitive skills are not directly accessible to observation and can only be presumed from children's behaviour.

The metalinguistic awareness categories used by Clark are not mutually exclusive, in some instances what appear to be very similar activities can be found under two headings. Interpretation of the type of metacognitive skill being employed in such cases appears to be dependent upon such factors as tone of voice, and whether the child is interacting with someone else or indulging in a solitary activity. It can also be argued that the classification does not represent the full complexity of metalinguistic awareness. In most cases a metalinguistic activity appears to require more than one metacognitive skill. For instance practising new sounds involves not only deliberately trying to learn but also self monitoring.

e. Predicting the consequences of using inflections, words, phrases or sentences and **Reflecting on the product of an utterance**

Clark describes these last two metacognitive skills as emerging rather later than the others. These skills are also much more amenable to experimental investigation and little observational data is available. But there are observations of children **constructing puns and riddles (6c).** Such activities appear to be enjoyed by children from six or seven years upwards. Grieve, Tunmer & Pratt (1983) provide an illustration

> "Hey Dad , d'you know what sea monsters eat?
> No idea
> Fish and ships" (p. 296)

The son then goes on to explain that the point of the joke revolves around the words "ships" and "chips".

Such puns and riddles show that playing with language occurs throughout childhood. Further examples of language play are cited below and discussed in more detail in Chapter 5.

f. Playing with Language

Playing with language is often cited as evidence of metalinguistic awareness and encompasses a wide range of activities from playing with sounds to the use of pig Latin. See for example Cazden (1976), Garvey (1977) Weir (1966) and Kirschenblatt-Gimblett (1979).

These examples of playing with language are representative of a variety of skills within the Clark taxonomy, but it is not always easy to see how language play should be categorised. For example making up rhyming words could possibly be categorised as monitoring one's ongoing utterances or deliberately trying to learn.

Cazden (1976) provides examples of playing with sounds collected from various sources, including this from Matthew, (aged about two) as he was being undressed:

> "Nolly lolly, nolly, nilly nolly,
> sillie Billie, nolly, nolly". (p606)

Weeks (1979) provides many examples of the language play and games of Yakima Indian children, aged between

3.10 and 5.09. She describes oral skills as being highly valued in this group and these children as enjoying the rhythmical poetic effect of words.

For example making up words:-

> ...And then he said det det
> And he said gring gring gring
> Mik mik mik mak mik... (p.96)

(Further examples of this type of activity can be found in section 5.1.1).

Ferguson & Macken (1980) provide a wide ranging collection of examples of playing with sounds including the most sophisticated display of playing with language, devising and using secret languages and pig Latin. These have been extensively studied and involve such activities as adding syllables to words and speaking backwards.

2.2.2 EXPERIMENTAL EVIDENCE

Experimental investigations of metalinguistic awareness range from assessing the ability to judge syntactic acceptability to the ability to segment language into its component parts. A link between a child's performance on these tasks and his reading ability is frequently sought (see section 2.7). The majority of these abilities can be categorised within the last two sections in Clark's taxonomy, examples are cited below.

a. Predicting the Consequences of Using Inflections, Words, Phrases or Sentences

Making judgements about language comes within the first of these categories. This has been experimentally assessed in young children by using puppet activities to access judgements of relative politeness (Bates, 1976) and appropriate speech styles (Andersen, 1977). These experiments demonstrate that children from four upwards are aware of and can employ different speech styles, but that the ability improves with age.

Gleitman et al (1972) and De Villiers & DeVilliers (1972) attempted, with some success, to elicit syntactic and semantic judgements from two and three year old children by asking them whether sentences sounded "good" or "silly". (see 7.1.2. for further details). Hakes (1980) reviews a number of similar studies of older children.

b. Reflecting on the product of an utterance

This category has attracted the largest amount of experimental investigation and includes segmentation tasks. Such tasks have been particularly well documented and include both segmentation of sentences into words and words into syllables and phonemes. Reviews of this area are provided by Nesdale et al (1984) and Tunmer & Bowey (1984). The following researchers have carried out segmentation experiments Bruce, (1964), Fox & Routh (1975), Hakes (1980), Helfgott (1976), Calfee (1977), Liberman (1973), Rosner (1974), Barton, Miller & Macken (1980), Zhurova (1973), Ehri (1975), Holden & MacGinitie (1972) ,Huttenlocher (1964), Karpova (1966), and Karpova (1977). Overviews of the area are provided by Nesdale et al (1984) and Tunmer & Bowey (1984). Various experimental procedures have been used in segmentation investigations and there is conflicting evidence about the age at which children can successfully carry out these types of task. (Segmentation experiments will be discussed in detail in Chapter 6).

Synthesis and sound blending tasks can also be included within the area of identification of linguistic units. This ability has been investigated by Kirk, McCarthy & Kirk (1968), Roswell & Chall (1963), Goldstein (1976), and Helfgott (1976). The findings from these studies also provide variable results in respect of task success and chronological age.

The ability to provide and identify rhyming words is also seen as a metalinguistic activity which involves reflecting on and identifying linguistic units. Lundberg (1978) describes rhyme recognition as partial segmentation and believes it to be a simpler task than complete segmentation. The ability has been investigated by Bryant & Bradley (1985), Magnusson (1983) and Read (1975 and 1978). The results from these researchers show that many four year olds are capable of recognising and providing rhyming words. (Rhyming experiments are discussed in detail in Chapter 5.).

Providing Definitions

Although Clark includes verbal definition of word meanings as metalinguistic awareness she believes it to be "a rather indirect route for tapping children's awareness of word meanings " (Clark, 1978, p26). Bowey & Tunmer (1984) and Lundberg (1978) use the broader concepts of 'word awareness' and 'conception of words' as examples of metalingusitic awareness.

Papandropoulou & Sinclair (1974) and Berthoud-Papandropoulou (1978) demonstrate that young children of four and five have difficulty in separating a word from its referent. For example they gave "train" as an example of a long word and "primrose" (implying small) as an example of a short word.

The next section of the chapter reviews previous investigations of the metalinguistic awareness of language disordered children.

2.3 METALINGUISTIC AWARENESS AND LANGUAGE DISORDER

There have been comparatively few investigations of the metalinguistic awareness of speech and language disordered children, and very few of these investigations refer specifically to phonological disability. This section will review the available literature and those studies most relevant to the present investigation will be discussed in more detail in the following chapters.

Several types of experimental method have been used in these investigations. Some have compared language disordered subjects with language and chronological age matched subjects. Others have compared the performance of disordered subjects with previous investigations of normal subjects and a third group of experiments has looked at differences between language disordered subjects. The investigations have been concerned with the following aspects of awareness.

2.3.1 MONITORING ONGOING UTTERANCES

Repairing Language

Language disordered children have been found to behave differently to normal children in their use of repair strategies when experimenters have employed deliberate misunderstanding. Gallagher & Darnton

(1978) found that language disordered children were able to make repairs but appeared to be less systematic in their choice of revision strategies and did not employ either the linguistic knowledge or the linguistic strategies they had acquired to the full. Weiner & Ostrowski (1979) found that three to five year old phonologically delayed children were able to make repairs in an experimental situation when the experimenter pretended to misunderstand them. (More details of these experiments can be found in 7.1.3).

Accomodating to situation and listener

Language disordered children have been found to be sensitive to both situation and listener and they are able to select and modify their speech accordingly Fey (1981), Fey, Leonard & Wilcox (1981). Weiner & Ellis (reported in Leonard, 1983) found that phonologically disordered children made more accurate distinctions in a naming task when two potentially homonymous words appeared immediately after each other compared to when they were separated by other words. (see also 7.1.3).

Leonard (1983) in a review of the available literature on speech selection and modification in language disordered children concludes that in general these children are sensitive to the needs of the listener and the situation and are generally able to make linguistic modifications within their current linguistic capabilities.

2.3.2 LINGUISTIC JUDGEMENT

Language disordered children have been found to have inferior skills on a variety of linguistic judgement tasks when compared with normal children. Liles, Schulman & Bartlett (1977) asked normal and language disordered children aged between 5.04 and 7.04 to indicate and correct grammatical errors. They found that the language disordered children were inferior at both indicating and correcting errors. In some instances the children were able to detect errors but unable to correct them, a behaviour not found in the normal group (see 7.1.3 for further details).

Berk, Doehring & Bryans (1983) compared the ability of normal and severely language delayed children to judge emotional tone of voice. They found that the language delayed children aged between five and 11 years had inferior ability in this task. They suggest that this inferior judgement capability may result from an inability to attend to more than one aspect of language at a time.

Prinz (1982) compared language disordered children aged between five and seven with language matched normally developing children aged three to five on their ability to use and recognise degrees of politeness in request forms. The language disordered children were found to lag behind the younger normal children, on average by about two to two and a half years on this task. Prinz concludes that these findings about "metapragmatic" ability lend preliminary support to a hypothesis of an underlying pragmatic deficit influencing communicative performance.

2.3.3 REFLECTING ON THE PRODUCT OF AN UTTERANCE

Magnusson (1983) investigated the relationship between the rhyming skills and phonological production abilities of Swedish children with a diagnosis of "retardatio loquendi idiopathica" (From the description of these children it can be assumed that their major linguistic difficulty was with phonology). She found that subjects varied in their rhyming ability. There was a general tendency for those with the most severe phonological problems to be the poorest rhymers. Magnusson carried out a further investigation comparing the rhyming abilities of pre-school and school aged language disordered children with pre-school and school aged normal children (Magnusson, Naucler & Soderpalm, 1983). (See also Magnusson & Naucler, 1987 and Chapter 10). These researchers found that the language disordered children made more errors than the normal children of the same age but that the pre-school normal children made slightly more errors than the school aged language disordered children. (see section 5.1.2. for further details).

Kamhi, Friemoth-Lee & Nelson (1985) compared the performance of language disordered children with that of two groups of normally developing children, matched to the experimental group for mental age and language age, on a sentence segmentation and a word awareness task. Both the mental age and language age matched groups of normal children obtained significantly better scores on the segmentation task than the language disordered children (see section 5.1.4 for more details). Superior scores were also achieved by the normal children in the word awareness task but the difference only reached significance for the mental aged matched group. The authors conclude from their results that the language disordered children have difficulty in acquiring new linguistic knowledge and accessing and using the linguistic knowledge that they already possess.

Murray (1988) compared the metalinguistic awareness of a group of children with impaired expressive language (mean C.A 7.01) with two groups of normally developing children. One group was matched to the impaired group on the basis of comprehension ability (mean C.A. 7.0) and the other on the basis of expressive language ability (mean C.A 5.06). Using phonological, word and syntactic form awareness tasks she found that both groups of normal subjects did significantly better than the impaired group on the phonological task. There was no significant difference between the three groups on the word awareness task. On the syntactic form awareness task the comprehension matched group did significantly better than impaired and expressive matched groups. Murray concludes from these results that the metalinguistic awareness of the disordered group was selectively rather than globally impaired.

It is not possible to make other than the most general comparisons between the results of these investigations, because they used subjects of different ages with different types of language disorder and tested them on different tasks. But the following general areas of agreement emerge:

1. On some tasks language disordered children do not perform as well as normal younger children with the same level of language development.

2. When the same subjects take part in a series of metalinguistic tasks they achieve different levels of performance on each task.

3. There is considerable variation in individual subject performance within each group, particularly the disordered groups, and poor performance on

metalinguistic tasks is not necessarily related to severity of language disorder.

The currently available research therefore suggests that there are differences between the metalinguistic awareness of speech and language disordered and normally developing children. Because many of the experiments assess awareness from the subject's verbal responses it is difficult to determine whether these differences should be attributed to metalinguistic or expressive language limitations. However, in those experiments which have attempted to control for language limitations by using language ability matched controls, some language disordered children have done less well than younger normal children with comparable language development. These investigations suggest that language disordered children are not insensitive to the need to make modifications to speech output, but they may make them in ways rather different from normal children.

A wide variety of reasons have been suggested for the inferior metalinguistic awareness of language disordered children, including the inability to attend to more than one aspect of language, an underlying pragmatic deficit, comprehension difficulty and inability to access available knowledge. The basis on which these conclusions are made however is not usually discussed in any detail.

Making comparisons between these investigations and generalising the results to other language disordered children must be done with great caution. Frequently very small numbers of subjects were involved in the experiments. The nature of their linguistic problems is not always clearly specified and consequently they may not be representative of the language disordered population as a whole. In most of these investigations little information is given about subject variables which may influence metalinguistic awareness, for example language comprehension. When attempts are made to to assess the possible influence of such variables it may be difficult to assess them independently of metalinguistic awareness. For example Van Kleeck (1984) suggests that standardised language assessments may themselves be assessing some aspects of metalinguistic awareness because they are assessing language competence outside a normal communicative context.

The measures used to match the expressive language ability of language disordered and normal subjects (usually Mean Length of Utterance) provide only a quantitative measure of ability. There may be qualitative differences between the language abilities of different subjects which are not revealed by such assessments and such differences may influence metalinguistic awareness.

These factors should be taken into account when designing further investigations and in discussing the metalinguistic awareness of phonologically disordered children.

2.4 LIMITATIONS OF CLASSIFICATION AND DESCRIPTION

The previous sections of this chapter have shown that Clark's taxonomy can be used to list the wide range of behaviours that have been interpreted as metalinguistic awareness. In addition it makes possible an examination of the various types of skills that are involved in these behaviours; monitoring, correcting, learning, commenting, reflecting and making judgements.

This type of classification also demonstrates the difficulties of describing metalinguistic awareness. It shows that the categories that have been used are not exclusive but can also represent cumulative, increasingly complex, behaviour. The difficulty of distinguishing between metalinguistic awareness, reflecting on language and using language has also been demonstrated, particularly in relation to speech and language disordered children. In addition it has been shown that categorisation of the child's behaviour as evidence of metalinguistic awareness is frequently dependent on the observer's interpretation and cannot always be objectively measured.

Classification and description of metalinguistic awareness does little to illuminate its boundaries or limitations in two important respects. That is determining the boundary between language use and awareness and determining the developmental age limits of metalinguistic awareness. These two points are to some extent interrelated and are also of concern in the consideration of the association between awareness and language acquisition (see section 2.5.).

2.4.1 EXPICIT VERSUS IMPLICIT KNOWLEDGE

No consensus exists to determine the boundary between using language and reflecting upon it, or to put it in related terms, between implicit and explicit, unconscious and conscious or spontaneous and requested behaviour. Rather than attempting to make a specific distinction between implicit or unconscious and explicit conscious, metalinguistic awareness Levelt, Sinclair & Jarvella (1978) suggest a range of degrees of awareness, a continuum of awareness. They see some types of metalinguistic phenomena as being at the border between language use and language awareness, whilst others represent very deliberate reflections on language. At one end of the spectrum there are the self corrections and restarts (repair strategies) and at the other end, there is the ultimate form of explicitness, the analysis of linguistic rules. Self corrections are readily observable, universal and are present from a very early age as the examples that have been cited earlier demonstrate, whilst active analysis of linguistic rules is a highly conscious learnt activity, the province of a very small section of the population.

Clark (1978) when considering the question of implicit versus explicit knowledge equates implicit with Vygotsky's (1962) first stage in the acquisition of knowledge - automatic unconscious knowledge and explicit with his second stage - active, conscious control of knowledge. She sees Vygotsky's explicit stage as comparable to the types of metalinguistic awareness listed in her taxonomy, which includes repair strategies. She therefore appears to be in agreement with Levelt et. al. She is however careful to state that explicit knowledge of language develops gradually and that different types of awareness develop at different rates. She is also concerned about the difficulty of distinguishing between use of language and awareness of language, for example, she considers whether the ability to use a linguistic rule, such as the application of the past tense suffix 'ed' implies awareness. She says that ultimately the only unequivocal test of explicitness is specific comment.

Grieve, Tunmer & Pratt (1983) also discuss the question of determining whether the child has conscious knowledge. They suggest that a child may have metalinguistic awareness but may be unable to articulate or convey that he has this awareness, that is display the explicit knowledge he possesses because of lack of appropriate vocabulary or language ability.

2.4.1 METALINGUISTIC AWARENESS AND CHRONOLOGICAL AGE

Discussion of the relationship between metalinguistic awareness and chronological age is inevitably determined by the particular definition of metalinguistic awareness and the theoretical orientation that one subscribes to. Bialystock & Ryan (1985) believe that any consideration of age relationships is irrelevant and futile whilst the focus of investigation is still on description rather than explanation and whilst there is still no clear definition of the ability. Clark and Levelt et al would not subscribe to this view, both of them consider that the self corrections, observed from around eighteen months of age, provide evidence of the earliest form of metalinguistic awareness.

Tunmer & Herriman (1984) address the question of chronological age relationships in some detail and present the following three age related views of the development of metalinguistic awareness:

1. **Metalinguistic awareness develops concomitantly with language acquisition.**

2. **Metalinguistic awareness develops in middle childhood.** It is related to more general changes in information processing capability which occur during this period.

3. **Metalinguistic awareness develops after the child begins formal schooling.** It is seen as resulting mainly from learning to read.

It can be seen that these particular viewpoints are not only age related but raise theoretical questions about the nature and development of metalinguistic awareness. The first implies that awareness has a role in language acquisition. The second that it is a distinct kind of linguistic function related to other cognitive abilities and the third that it is essentially a product of literacy.

These alternatives serve to illustrate the difficulty of isolating age relationships from both descriptive and theoretical considerations. However age and mental development are important when considering how to design tasks for assessing metalinguistic awareness.

The next three sections of the chapter will use Tunmer & Herriman's three age related views as a framework to examine the association of metalinguistic awareness with other aspects of behaviour.

2.5 METALINGUISTIC AWARENESS AND LANGUAGE ACQUISITION

The relationship between metalinguistic awareness and language acquisition is particularly important in the current investigation where the concern is with an aspect of disordered language development. The possibility of a role for metalinguistic awareness as a necessary part of language acquisition has been discussed mainly in connection with the use of repair strategies. Levelt, Sinclair & Jarvella (1978) argue that in the early stages of aquiring any complex skill conscious attention to the basic elements of the skill is required. They extrapolate this to the process of language acquisition and suggest that the young child may have to work consciously to acquire the basic aspects of language structure and that this will involve the utilisation of repair processes.

Clark (1978) believes that to make it possible for children to move on from one stage of language acquisition to the next they must become aware of when language "fails". This involves checking language output and repairing it when required. She says that evidence of this activity is readily available:

"We suggest that the awareness of language revealed by spontaneous repairs may play an essential role in the process of acquisition itself. Without the ability to monitor, check, and then repair one's utterances, it is unclear how children go about changing a rudimentary system into a more elaborate one"
Clark & Andersen (1979, p 11).

Clark says it is more difficult to suggest a role for other types of metalinguistic awareness in the process of language acquisition as they offer fewer opportunities for investigation, principally because of the difficulty of eliciting explicit judgements from very young children at the time when the ability will probably be most critical in language acquisition.

A theoretical model which suggests a role for repair strategies in language acquisition has been suggested by Marshall & Morton (1978). They propose an error detecting monitoring and repairing mechanism (EMMA). They hypothesise that awareness arises from the operation of this error detecting mechanism, arguing that the "sheer complexity" of language requires the development of such a mechanism.

Karmiloff-Smith (1986a & 1986b) argues that metalinguistic awareness does not have a role in language acquisition. She defines metalinguistic awareness very specifically as explicit verbal comment on aspects of language, and this is distinguished from repairs which are seen as representative of unconscious meta processes. However she provides a theoretical model within which repairs and her concept of metalinguistic awareness are linked. This model is concerned with the development of internal representation, which is hypothesised as consisting of levels of increasing explicitness. This model of representation is in turn related to a three phase model concerned with the development of problem solving ability.

Cognitive hypothesis models of language acquisition which view the child as an active creative problem solver, imply a role for metalinguistic awareness in the process of language development. Menyuk & Menn (1979) for instance cite the use of avoidance and exploitation of certain phonemes in early speech production as evidence that metalinguistic awareness is being utilised in acquisition. But they also raise the question of how conscious this linguistic knowledge can be in young children (see also 5.3.3).

Ferguson & Macken (1980) discuss the possible role of play and cognition in phonological development. They are not directly concerned with metalinguistic awareness but many of the sound play examples they provide are those that other authors have used as illustrations of the phenomenon. They raise several basic issues about the role of such play in phonological development and ask

> "Is (sound) play a necessary or a sufficient condition for normal (phonological) development?"
> (Ferguson & Macken, 1980, p. 142).

These authors identify three types of behaviour that appear to be taking place in the exercise of expressive sound play which would point towards a role for metalinguistic awareness in language acquisition. These are; exploratory behaviour when the child seems to be seeing whether certain sounds are sayable; sound practice, which appears to be deliberate drilling and sound play, where mastery of the system is not obvious and where the child appears to be enjoying the sound play for its own sake.

Many Soviet psychologists and linguists regard, metalinguistic awareness as essential in the language acquisition process and argue that the preschool years are a period of heightened sensitivity to language, in particular sensitivity to the phonological structure of words. Elkonin (1971), who provides a detailed discussion of the Russian viewpoint says

> " language mastery (is) not possible without formation of activity with language as a material object with its concrete form"
> (Elkonin, 1971, p. 141)

Tunmer & Herriman (1984) argue against a role for metalinguistic awareness in language acquisition by distinguishing between two sorts of awareness; awareness of the goals of language and awareness of the structural features of utterances.

In the process of learning language they see the child as trying to make sense of the whole of his social environment, not just the linguistic input. This involves making sense of the intentions of adult speakers and the environmental context. It is this awareness of the functions and content of language not the structure of language which they believe influences language development. Awareness of the structure of language, which they equate with metalinguistic awareness, is seen as emerging later in the language acquisition process, not as developing alongside language.

Flood & Salus (1982) take a midway position between the above viewpoints. They believe that metalinguistic awareness for different aspects of language develops as language develops. Children, they say, will be most aware of those aspects that they have already learnt, will be less aware of those that they are in the process of learning and will not yet be aware of language that they have not yet acquired. They go on to provide examples of various metalinguistic activities which have been observed occurring alongside newly acquired aspects of language use.

Rejecting the notion that metalinguistic ability develops alongside and influences language acquisition Pratt & Grieve (1984b) argue that the evidence that is used to support this viewpoint is not sufficiently convincing. Discussing the repair strategy evidence they argue that awareness of failure is different from awareness of linguistic structure. They add that the evidence that has been collected of children commenting on and correcting the speech of others may be simply the result of using echoic memory to automatically edit conversation. With regard to "practising" they suggest that this may not be deliberate and (quoting Hakes, 1982) suggest that it is perhaps "more in the ears of the adults than the mouths of the children" (Pratt & Grieve, 1984b, p.23).

Given our current state of knowledge it remains impossible to say whether metalinguistic awareness is an essential component of the language development process or simply an interesting epiphenomenon, further investigation is required in the area. Currently it appears that the viewpoint that is taken depends both on the definition of metalinguistic awareness and on the theory of language acquisition that is subscribed to. But if metalinguistic awareness is a necessary condition of language acquisition then it should be possible to demonstrate it in all *children* with linguistic skill, providing a suitable method can be devised to reveal it.

2.6 METALINGUISTIC AWARENESS DEVELOPS IN MIDDLE CHILDHOOD

Authors who subscribe to this particular viewpoint, believe that metalinguistic awareness does not develop until the child has well developed linguistic ability, that is from around the age of four or five. These authors only recognise demonstrable conscious reflection as awareness, and confine their definition to Clark's final metalinguistic skill; Reflecting on the Product of an Utterance. Research which supports this viewpoint has been concerned primarily with establishing metalinguistic awareness as part of a general development of metacognitive abilities and the growth of cognitive control at this stage in childhood.

Pratt & Grieve and Tunmer & Herriman are the main supporters of this viewpoint. It was said earlier that the last named authors believe that the term metalinguistic awareness should be restricted to awareness of linguistic structure. They consider it to be a "developmentally distinct kind of linguistic functioning that emerges during middle childhood" (Tunmer & Herriman, 1984, p.27). Metalinguistic awareness does not include "automatic" repair strategies and is a product of explicit conscious control. The language system itself is treated as an object of thought with "control processes being employed to perform mental operations on the products of the mental mechanisms involved in normal language processing" (Tunmer & Herriman, 1984, p. 27).

In subscribing to such a viewpoint these authors are considering metalinguistic awareness within a Piagetian and Neo-Piagetian theoretical framework. Requirements of such activity they argue are the ability to attend to and to choose whether or not to perform the operations. Essentially they say the child must possess the ability to separate language from its conversational context. They refer to the work of Donaldson (1978) and Karmiloff Smith (1979) to support their argument. Karmiloff Smith, for instance, says that there is a general trend, as the child gets older, for language to be not only a useful tool for representing the world but also an object of cognitive attention.

Donaldson (1978) uses the term "disembedding" for this ability to think outside a supportive context. The child, she says acquires linguistic skills before he is aware of them; language is initially embedded in the events which accompany it. To be aware of language as a separate structure is to free it from its embeddedness. Commenting on Clark's taxonomy Donaldson suggests that Reflecting on the product of an utterance appears to equate with the ability to think about language independent of its use. She therefore implies, though does not explicitly state, that only this last appearing activity represents her concept of metalinguistic awareness.

Donaldson believes awareness to be enormously variable, some children will start school with a well developed ability to think about language as a separate structure whilst others will have very little notion about the nature of language. According to Donaldson reflective awareness of language represents only one aspect of disembedded thinking. The child must also be able to sustain attention and resist irrelevancies, "this question of control is at the heart of the capacity for disembedded thinking" (p. 93).

According to Pratt & Grieve (1984b) this ability to deal with language in a disembedded manner is related to underlying changes in cognitive ability which take place in middle childhood. They suggest that being able to focus attention on the structural aspects of language is equivalent to being able to "stand back" from any situation (Piaget's "ability to decenter"). In other words metalinguistic awareness is associated with a whole range of other metacognitive abilities, and is representative of a growing general ability to control one's own thinking.

In support of this viewpoint Pratt & Grieve quote Flavell's view that children become capable of directing and controlling a whole range of cognitive abilities at this stage in their development. These authors also quote the studies of Hakes (1980) and Tunmer & Fletcher (1981) who found correlations between metalinguistic and Piagetian Conservation tasks when performed by children aged between eight and ten. These results are seen by Tunmer & Fletcher as evidence of a common underlying cognitive ability which influences both metalinguistic and conservational ability.

Hakes is more cautious in interpreting his experimental results. He rejects the view that development of metalinguistic awareness should be specifically related to middle childhood. He states rather that

> "it would be unreasonable to expect an age or cognitive developmental level below which children give no evidence of metalinguistic abilities"
> (Hakes, 1980, p.39).

In doing so he uses a description of the ability very close to that used by Clark, observing that it can be found quite early in language development and suggests that it develops progressively and gradually encompasses more situations.

Although Hakes subscribes to a broad view of metalinguistic awareness his research was concerned with exploring the level of metalinguistic awareness in middle childhood and its relationship to concrete operational thought. He compared the ability of children, aged between four and eight, on three metalinguistic tasks; judging synonymy, judging acceptability and segmenting syllables and six Piagetian conservation tasks. The results showed an association between success on the various metalinguistic tasks, success increasing with age. This was interpreted as evidence of the "emergence of a *general* metalinguistic ability". A relationship was also found between this metalinguistic ability and the ability to perform the conservation tasks suggesting a general underlying ability responsible for both "advanced metalinguistic performance" and the "emergence of concrete operational thought" (Hakes, 1980, p.100).

There is an acceptance by the authors quoted in this section that regardless of the precise definition of metalinguistic awareness used it involves the ability to control one's own thinking. What is at issue between them is the relationship between the specifically linguistic behaviour and more general aspects of reflective thinking. For Grieve & Pratt it appears to be essentially part of a general underlying ability to control one's own thinking. Donaldson (1978) says that the study of reflective thinking processes is a "momentous" area, but she suggests that awareness of language, in particular the written word, may encourage the development of reflective thinking in general terms. Lloyd and Beveridge (1981) develop Donaldson's view still further by saying that reflection on language may arise from reflection on communication which in turn is influenced by the child's social situation. (See section 2.9.1).

Bialystok & Ryan (Bialystok & Ryan, 1985 and Bialystok, 1986) propose a theoretical framework which attempts to specify the "precise skills" involved in metalinguistic awareness. These authors see the development of metalinguistic awareness as the growth of two skills, which they believe are involved in all language processing, analysis of knowledge and cognitive control. Therefore within this model metalinguistic awareness is seen as part of language development. Analysis of knowledge is described as an increasing ability to use available knowledge for problem solving. Development of this skill can be influenced by a number of factors. For example judging and correcting syntactic errors is more advanced than simply recognising errors and one of the factors which may be influential in the ability to correct errors may be literacy. Cognitive control is the ability to select and coordinate information. Increase in cognitive control involves the ability to integrate more types of information. For example conversation requires a low level of cognitive control whereas metalinguistic tasks, because they usually require concentration on linguistic form as well as meaning, require a higher level of control. Development of the ability to solve metalinguistic problems is seen as the joint development of these two skills. Differences between metalinguistic awareness and other linguistic abilities such as conversation can be attributed to the different demands of these behaviours on these two skills.

These two skill requirements appear very similar to those abilities which Donaldson (1978) discusses; knowledge of the units of language and the ability to control one's thinking, and as such they link very closely with the Pratt & Grieve view of metalinguistic awareness.

2.7. METALINGUISTIC AWARENESS AND READING

The third view of metalinguistic awareness presented by Tunmer & Herriman (1984) is that it develops after the child begins formal schooling and is largely the result of learning to read. This is only one of three competing hypotheses concerned with the relationship between the phenomenon and reading. This topic has received more discussion than any other aspect of metalinguistic awareness. It is also a topic which is of particular interest for this study as it is known that children who have difficulty with the secondary linguistic skills of reading and writing are frequently reported as having earlier or concomitant primary language difficulties, particularly with articulation (see section 5.1.2).

The three competing hypotheses relating reading ability to metalinguistic awareness are:

1. Awareness is largely the result of learning to read
2. Awareness is a necessary prerequisite for literacy
3. Awareness and literacy are essentially interactive

The first two hypotheses are discussed below. (The third will be considered in sections 6.1.3 and 6.3.2. in relation to a discussion of the specific association between rhyming and segmentation tasks and reading ability).

2.7.1 READING AS A PREREQUISITE FOR METALINGUISTIC AWARENESS

There are three studies which can be used to provide some evidence to support reading as a prerequisite for metalinguistic ability. First a comparative study of Portuguese literate and illiterate adults who had had similar environmental and childhood experiences. It was found that the literate adults were significantly better than the illiterate adults on a phoneme manipulation task (Morais, Cary, Alegria & Bertelson 1979). Second Barton, Miller & Macken (1980) found that preschool children who had some reading ability were able to segment word initial consonant clusters into single phonemes whilst non readers of the same age saw the clusters as single units. Third Ehri & Wilce (1980) conducted an experiment designed to investigate whether prior experience with printed word forms assisted segmentation ability of nonsense words in two groups of subjects (mean C.A. 9.08). The results showed that phonemic awareness could be a consequence of printed word learning. These studies suggest that knowledge of reading makes some contribution to metalinguistic awareness at least as it is measured by the ability to manipulate phonemes.

Donaldson (1978) sees learning to read as having a highly significant *contribution* to make in language awareness and the control of thought processes but possibly as an opportunity to exercise awareness rather than as a necessary prerequisite to it. She believes that the written word is able to be freed from its context in a way that is not possible with the spoken word. The lasting character of the written form gives children time to think and this will provide an opportunity for reflection that they may have never had before.

Donaldson also says that although it is true that four year olds are not incapable of segmenting words they may not have *thought* of doing so. She appears to be suggesting that an environment which provides encounters with books and the opportunity to talk about words, the experience of written forms, rather than reading ability as such, is important in developing metalinguistic awareness. For some children it just so happens that introduction to reading provides them with their first opportunity for developing awareness (see also 10.4).

2.7.2 READING IS DEPENDENT UPON METALINGUISTIC AWARENESS

This hypothesis is supported by Mattingly (1972) and Liberman (1973) among others and favours the view that "reading ultimately depends on metalingusitic awareness" (Mattingly p. 144). Tunmer & Bowey (1984) suggest that the development of metalinguistic awareness may be central in learning to read.

Awareness of individual phonemes and the ability to match phonemes to graphemes is of prime importance. Phonemic awareness is particularly relevant to rhyming and segmentation tasks and Tunmer & Bowey quote evidence that prior training in phonological awareness through rhyming and sound sorting tasks can facilitate reading acquisition. (see Chapters 5 & 6 in this volume for further discussion).

The work of Bradley & Bryant (1983) (see also Bryant & Bradley 1985) also supports the hypothesis that metalinguistic awareness precedes reading. In an extensive longitudinal study these authors have demonstrated that ability on rhyming tasks is an excellent predictor of later reading and spelling ability. The link between rhyming and reading was shown to be a specific one unrelated to other abilities, for example mathematical ability. Bradley and Bryant argue from the results of their investigations that awareness of sounds is a skill that occurs as a continuum across the child population, that it is important in reading success and that it can be trained across a wide intellectual range with consequent specific improvements in reading ability. (see 5.1.3. for further discussion).

Most of the currently available evidence suggests that some degree of metalinguistic awareness is a necessary prerequisite for reading proficiency but that reading experience may also provide an opportunity to enhance language awareness and encourage reflective thinking. There is considerably less evidence to support the hypothesis that reading ability is a necessary prerequisite for metalinguistic awareness.

2.8 UNIVERSALITY AND INDIVIDUAL DIFFERENCE

If metalinguistic awareness is a necessary prerequisite for reading or if it has an essential role in language acquisition it must be possible to demonstrate its universality. It is currently not possible to determine whether all children engage in metalinguistic activity. This aspect of the phenomenon has so far received little direct attention in the literature. Observational reports of very young children have been concerned with very small numbers and there appears to have been no attempt to assess the generality of the behaviour, but it has been possible to find the following incidental comments on the subject.

Weir (1966) reports that pre sleep monologues were rare in her two younger children but like Anthony, her oldest child, they indulged in language play and actively practised sounds. Weir attributes the comparative scarcity of pre speech monologues by her two younger children both to a lack of privacy and the opportunity to practise and converse with other children. She reports for instance bedtime conversations and arguments about pronunciation between Anthony and the other children. She believes that much of sound play and practise is essentially private activity and that this will present difficulties in collecting observations. It is perhaps significant that Dunn & Dale (1984) never observed role identity and enactment, in the children they recorded, when adults were present. Children in the current study were very reluctant to play with sounds (see Chapter 8). However, Weeks (1979) says that language play and practise was common in all the children she observed in a variety of language studies.

Tunmer & Herriman (1984) in arguing against a role for metalinguistic awareness in language development, and by implication against metalinguistic awareness as a universal attribute, support their argument by citing the considerable variation found among results from metalinguistic awareness experiments. As a counter argument, it can be said that the design of the task and its meaningfulness to the child may be crucial in determining success for younger children. Task differences as much as subject variation may be responsible for conflicting experimental results. In addition the effect of the children's other abilities and possible environmental influences must also be taken into account in interpreting experimental results. Environmental influences will be considered next.

2.9 ENVIRONMENTAL INFLUENCES

2.9.1 SOCIALISATION

Lloyd & Beveridge (Lloyd & Beveridge, 1981 and Lloyd, 1982) consider the influence of the child's socialisation on metalinguistic awareness. They suggest that the very early occurrence of metalinguistic activities in mother-child interaction may facilitate the process of disembedded thinking. It seems probable, as was suggested earlier, that linguistic environments vary in conditions that encourage the development of metalinguistic awareness. Beveridge & Dunn (1980) take the discussion further however and suggest that differences in the ability to reflect on language are probably related to broader aspects of family relationships and styles of socialisation some of which will specifically encourage reflective skills. They believe that it would be difficult to argue for the development of these skills solely through *activities which specifically encouraged* reflection on language. They suggest that there will be general differences in the importance of reflective skills in the maintenance of the parent child relationship. (See also Chapter 9 this volume).

Wells (1981) considers the role of linguistic environment in the development of literacy. He believes that early development of literacy is related to the linguistic interest and involvement of parents. Certain factors; the number of books in the house, adults sharing books and reading with children, responding to children's conversational initiation, and drawing attention to inadequate communication are seen as particularly important to superior literacy skills. Wells suggests that these types of experience help the child to use language as a means of disembedded thinking in which case it enhances metalinguistic awareness. This parental linguistic interest is perhaps more likely to be found in middle class homes but is not confined to them and can be seen in all social groups.

There appears to be only one study which looks specifically at the relationship between socio economic environment and metalinguistic awareness. Wallach, Wallach, Dozier & Kaplan, (1977) investigated the ability of disadvantaged and middle class children to perform a speech discrimination task and phoneme recognition and identification tasks. They found no significant difference between their groups of subjects on the discrimination task but a significant difference on the metalinguistic task. Tunmer & Myhill (1984) suggest that an impoverished language environment may result in the poor development of metalinguistic skills, but do not take the issue further.

The Wallach study is valuable not only in socio economic terms but also as an indication that metalinguistic awareness does not seem to be related to auditory discrimination. They appear to be separate skills. There appear to be no other investigations which consider the association between psycholinguistic abilities such as discrimination and memory and metalinguistic awareness.

2.9.2. METALINGUISTIC AWARENESS AND BILINGUALISM

The relationship between a bilingual environment and metalinguistic awareness has received some attention, particularly by Tunmer et al (1984). Reviewing the available evidence these authors suggest that exposure to more than one language enhances metalinguistic awareness. Slobin's daughter, Heida who displayed wide ranging and explicit awareness of language from a very early age was exposed to a variety of foreign languages between the ages of 2.09 and 3.11. Slobin (1978) suggests that this rather untypical situation may have stimulated her early interest in language. Leopold's daughter (Leopold, 1949), another frequent source of metalinguistic evidence, also had constant exposure to more than one language.

Tunmer et al (1984) discuss possible reasons for the influence of bilingualism on metalinguistic awareness, they suggest that children in this situation may be forced into the process of separating the languages to make sense of them. They cite Ben-Zeev (1977) who believes the child has to develop coping strategies which may accelerate some aspects of cognitive development. They also quote Vygotsky (1962) who discusses the relationship between words and their meaning. When an object has two names, the words that represent the object become more detachable from that object, as a consequence metalinguistic awareness is enhanced.

This discussion on the relationship between environment and metalinguistic awareness suggests that exposure to more than one language assists in the ability to reflect upon language but the question of whether this is a specific linguistic influence or part of a broader influence as Beveridge & Dunn (1980) suggest must be left to further research.

2.10 CONCLUSION

Five questions which were considered pertinent to the study of the metalinguistic awareness of phonologically disordered children were posed at the start of this chapter. An examination of the available literature has shown that there is no clearly defined framework within which to base an investigation of metalinguistic awareness.

There is no agreed definition or description of the phenomenon Researchers have determined their own criteria of what constitutes metalinguistic awareness and carried out their investigations accordingly. As a result there is no definitive information available about the relationship between metalinguistic awareness and other variables such as chronological age. The available theoretical models of metalinguistic awareness highlight the complexity and extent of this field of study. Marshall & Morton (1978) are concerned with the specific process of repair. Bialystok & Ryan (1985) suggest the operation of two interactive skills and Karmiloff-Smith (1986 a & b) is concerned with development and change in mental representations.

Some of the available evidence suggests that language disordered children have metalinguistic awareness which is inferior to that of normally developing children of the same age, and in some instances inferior to that of younger children with the same level of language development. Therefore despite the problematical nature of of the phenomenon it was considered that metalinguistic awareness was an appropriate area of study to further knowledge about phonological disorder. Accordingly a pilot study was carried out which attempted to take into account some of the problems cited above; this study is described in the next chapter.

CHAPTER 3
THE PILOT STUDY

The present investigation consists of three parts

1. A pilot study to establish the design of the experimental tasks to be used in the main investigation.

2. The main investigation: a comparison of the metalinguistic awareness of normal and phonologically disordered children.

3. A follow up study to compare changes over time in the metalinguistic awareness of the children who took part in the main investigation.

3.1 THE NEED FOR A PILOT STUDY

Three main, interrelated factors indicated the need for a pilot study, the paucity of previous research in this area, the problematical nature of metalinguistic awareness itself and the age range of suitable subjects.

3.1.1 THE LACK OF PREVIOUS RESEARCH

At the start of this investigation, apart from the work on revision strategies by Gallagher & Darnton (1978) and Weiner & Ostrowski (1979) (see section 2.3.1) there appeared to be no investigations which had examined awareness of the phonological aspects of language in the language disordered population. There were therefore no exisiting studies which could be replicated or used as the basis for further investigation.

3.1.2. THE NATURE OF METALINGUISTIC AWARENESS

The review of the literature in Chapter 2 shows that there is no agreed definition of metalinguistic awareness. There is controversy about what constitutes a metalinguistic task and conflicting information about the age at which children become capable of successfully accomplishing such tasks. These problems are further exacerbated by the wide variety of experimental methods which have been used to assess those activities which, it is commonly agreed, do tap metalinguistic awareness, for example rhyming and segmentation. As a consequence no agreed methodolgies or standardised norms of metalinguistic awareness exist for normal children which can be used with phonologically disordered children.

3.1.3. THE AGE RANGE OF SUITABLE SUBJECTS

Two factors restricted the upper age limit of subjects suitable for the investigation and consequently restricted the experimental methods that could be employed. The factors concerned were learning to read and exposure to speech therapy. To accommodate to the possibility that acquisition of literacy has an influence on the development of metalinguistic awareness it was decided that the experimental population should be confined to those children who had received no formal education. Speech therapy treatment could also be considered to provide an enriched linguistic environment. Even if speech correction did not trigger awareness this experience may have had a positive influence on metalinguistic awareness. All the children in the investigation therefore were new referrals to speech therapists (see 4.2.1.).

The decision to avoid as far as possible these potential influencing factors meant that the experimental population would have to be recruited from children under the age of five. (Children in Lothian Region enter school between the ages of four and a half and five and speech therapy screening leads to therapy being provided shortly after the age of four). The experimental population would therefore consist of children whose cognitive and attentional limitations may limit the range of suitable experimental tasks and affect participation in an experimental situation.

3.2 THE AIMS OF THE PILOT STUDY

The aims of the pilot study were;

1. To devise a variety of tasks concerned with the phonological aspects of language, each task assessing different kinds of metalinguistic awareness.

It was decided to restrict the experimental tasks to those which assess metaphonological awareness rather than awareness of other aspects of language because children with specific phonological disorder were the focus of the investigation. The tasks were selected to represent a range of metaphonological skills at presumed different developmental levels.

2. To devise metalinguistic tasks appropriate to the cognitive and attentional capabilities of pre-school children. They therefore had to consist of activities and materials that were meaningful and attractive, use instructions that could be easily understood and require responses that, as far as possible, would not penalise shy children or those with possible expressive language limitations.

3. To devise tasks with materials that are easily portable so the subjects could be seen in nursery schools and clinics rather than a laboratory. In addition tasks which use simple materials are more

easily replicable and lend themselves to use as clinical assessments.

3.3 THE EXPERIMENTAL TASKS

The description and categorisation of metalinguistic awareness, devised by Clark, (see Table 2.1, p. 47) provided the framework for designing the experimental tasks. It suggests what metacognitive skills may be involved in different kinds of metalinguistic tasks and indicates developmental progression. Five tasks were devised from the Clark taxonomy. These are described briefly below and detailed descriptions are included in the accounts of the respective experiments in the main investigation.

3.3.1 EXPERIMENT 1: RHYMING

This task requires the selection of the odd one out, i.e. a non-rhyming word from a series of rhyming words. It involves recognition of shared linguistic features of words and can be described as utilising the metacognitive skill of **Reflecting on the Product of an Utterance (see 2.2.2.2 and Chapter 5).**

3.3.2 EXPERIMENT 2: SEGMENTATION

The child is asked to segment the first sound of pictured words. The experiment involves the identification of linguistic units and is another activity which involves Reflecting on the Product of an Utterance (see 2.2.2.2 and Chapter 6).

3.3.3 EXPERIMENT 3: PRONUNCIATION ACCEPTABILITY

In this task the child is asked to make a judgement about the acceptability of another persons pronunciation and correct phonological errors in this pronunciation. Within the Clark categorisation this activity would be described as Checking the Result of an Utterance. This skill is described as developing rather earlier than the first two tasks (see 2.2.1 and Chapter 7).

3.3.4. EXPERIMENT 4: PHONOTACTIC CONSTRAINTS

This experiment involves choosing between and imitating possible and impossible English nonsense words. This task can be placed within Reflecting on the Product of an Utterance but it is rather different from the other tasks in this category (see Chapter 8).

3.3.5 EXPERIMENT 5: TALKING ABOUT TALKING

In this experiment the children were asked a series of questions to encourage them to make explicit comments about factors which might affect pronunciation and speech development. It is difficult to state specifically what metacognitive skill is employed in this activity. Talking about the structure of language is classified as Reflecting on the Product of an Utterance (2.2.2) . Talking about talking obviously involves reflection but whether it requires skills as advanced as reflecting specifically on language structure is debatable (see Chapter 9).

3.4. PILOT STUDY SUBJECTS.

A total of 22 normally developing children, 10 boys and 12 girls took part in the pilot studies. They had an age range of 3.10 to 4.10 (mean 4.01). All the children came from mono-lingual families and were thought to have normal language development, although this was not formally tested. The children had no known hearing, neurological or psychological problems.

The children attended a local authority nursery school in an Edinburgh suburb. Children from this nursery school were chosen for the pilot study because the area has a mixed social population, though the majority of the children's parents are skilled manual and non-manual workers. Currently little is known about the influence of socio economic background on metalinguistic awareness apart from the findings of Wallach et al (1977) (see 2.9.1) but it is possibly an affecting variable. It was felt that this population was sufficiently representative of a broad variety of socio-economic backgrounds.

The nursery school teaches the children some basic number concepts but there are no specific activities in their programme directed towards reading or pre-reading skills.

3.5. THE PILOTING PROCEDURE

Each task was based on previous investigations where these existed. The materials and presentation of the activities were adapted in response to the children's reactions and ability to perform the task until they appeared to be within the capabilities of this group of children. A set of standardised instructions and procedures was then compiled and this was used with a final group of children.

Varying numbers of the 22 children participated in the construction of each task. A minimum of nine children who had not had any exposure to the materials and presentation during the formulation stages participated in each final version. Further details of the piloting of each task can be found in the appropriate chapter dealing with the main investigation.

At all stages of the piloting the children were seen individually in a small room adjacent to the nursery classroom. All the sessions were tape recorded. These recordings were used to assess the children's responses, the presentation of the task and the interactions between child and adult as an aid to devising the final versions of the experiments.

The pilot studies demonstrated that it was possible to design a variety of appropriate tasks that could be used to compare the metalinguistic awareness of phonologically disordered and normal pre-school children. Furthermore the children's enthusiastic responses showed that these activities were meaningful and enjoyable for this age group.

CHAPTER 4

THE MAIN INVESTIGATION

This chapter introduces the main investigation. It contains a description of the general aims of the investigation, information about the subjects and the general experimental procedures. It also provides the results of assessments carried out before the investigation and descriptions of the phonological characteristics of the children.

4.1 THE AIMS OF THE INVESTIGATION.

The main investigation had four aims:

1. The assessment of the metalinguistic awareness of phonologically disordered children.
2. A comparison of the metalinguistic awareness of phonologically disordered and normally developing children.
3. An assessment of the relationship between metalinguistic awareness and other variables such as chronological age, auditory comprehension and non-verbal intelligence.
4. An examination of the relationship between the metalinguistic tasks used in the investigation.

4.2 SUBJECT SELECTION

4.2.1 THE PHONOLOGICALLY DISORDERED GROUP

The following descriptive and quantitative criteria were used to select the phonologically disordered group (PDG).

1. The main characteristics of phonological disorder as described by Grunwell (1981) (see section 1.5).

According to these criteria phonologically disordered children have

a. Normal hearing

b. Adequate intelligence for speech development

c. No detectable anatomical or neurological abnormalities.

These criteria were used to ensure that the subjects had a specific phonological disorder rather than more extensive linguistic or intellectual problems.

2. A score of 85 or less on the Edinburgh Articulation Test. (E.A.T.) (Anthony, Bogle, Ingram & McIsaac, 1971)

The E.A.T. was standardised on Edinburgh children. A score of 85 or less is the recommended screening threshold and indicates a delay in this area of development which is outside the range of normal variation. This score is equal to minus one standard deviation, for this assessment, and represents, the level, below which therapeutic intervention may be required.

Potential subjects were identified from the waiting lists of speech therapists employed by Lothian Health Board. Consent for referral to the project was obtained from the parents of each child but no parents refused permission for a child to be included in the project. (See Appendix 1 for the letter to the speech therapists requesting children for the investigation and a copy of the consent form to be signed by the parents).

No child in the investigation had received any speech therapy treatment prior to the investigation and, with one exception, they had not started school. All the children had Scottish or English parents and came from mono-lingual English speaking backgrounds.

4.2.2. REJECTED PHONOLOGICALLY DISORDERED CHILDREN

Twelve children who were referred to the project were not suitable for inclusion in the final group. Seven of them scored above 85 on the E.A.T. Two of them had been at primary school for more than one term, and one child, although still at nursery school, was apparently a fluent reader. The two remaining children had obvious additional difficulties, one was receiving treatment for chronic upper respiratory tract infections and fluctuating hearing loss. The other child presented with behavioural problems and general cognitive delay and was subsequently referred to the child guidance clinic.

4.2.3. SELECTION OF NORMALLY DEVELOPING SUBJECTS

Two local nursery schools provided the pool of possible subjects from which the normally developing group (NDG) was chosen. The criterion for selection was a standard score of 100 or above on the E.A.T. Final selection of these subjects was governed by the requirement to provide a group that matched the characteristics of the phonologically disordered group. That is, both groups contained the same numbers of males and females with comparable ages and family backgrounds. But no attempt was made to match individual children across the groups.

Like the phonologically disordered group no member of this group had any known intellectual or hearing handicap and they all came from mono-lingual backgrounds and had Scottish or English parents.

Parental consent was requested and given for all the children to participate in the investigation. No parent refused permission for their child to be included in the group. (See Appendix I for the letter explaining the project and the consent form.).

4.3. THE SUBJECTS SELECTED.

Twenty one of the children referred by the speech therapists satisfied the selection criteria and were included in the final phonologically disordered group (Subjects A1 to A21). The same number of normal children were chosen to form the normally developing group (Subjects B1 to B21).

4.3.1 E.A.T SCORES

The standard scores obtained by the selected subjects on the E.A.T can be found in Appendix 6, Table A, (PDG), Table B (NDG). The range, mean and standard deviations of these scores for both groups was:

Group	Range	Mean	S.D.
PDG	53-85	74	9
NDG	101-149	121	15

4.3.2. SEX AND AGE DISTRIBUTION

There were 15 boys and six girls in each group. A ratio which appears to support the reported incidence of phonological disorder. The age range of the PDG subjects was 3.08 to 5.05 (mean 4.02) and the NDG subjects 3.10 to 4.09 (mean 4.03), the ages of individual subjects can be found in Appendix 6 Tables A & B.

4.3.3 SOCIAL BACKGROUND

Social background was not controlled in subject selection and as a result subjects came from a variety of family backgrounds.

Social background was determined by using a socio environmental formula devised by Wells (1981 & 1982). This is a more sophisticated and linguistically more sensitive index than the Registrar General's categories, which are based on fathers occupation. The Wells formula takes into account the current or previous occupations, and the amount of education, of both parents.

A numerical score is given for each of these factors. These scores are totalled and converted into a letter score for each family, A, B, C, or D. An A is allocated to a family where both parents received further education and have, current or previous professional occupations, whilst D represents two parents with minimum education and unskilled occupations. Wells does not provide any information about the relative proportions of each group in the total population but he suggests that approximately 50% of total families, might belong to group C.

Tables A and B, in Appendix 6 show the family backgrounds of each subject. Table 4.1 shows the distribution of phonologically disordered and normally developing children in each socio-environmental group.

Table 4.1 Number of Subjects in each Social Group

Subj. Group	Social Group A	B	C	D	Totals
PDG	4	5	9	3	21
NDG	3	8	8	2	21
Totals	7	13	17	5	42

There is a greater concentration of normally developing subjects in Group B, but it is considered that the social backgrounds of the groups are comparable and they appear to be fairly representative of the population as a whole.

4.3.4 EDUCATIONAL EXPERIENCE

All the children had some pre-school social experience with other children. Eighteen of the phonologically disordered children and all the normally developing children attended local authority nursery schools for half of each school day. One of the phonologically disordered children (A1) was in his first month at primary school. The two remaining phonologically disordered children (A11 and A14) attended play groups two or three times a week.

4.3.5 OTHER PRE-INVESTIGATION VARIABLES

In addition to the metalinguistic tasks and the E.A.T. the children were assessed on a variety of standardised assessments and non-standardised measures of ability (the results of the assessments are discussed in 4.5). The assessments used were:

1. **The Reynell Developmental Language Scales (Comprehension) (R.D.L.S.) (Reynell, 1977).**

2. **The Wechsler Pre-School and Primary Scale of Intelligence, Performance Scales (W.P.P.S.I) (Wechsler, 1967).** This provided a measure of non verbal intelligence to determine whether there were any cognitive non-linguistic differences between the two groups of subjects.

3. **The Auditory Sequential Memory sub test of the Illinois Test of Psycholinguistic Abilities (I.T.P.A.)** (Kirk, McCarthy & Kirk 1968) was used to assess auditory memory.

4. **Auditory Discrimination**

In the absence of a satisfactory standardised auditory discrimination task one was devised for the investigation, based on Locke (1980).

This task utilised minimal pair words in an ABX format . The participant was auditorily presented with a minimal word pair, for example "wing" and "ring", and was then asked to match a second presentation of one of the words to the appropriate member of the original pair. Further details of the task, the full list of words and the instructions for administration can be found in Appendix 2.

In addition to these quantitative measures the following aspects of behaviour were assessed.

Hearing Acuity

It was not possible to carry out audiometric tests on the subjects. The experimenter observed the children during the assessments and experiments for any indication of possible hearing failure. In addition all the parents of the phonologically disordered children completed a questionnaire on current hearing ability and upper respiratory tract infection history. (this is reproduced in Appendix 3).

The questionnaires revealed that some of the children had a history of isolated episodes of Otitis Media, but in no child did this appear to be a chronic or frequently recurrent problem. None of the parents suspected any current hearing loss and their answers to the questionnaires supported their opinions. Three children were referred for audiometric assessment on the basis of the speech therapists or the investigators observations. The results were in all cases negative.

Expressive Language Level

A general level of the expressive language development of each child was obtained by assessing the syntactical development of the children. An elicited Language Assessment Remediation and Screening Procedure devised by Ainley (1982) from Crystal (1976) was used for this purpose. Using this procedure it was possible to determine that all the children in the investigation had expressive language levels above approximately 3.06. This procedure provides only a general estimate of expressive language and no comparative scores are available.

Phonological Characteristics

The phonological characteristics of each child were obtained by carrying out a phonological process analysis. Transcriptions of the E.A.T. assessment were used as a data source for this analysis. The results and discussion of this analysis can be found in section 4.6 .

4.4 ADMINISTRATION OF THE PRE INVESTIGATION ASSESSMENTS AND THE EXPERIMENTAL TASKS.

Each child was seen individually. Most frequently the tasks and assessments were carried out at the children's nursery schools in rooms adjoining or close to their classrooms. A few of the phonologically disordered children were seen in speech therapy clinics or were visited in their own homes. In these locations mothers were sometimes present in the room but took no part in the activities.

The assessments and tasks were always administered in the same order, using standardised introductions and instructions. The E.A.T was administered first as the basic selection assessment. This was followed by the language assessments and the auditory discrimination and sequential memory assessments. The W.P.P.S.I was administered next. The metalinguistic experiments were then administered in the following order; Rhyming, Segmentation, Acceptability, Talking about Talking and Constraints. The total administration time for each child varied between two and three hours spread over three to five visits. Normally each child was visited once a week until the activities were completed but there were some exceptions to this pattern because of holidays or illness.

4.5 RESULTS OF PRE-INVESTIGATION ASSESSMENTS

The scores obtained by the subjects on the R.D.L.S. (Comprehension), the W.P.P.S.I (Performance Scale), I.T.P.A. (Auditory Sequential Memory) and the Auditory Discrimination assessments can be found in Tables A and B in Appendix 6. Table 4.2 shows the means and standard deviations of these scores.

Table 4.2 Group Means and Standard Deviations of Pre-Investigation Asssessment Scores

Assessment	Subj. Grp.	Mean	S.D.
R.D.L S (St.Sc.)	PDG	0.3	0.5
	NDG	0.8	0.6
W.P.P.S.I (I.Q.)	PDG	111	9
	NDG	115	10
Audit.Mem. (St.Sc.)	PDG	42	9
	NDG	41	6
Audit.Dis. (Raw Sc/40	PDG	27	6
	NDG	28	5

There is little difference between the mean group scores on these assessments with the exception of those obtained on the R.D.L S. A Mann-Whitney *U* statistical test was carried out to see if the difference between the language comprehension of the two groups was significant. The result was:

$U = 140$, $p < 0.05$ level (two tail, tie corrected).

This small but significant difference is a possible indication that the problems of the phonologically disordered group are not confined to the phonological aspects of language (see section 1.2.3).

The Standard Deviations in Table 4.2 show that the distribution of scores on these assessments is similar for both groups with the exception of Auditory memory where the phonologically disordered group have a wider distribution.

Kendall Rank-Order Correlation Coefficients (T) were calculated to determine if there was any association between these variables and the E.A.T. and Chronological age for the total population. The results are presented in Table 4.3.

This table shows that the only significant correlation obtained between the E.A.T and other variables was with the R.D.L.S. (T=0.33, $P<0.01$). There were also significant correlations between the R.D.L.S. and the other three assessment variables, all significant at the 0.01 level.

Table 4.3 Kendall Rank-Order Correlation Coefficients (T) of E.A.T and other Pre-Investigation Variables

	EAT	CA	RDLS	WPPSI	A.MEM
EAT	-				
CA	0.12	-			
RDLS	0.33**	-0.03	-		
WPPSI	0.15	-0.13	0.45**	-	
A.MEM	0.10	-0.02	0.34**	0.15	-
A.DIS	0.14	0.20	0.36**	0.19	0.17

** Significant at 0.01 level

4.6. PHONOLOGICAL CHARACTERISTICS

This description of the subject's phonological characteristics provides an indication of their level of phonological development and enables identification of any differences in pronunciation patterns, both within and between the two groups of subjects. This information is not directly available from the E.A.T. scores, but the data collected during this assessment was analysed to determine the phonological simplifying processes operating in the speech of all the children.

4.6.1 ANALYSIS PROCEDURE

Phonological process analysis (Stampe 1979) was used to analyse the data. This method of analysis has a developmental perspective and is suitable for analysing both normal and disordered phonological development. General comparisons can therefore be made between level of phonological development and chronological age and between developmental measures of other variables. It can also be used to determine whether a child is using normal developmental processes or atypical (unusual or idiosyncratic) processes. And the present data can be compared with data from previous research into phonological disorder (this was reviewed in 1.3.2).

Process analysis is derived from the theory of Natural Phonology proposed by Stampe (1979). This theory was originally formulated as an explanation of normal phonological development but it has increasingly been used to describe patterns of disordered phonology.

The essence of the theory is that phonological processes are simplifying, innate, universal, mental operations that serve to accommodate to the neuromuscular limitations of the young child. The processes operate by merging potentially contrasting classes of sounds or sound sequences to the articulatorily 'easiest' member of the contrast. For example the contrast between fricative /s/ and plosive /t/ is lost in the *Stopping* process in which manner, frication, is simplified to stopping but the place of articulation is maintained. As the child gets older and the articulatory mechanism develops the processes are suppressed, or revised, and the child moves towards the adult system. In the current investigation process analysis is used purely as a descriptive tool, no explanatory significance is implied and there will therefore be no attempt to evaluate the theoretical basis.

Several analytical frameworks based on process analysis are available (see for example Grunwell, 1982 & 1985, Hodson, 1980, Ingram, 1976 & 1981, Shriberg & Kwiatkowski, 1980 and Weiner, 1980). There are strong similarities between these frameworks, but they may use different terminology or classify and organise the processes in slightly different ways. The descriptive framework used in this investigation is closest to that of Grunwell (1982 and 1985). This framework provides a developmental chronology of processes, it distinguishes between structural and systemic simplifications and attempts to deal with atypical processes.

Table A, Appendix 4 lists the developmental processes used to analyse the current data. This table indicates whether the processes are structural or systemic and provides illustrative examples from the current data. The table is arranged in broad chronological stages according to the age by which processes are expected to disappear in normal development. Grunwell (1985) cautions that these stages are only general approximations and that variations of six months either way can be expected in normal development.

4.6.2 THE DATA BASE

There are limitations in using the E.A.T data for this analysis. It provides only a limited sample of each child's output and can therefore indicate only general levels and trends in phonological behaviour. The E.A.T. does not represent the range and distribution of all possible adult targets or allow for repeated representations of identical targets. Consequently the analyses do not fully reflect the number and distribution of processes that may be operating and do not allow for the assessment of possible variation in the use of processes in repetitions of the same word, or in a wide variety of phonetic contexts.

However the use of an identical sample for each child does have the advantage of allowing quantitative comparisons to be made between the subjects and across the two groups. It is therefore considered, even though only general inferences can be made, that this data is satisfactory for current descriptive and comparative purposes. For clinical purposes where therapeutic decisions and planning are made on the basis of analysis this amount of data is insufficient. For such purposes a minimum sample of 100 words (Crystal, 1982) or 200-250 words (Grunwell, 1985) is advised. The E. A. T. contains 41 words.

4. 6. 3 PROCESS ANALYSIS RESULTS.

The analysis revealed the number of developmental and unusual/idiosyncratic processes each subject was probably using, the nature of these processes and the types of processes used by the groups as a whole.

a. <u>Phonologically Disordered Group</u>

Developmental Processes

Table B Appendix 4 lists the number and type of developmental processes used by each phonologically disordered subject, arranged in broad chronological order. Each of these subjects used between 7 and 12, (mean=9) out of a possible fifteen processes.

Although all the subjects used a similar number of processes there was wide variation in the types of processes they used. Each child presented with a unique pattern of phonological behaviour and there were no identical combinations of processes, but they all used both systemic and structural simplifications.

The frequency with which each child used each process was very variable. There were very few instances of obligatory use of processes, that is the operation of a process for every appropriate word and contextual situation within the data sample. Table B shows that *Stopping /s & z/*appears to be obligatory for two children and *Fronting /k, g, ŋ/*for three children. *Fronting /ʃ,tʃ,dʒ/* and *Substitution /θ & ð/* are both obligatory for one child. Obligatory operation although present is not therefore a frequent phenomenon for this group of children.

When a process is used optionally frequency of occurrence appears to be particularly affected by the contextual situation. For example *Cluster Reduction* and *Stopping* appear to be particularly prevalent word initially. There were some instances of single or rare occurrences of a process. This may indicate a persisting example of a long resolved process or the remnants of process currently being resolved.

For these phonologically disordered children non occurrence of a process does not automatically imply attainment of the adult target; the child may be using a different developmental or atypical process in such a situation.

Information about the relative occurrence of different processes for the group as a whole can also be obtained from Table B. Two processes *Cluster Reduction* and *Fricative Substitution* of /θ & ð/ by /s & z/ or /f & v/ were used to some extent by all the twenty one children in this group. Both types of *Fronting* together with *Vocalisation* were also used by most of these children. On the other hand *Weak Syllable Deletion* was used by only one child and there were no examples of *Reduplication*. All the other processes were used by at least one third of the children and the majority of them by over half the group.

Clear developmental trends were not apparent in the use of processes. It is of interest that there is no example of *Reduplication*, the earliest resolving process, and 100% use of *Substitution* /θ&ð/ by other phonemes but apart from these two extremes of the developmental spectrum no clear developmental picture emerges.

Atypical Processes

This group used some processes which could not be classified within the commonly documented developmental processes listed above. In the literature describing such processes the term 'unusual' has been used to refer to infrequent processes observed in normal development, whilst the term 'idiosyncratic' has been used for those processes which appear to be confined to phonologically disordered speech. Because the use of this division is somewhat problematical the term 'atypical' will be used here for all non-developmental processes and no attempt will be made to sub-divide them further. (see Grunwell, 1982 & 1985 and Ingram, 1976 for further discussion).

All the phonologically disordered children had some atypical processes. Table C Appendix 4 lists these processes and shows which children used them. They used between one and three processes each, a third of the group using three, a third two and the remaining third, one atypical process.

Glottal Insertion/Replacement was the most commonly occurring atypical process. It was used by 17 of the children. For six of them it appeared to be a very prevalent process, occurring in a variety of contexts and substituting for a wide variety of phonemes. For the other 11 children this process tended to be confined to word final position and was usually substituted for stops.

Other atypical processes occurred with much less frequency. Six children showed *Free Variation of Approximants*, in particular they appeared to freely interchange /r, w & l/. Four children used a *Backing* process, which could include both backing alveolar stops to velar and bi-labial stops to alveolar. Three children had *Initial Consonant Deletion*.

There was no obligatory use of atypical processes but two children used them very frequently. For example subject A11 used *Initial Consonant Deletion* for all stops and some other phonemes and *Glottal Replacement* to a lesser but still frequent extent. Subject A10 also made considerable use of *Glottal Replacement* and *Backing*. The use of the remaining atypical processes tended to be infrequent and in some instances may have represented isolated frozen forms lingering from infancy.

b. Normally Developing Group

Developmental Processes

The data from the normally developing subjects shows that, even though they had at least average articulatory ability for their age as measured by the E.A.T, phonological development is not yet complete. Table D, Appendix 4 shows the type and number of processes used by each normal child. Only one child (B16) attained all the adult target phonemes. The other twenty used between one and six developmental processes (mean=3).

Most processes occurred in the group data but in the vast majority of cases there was very restricted use of a process. It is therefore appropriate to look at all aspects of the use of processes together.

Nineteen of the 21 subjects used the *Fricative Substitution process /θ& ð/ -> /s &z/ or /f & v/.* For three children it appeared to be an obligatory process. *Fronting of Palato- alveolars* was also a common process in this group (13 subjects). These particular processes together with *Gliding* (used by 6 subjects) tended to be used frequently by a child if they occurred in its system. These processes are reported in the literature as late to resolve. The pattern observed in this group therefore appears to reflect the expected phonological developmental level for this age group.

Vocalisation, and *Cluster Reduction* are the only other processes that occurred with any frequency in this group. *Cluster Reduction* was used by thirteen subjects but in most instances it was confined to a particular phonemic combination or was an isolated occurrence. Other processes noted in Table D are isolated examples, and, as with the phonologically disordered group, these may be possible remnants of long resolved processes retained for a specific word. The use of the *Harmonisation* process in the word "yellow" is particularly notable here. One child produced it as [wɛwo] and one as [lɛlo].

Atypical Processes

Isolated atypical processes were noted in the data of six of the normally developing children, these were infrequent or single occurrences and may represent remnants of infantile productions or possibly normal assimilations. Three of these children had some free variation of Approximants and the other three would, in some contexts, substitute /θ & ð / by /l, r, or n/.

4.6.4 DISCUSSION OF PHONOLOGICAL ABILITIES

This discussion will focus on three main points:

1. The differences in phonological behaviour between the two groups of children.

2. The variations in phonological ability within the phonologically disordered group.

3. The extent to which this group of phonologically disordered children compares with the phonologically disordered population as a whole.

a. <u>Comparison of the Two Groups of Subjects</u>

As would be expected clear differences are apparent in the phonological abilities of the two groups of children. The phonologically disordered children used many more developmental processes than the normal children and they used them much more frequently. They also used more atypical processes, again more frequently, all the phonologically disordered children used atypical processes compared with six of the normal children.

There were also some similarities between the two groups. One process *Substitution of /θ & ð /*, a late resolving process was used by virtually all the children, 21 disordered and 19 normal. However it appeared to be an obligatory process for only one disordered and three normal children. Two other processes, *Cluster Reduction* and *Fronting Palato Alveolars* were used by the majority of phonologically disordered and over half of the normally developing children, although with less frequency.

Both groups of subjects therefore share the use of some processes and in one instance they used them with equal frequency. Some other processes are used by the majority of subjects, but less frequently by the normal subjects. The remaining processes are used predominantly by the phonologically disordered children but also infrequently by a few normal children. This pattern of occurrence shows that the two groups differed most in the extent rather than in the kind of processes they used.

This finding suggests that this group of phonologically disordered children have essentially delayed rather than deviant phonology. This result supports the work of Schwartz, Leonard, Folger & Wilcox (1980). These authors compared the phonological characteristics of phonologically disordered and younger normally developing children and found that the phonological behaviour of the disordered children, aged between 3 and 8 years, was comparable to that of normally developing children of 18 to 24 months.

The phonologically disordered children in this and other studies therefore appear to have much in common with normal children. However it is not possible to assume that the disordered children in this investigation are simply delayed in phonological development. They also demonstrated characteristics that were not shared with the normal children. In particular, seventeen of them made use of *Glottal Insertion/Substitution* a process that did not occur at all in the normal data. Grunwell (1985) reports this to be a process that is frequent in, and apparently largely confined to disordered phonology.

The groups may also differ in ways that have not been tapped by the current limited data sample and analysis. For example little information is available about variablity of production, a common characteristic of phonologically disordered children according to Stoel-Gammon & Dunn (1985).

Grunwell (1985) suggests that it is not the type but the extent of use of phonological processes that indicates abnormality. It appears to be this distinction that most clearly differentiates the two groups of subjects in this investigation.

b. <u>Differences within the Phonologically Disordered Group</u>

Table B shows that although this group of children had many processes in common the combination of processes that each child used was unique. The individual nature of the child's production is a typical characteristic of the disorder.

This characteristic makes comparison of phonologically disordered children by any categorisation or severity grading system extremely difficult. Any comparison is made even more difficult by the need to take into account not only the number and type of processes that the child is using but also the frequency and variability with which they are applied. A simple count of the number of processes occurring reveals little about the severity of the disorder.

Grunwell (1985) suggests five possible patterns of occurrence and use of processes which may be used as some indication of relative severity. These are Persisting normal processes, Chronological mismatch, Unusual/Idiosyncratic processes, Variable use of processes and Systematic sound preference. These patterns can co-occur but the last four would appear to be particularly indicative of severity. (see also section 1.3.3 where the first three patterns were discussed in relation to delay and deviance).

These patterns were used in an attempt to categorise the current data, but no clear trends emerged. All the children demonstrated persisting normal processes. They also showed chronological mismatch, that is the co-occurrence of early and late stages of normal development. This is demonstrated visually in Table B where occurrence of processes is scattered throughout the columns of each child. Atypical processes were also used by all the children (Table C) although they did not appear to dominate the data of any subject. There was insufficient evidence in the data to come to any conclusions about the occurrence of variablity or systematic sound preference in this group of children (see also Moss (1985) in section 1.3.3). It does appear therefore that using this type of description, although probably helpful in describing individual children, is apparently of limited use in comparing children within a group.

In the absence of clear indices for quantifying the extent of the disorder or making specific comparisons between children, apart from a count of the number of processes they use, each child's phonological ability must be evaluated individually. This evaluation should take into account the sort of patterns of occurrence suggested by Grunwell, the relative dominance of each pattern and the frequency with which each process is applied. In the absence of quantitative data these criteria can provide a subjective evaluation of phonological behaviour when examining the relationship between phonological and other abilities.

c. Comparison with other Investigations

This group of phonologically disordered children appears to be typical of the phonologically disordered population as a whole. They not only use the same developmental phonological processes but, as far as can be ascertained, they appear to use them with the same general frequency. The processes used by the phonologically disordered children in the current investigation are comparable to those reported by Stoel-Gammon & Dunn, for example the high percentage of *Cluster Reduction* and *Stopping*. The present data appears almost identical to that reported by Moss (see section 1.3.2).

A comparison of the use of atypical processes found in the current investigation with those found in other investigations shows a similar picture, despite the fact that these processes are more varied and less well documented. *Initial Consonant Deletion, Glottal Replacement/Insertion and Backing* are specifically noted by Moss and are also mentioned by Stoel-Gammon and Dunn. These were the most common atypical processes found in the current investigation. No processes occurred in the current study that were not previously mentioned in the literature and apart from *Reduplication* all developmental processes recorded in the literature were present in the data.

It is possible to conclude therefore that the phonologically disordered children in this investigation are typical of the phonologically disordered population as a whole. And that although this group share several characteristics with the normally developing group they are different from them, both in the number of phonological processes they use and the frequency with which they use them.

CHAPTER 5
THE RHYMING EXPERIMENT

5.1 INTRODUCTION

This experiment assesses the children's ability to differentiate between rhyming and non-rhyming words by selecting the non-rhyming words from sets of pictured objects.

Sensitivity to rhyme has frequently been used as evidence of metalinguistic awareness. Two sources of evidence are available; observations of spontaneous rhyming play and experimental investigations of the ability to manipulate and recognise rhyme.

5.1.1 EARLY RHYMING ACTIVITIES

Spontaneous rhyming activity has been observed as part of language play from around 18 months of age. This creative activity should be distinguished from the general appreciation and enjoyment of rhyme which appears to be common to children of all ages. But creative spontaneous play and enjoyment of rhyme appreciation tend to merge into each other in children's play and this joint focus may encourage sensitivity to rhyme and may be a precursor to later success in more formal rhyming activities.

General enjoyment and appreciation of rhyme appears to be universal in childhood (Opie & Opie, 1959). These authors provide many examples ranging from nursery rhymes to the rhymes of later childhood where they appear to be an important component of a wide variety of games and activities.

Developmentally the earliest noted examples of rhyme creation are the rhyming components of the pre-speech monologues of the type reported in section 2.2.1. These monologues frequently appear to have rhyme as the motivating association between the strings of words produced by the child. Rhyme creation appears to be at its peak between two and three years of age; at this age both real and nonsense words are used to create rhymes. There are many reported examples of this type of activity in the literature, see for example (Cazden, 1976, Chukovsky, 1968, Clark, 1978, Garvey, 1977, Horgan, 1981 and Weeks, 1979).

This rhyming play may take the form of rhythmical chants to accompany physical activity. Sometimes the chaining of rhyming words is triggered by a physical activity with rhyme gradually becoming the primary focus of attention and often continuing long after the triggering activity has been completed (Garvey, 1977). In other cited examples the rhyme appears to be the sole focus of attention as in this example from Horgan

(1981) from Kelly aged 2.03.

> "Five socks. Pick up stock Seven ox. Close the Gox. Nine tens. Start agains"
> (Horgan, 1981 p.219).

a. Rhyming Play and Language Acquisition

If enjoyment and creation of rhyme are so prevalent in childhood it is pertinent to consider what role the activity may play in language development. Chukovsky (1968) is the strongest supporter of a role for rhyming sensitivity in language acquisition. He believes that the rhyme creating activities of two year olds is an essential stage in linguistic development and that children who do not go through such linguistic exercises are abnormal. It is seen as providing necessary phonetic practice of all possible sound variations. Similarly Elkonin (1971) believes that playing with the sounds of language provides the child with orientation to the "sound forms of words" and that language is learnt through this activity. Weir (1962) suggests that one of the functions of pre speech monologues is systematic linguistic exercise and that through such practise the child discovers not only that linguistic units can be combined but that they are also subject to rules.

There appear to be no strong detractors from this point of view but Garvey (1977) is more cautious in her discussion of the role of language play and says that it is not known whether this type of activity plays any part in language development.

Several factors appear to support the proposition that this activity may assist in some way in the development of the structural aspects of language.

1. The rhymes the children imitate or create observe only phonological rules and appear to serve no grammatical or semantic functions. In discussing what he calls the universal existence and demand of rhyme Jakobson (1979) says that, in producing and playing with known or invented words, production is determined solely by attention to features of the sounds of language rather than semantic or grammatical features.

2. In the process of stringing rhyming words, the child starts with a known word and manipulates it so that a new word is produced which still retains some of the elements of the previous word. This pattern of minimal change often continues over several words.

3. The ability to focus on the form rather than the meaning of language is also suppported by the ability to create novel words to fulfil and continue pattern change.

4. Rhyming play usually appears to be a private activity without any apparent communicative function. Garvey (1977), writing about sound play in general,.

reports only isolated examples of this sort of rhyming activity being shared by children. She says that the child becomes aware in private of the structural properties of language. He takes apart and puts together building blocks of sequences that he can't until later consciously isolate.

If rhyme sensitivity has a role in language acquisition it should be possible to observe and demonstrate it in all children. Most young children appear to be sensitive to rhyme, to the extent that they enjoy rhyme activities initiated by others, but universal evidence of rhyme creation is not currently available and there is some evidence to suggest that in fact not all children do engage in this type of activity (see also section 2.8).

Children who indulge in the type of creative rhyming activities cited above must have some kind of sensitivity to the phonemic structure of language. However, insufficient evidence exists to determine whether rhyming activity represents active practise and has a role in phonological acquisition or is carried out simply for the enjoyment of the sounds of language. Whatever interpretation is put on the activity it is difficult to deny that it will reinforce and encourage greater sensitivity to the sound patterns of the language being acquired.

If rhyme sensitivity is required for successful language development it is an essential focus of enquiry in the investigation of phonological disorder. No observational information is available about early sensitivity to rhyme in language disordered children. It would be impossible to acquire this information except through extensive longitudinal studies. Further discussion of the possible relationship between language acquisition and rhyming sensitivity together with possible implications for later phonological disorder can be found in section 5.3.3. Meanwhile the next section of the chapter describes previous experimental investigations into rhyming ability.

5.1.2 EXPERIMENTAL INVESTIGATIONS OF RHYMING ABILITY

The majority of experimental investigations have been concerned with the relationship between rhyming and the secondary language skills of reading and spelling but there have been two investigations into the rhyming ability of language disordered children and some investigation into the interrelationship between language disorder and rhyming and reading and spelling ability.

a. Rhyming Ability and Language Disorder

Magnusson (1983) investigated rhyming ability as part of a study designed to identify sub-groups of phonologically disordered children. Thirty one children aged between four and six years took part in this investigation. The experimental task used sets of pictured words, each set consisting of two rhyming words and a semantic or linguistic distractor. The children were shown the pictures and asked to point to the rhyming pair. The results showed considerable variability within the group in their ability to match the rhyming words. There was some tendency for poor rhyming ability to be associated with more severe phonological problems but Magnusson also found that it was possible to have a severe phonological problem and be a good rhymer, or have a minimal phonological problem and be a poor rhymer. She concludes that one can only speculate about whether lack of rhyming ability is a consequence of, or a contributory factor to, delayed phonological acquisition. This researcher did not compare her disordered children with a normal control group so it is not known to what extent they differed from the normal population on her task. (but see Chapter 10). Magnusson concludes that language development is more important than cognitive development for linguistic awareness, indicating it to be a specific linguistic rather than a general cognitive ability.

Stackhouse and Snowling (Stackhouse & Snowling, 1983 and Stackhouse, 1985) compared the ability of dyspraxic children to that of normally developing children on a different type of rhyming task. These investigators presented the children with a picture of a target word and then showed them two additional pictures, one of a word which rhymed with the target and another which was semantically related and asked them to select the word that rhymed with the target. They found considerable differences in ability between the two groups. Some normal five and six year olds were at ceiling on this task, but some speech disordered children as old as 10 and 11 scored below normal five year olds. Rhyme production was also found to be difficult for these dyspraxic subjects. They were frequently unable to provide rhyming words for target monosyllabic words, or if successful in giving one rhyming word they would be unable to sustain the task by producing further examples. Some 10 and 11 year old dyspraxic children frequently persisted in making semantic associations in this type of task, a response which Stackhouse reports as being common in nursery school children but one which has usually disappeared by five years of age. This finding that an ability that is within the spontaneous, even if unconscious, capability of many normal three year olds appears to be outside the sustained grasp of some much older disordered children provides a clear indication of some relationship between rhyming ability and one type of language disorder.

Both Magnusson and Stackhouse and Snowling extended their investigations to look at the relationship between rhyming ability, language disorder and reading and spelling ability.

b. <u>The relationship between language disorder, rhyming ability and reading and spelling ability</u>

Stackhouse & Snowling (1983) report a strong relationship between primary and secondary language disorder and rhyming ability. Stackhouse suggests that these children have poor written language abilities because they "are laid down onto a faulty language base" (Stackhouse, 1985, p. 96) and result from poor grapheme phoneme associations. She believes that these poor associations may result from poor auditory processing skills; auditory discrimination, auditory memory and poor auditory organisation, including rhyming ability.

Naucler & Magnusson (1984) investigated the reading and spelling abilities of Magnusson's original group of phonologically disordered children six years after the first investigation. They found that 50% of the children had persisting reading and spelling difficulties and that poor early rhyming ability was a general predictor of later reading and spelling ability. They also found that the poor rhymers were all poor spellers but that good rhymers could also be poor spellers. They concluded from these findings that rhyming is a necessary but not a sufficient pre requisite for spelling (see also Chapter 10).

The directional influence between language disorder, rhyming and reading and spelling is unclear. Stackhouse is not specific about whether language disorder results in poor auditory organisation and later reading difficulties or whether poor auditory organisation is a common underlying explanation of both the primary and secondary language difficulties. Magnusson suggests a cause and effect relationship; poor rhyming ability leads to poor language development which in turn affects reading and spelling.

Any consideration of cause and effect relationships between language disorder, rhyming and reading and spelling ability would have to take account of the following factors. First reading and spelling difficulties can be related to poor rhyming ability in the absence of apparent primary language deficiency. Second it is possible that lack of sensitivity to rhyme results from, rather than brings about phonological disorder or poor reading and spelling. In Chapter 2 the possible directional influence between literacy and metalinguistic awareness generally was seen to be controversial. It was also noted that environmental influences such as bilingualism appeared to be influential in increasing metalinguistic awareness. It may be that metalinguistic awareness is predominantly an influenced rather than an influencing factor. However there is considerable evidence to show that rhyming sensitivity precedes literacy in those investigations which have considered this relationship and some of these will be considered next.

5.1.3. RHYMING ABILITY AND LITERACY

The majority of investigations into rhyming ability have been concerned with the relationship between rhyming and reading and spelling ability in the absence of known language disability. (See Bryant & Bradley, 1985 and Snowling, 1987 for reviews of this research). Investigations of this kind are pertinent to the present study because they provide additional knowledge about sensitivity to rhyme and suggest a variety of possible experimental methods. Some of these investigations, which have been carried out with subjects near the chronological age of the present experimental population have been selected for discussion.

Two findings predominate in these investigations, regardless of the experimental methods employed. First, a significant correlation is invariably found between success on rhyming tasks and reading and spelling ability. Second those investigations which have examined the direction of influence between the two factors have shown that rhyming ability is generally predictive of reading ability rather than vice versa (see 2.7).

Bradley and Bryant (Bradley & Bryant 1978 & 1983 and Bryant & Bradley 1985) carried out a series of three experiments which illustrate this predicitive relationship very clearly. In their first experiment (Bradley & Bryant, 1978) they compared a group of backward readers who were otherwise normal with a group of younger normal readers with comparable reading ages. Both groups were given a rhyme and an alliteration detection task and a rhyme production task. In the rhyme recognition task they used sets of four orally presented words. Three of the words in the set shared common consonants, either in a rhyming or alliteration condition, the other word did not fit the pattern. The child was asked to say which word did not match the other three. In the rhyme production task the child had to suggest a rhyming word for a word spoken by the examiner. The results showed that backward readers were "remarkably insensitive to rhyme" (Bryant & Bradley, 1985, p. 50) and they were significantly worse at this task than the younger normal readers. The results also indicated that the poor rhyming ability was the cause of rather than the result of poor reading ability.

To test this predictive relationship further a second investigation was carried out (Bradley & Bryant, 1983). In this, a longitudinal investigation, they used the same kind of rhyme detection task with four and five year old children as part of a battery of assessments. Three and four years later the experimenters carried out a further series of assessments on the same children. The relationship between rhyming and reading was confirmed by demonstrating that rhyming ability assessed at four and five was predictive of later reading ability. In addition they found that rhyming ability was not related to mathematical or other attainments.

In their final investigation they looked at whether teaching children about rhyme improved reading ability, and they found that it did, providing further evidence of the influence of rhyming ability on reading (Bryant & Bradley, 1985). This series of experiments demonstrates not only that there is a predictive relationship between rhyming ability and reading but also, that although children vary in their sensitivity to rhyme it is an ability that can be trained.

Further experimental evidence showing that children are sensitive to the sound relationships of language before they can read comes from Read (1973, 1975 & 1978). Read was particularly interested in trying to explain the regularity of spellings invented by pre-school children. For example he found that "bed" was likely to be spelt as "bAd" much more frequently than being given its proper spelling or another irregular spelling. He hypothesised that the regularity of these non-standard spellings indicated recognition by the children of phonetic and phonological relationships between certain vowels. He designed a series of experiments to test this hypothesis which required the children to make judgements of similarity between a target vowel and two other vowels in real and nonsense words. He used rhyming words as a training procedure before asking the children to match similar words. That is he asked first for judgements of sameness and then "not quite the same" (see 5.2 for more details).

Read found that he could elicit these types of judgements before the children were able to read and write and he concluded from this finding that pre literate children had knowledge of the phonetic aspects of language beyond that which was "strictly necessary for succesful communciation" (Read, 1978, p77).

The results of these experiments can only be used to determine that rhyming sensitivity precedes reading and spelling ability and can not be used to determine whether sensitivity to rhyme precedes phonological development. They do however show that children vary in their sensitivity to some of the structural aspects of language during the period of phonological acquisition. The various experimental methods used to assess rhyming ability will be reviewed before describing the task used in the current investigation.

5.1.4 PREVIOUS EXPERIMENTAL METHODS.

The tasks used for assessing rhyming ability fall into two main groups, those which ask for rhyme recognition and those which require the child to create rhyming words. The recognition tasks can be further sub-divided into those that involve rejecting non-rhyming words from a rhyming set such as those already described in the Bryant & Bradley and Magnusson experiments and those that involve matching a rhyming word with a target as in the Read and Stackhouse experiments. This type of task was also used by Knafle (1973 & 1974).

The experiments have used a variety of rhyming conditions and some experiments have also used alliteration recognition. The rhyming words for example might have only common vowels, or common vowels and final consonants. The recognition of identical initial sounds in the alliteration activity is usually the hardest task and recognition of shared common vowels and consonants are the easiest.

In a variation on the rhyme recognition task Calfee, Chapman and Venezky (1972) presented their subjects with pairs of words, some rhyming and others not. Subjects were asked to indicate whether the words sounded the same at the end.

In the rhyme production tasks the subjects are usually given a word and asked to say another one that rhymes with it (Stackhouse, 1985, Bryant & Bradley, 1985, Calfee et al, 1972). Alternatively subjects are asked to participate in a free association task to think up rhyming strings.

In a series of somewhat different rhyming tasks Jusczyk (1977) investigated detection, production and appreciation of rhyme. He assessed detection by asking his subjects to state their preferences between orally presented rhyming and non-rhyming poems and production by asking them to say something similar to what they had just heard. He completed his series of experiments with a questionnaire which tested the child's knowledge of rhyme, for example by asking for a definition of a poem.

A variety of different materials and methods of presentation have been used in these experiments. Stackhouse and Magnusson used pictures to accompany their rhyme selection tasks whilst Bradley and Bryant used only oral presentation. Read and Jusczyk used puppets to present words to their subjects.

The way the experimental task is presented often appears crucial to the success of the experiment particularly with younger children. Read (1978) found that very small changes in the way he presented his tasks brought dramatic increases in success, often reducing the age threshold for successful completion by as much as two years. His most important experimental changes involved embedding the task in a meaningful situation, giving practice on the task and providing a consistent target, that is a single word for matching with other rhyming words rather than a fresh target for each trial.

Gibson & Levine (1975) also comment that the form of words the experimenter uses to introduce the tasks may be crucial to successful completion. They found that children were often able to produce rhyming strings of words spontaneously in free association tasks by copying an example and when asked for words which were easy to remember, "like" a given target word. But when they were specifically asked for a rhyme or words which "sounded the same", they were unable to carry out these tasks.

These experimental investigations have demonstrated that from about four years of age children can take part in rhyming tasks, if the experiments use appropriately designed tasks. They show that sensitivity to rhyme is a phenomenon that is apparent in pre-school children and that it is related in some way to language disorder and to reading and spelling difficulties. Rhyming ability is therefore a suitable activity for assessing metalinguistic awareness in pre-school phonologically disordered and normal children.

5.2 THE PILOT STUDY

At the start of the investigation the experimental work on rhyming ability and language disorder carried out by Magnusson and Snowling and Stackhouse was not available for replication. Pilot studies were therefore carried out to establish an appropriate experimental design.

The first attempts at devising a suitable task were based on the training sessions used by Read in his vowel similarity experiment (Read, 1975). This task had already been used successfully with the current age group, It was a meaningful task and used a single consistent target word for the child to match other words against.

Read asked his subjects to indicate which of a pair of orally presented words rhymed with /ɛd/. He used a hand puppet called "Ed" who liked words that sounded the same as his name to help his subjects choose the appropriate word. In the current investigation a teddy bear called "Ed" was used as the target and the same kind of procedure was followed. The children were told that "Ed" liked words that sounded the same as his name, they were then asked, for example, if he would like *bid* or *bed*. Twenty pairs of words were used. The ten children from the pilot group who participated in this task were all able to make a choice of words, but their ability to choose the rhyming word was very variable. The mean score from twenty word pairs was 10, a result no greater than chance.

There was also some evidence from the results to suggest that familiarity or preference for some words overrode the rhyming characteristics, for example even children who scored highly on the task and appeared to be very aware of rhyme chose *boat* in preference to *bet*. The fragility of the rhyming condition was demonstrated by one child who spontaneously suggested other rhyming words that "Ed" would like but was also distracted by other qualities of the objects he had suggested. He volunteered that "Ed" would like *egg* because it "sounded the same" and then immediately said "ball as well because it's round like an egg".

The "Ed" task was reluctantly abandoned. The children had enjoyed the task, they were able to select rhyming words using this method and it was easy to administer but it was felt that the either/or choice was too vulnerable to chance because of the apparently fragile ability to concentrate purely on rhyme. A greater number of word pairs would to some extent have mitigated against chance selection but it was difficult to significantly increase the number of words without increasing the risk of introducing more semantic preferences, given the pre school child's limited vocabulary.

A second pilot study was therefore devised based on the Bradley and Bryant experiments (Bradley & Bryant, 1978 & 1983 and Bryant & Bradley, 1985). Initially the children were asked to choose the non-rhyming word from a set of three or four orally presented monosyllabic words. Although Bradley & Byant had used the one word from three selection task successfully with four year old children this task was unsuccessful in the current experiment. The children did not find the task sufficiently attractive to engage their attention; they either appeared to choose randomly or refused to cooperate. It was possible that the current subjects were slightly younger than those of Bradley & Bryant, and trying to remember three words whilst choosing the one to reject may have demanded too great a memory load.

The task was therefore adapted by introducing pictures to accompany the orally presented words. It was felt that this adaptation would make the task more attractive and meaningful to the children and help them to remember the words.

This version was administered to nine children who had not previously been involved in the pilot study, three boys and six girls with an age range of 3.11 to

4.08 (mean 4.06). Out of 10 possible items, they achieved a mean score of 8 with a range from 3 to 10. These results and the children's general response to the task suggested that it was suitable for use in the main investigation.

This final task overcame several problems of both the "Ed" matching task and the Bradley and Bryant oral selection task. The pictures provided a common semantic referent for the child and the experimenter. They increased the attractiveness of the task and reduced the demand on auditory memory and, by increasing choice of words to one out of four, reduced the element of chance.

When pictures were introduced into the task it appeared to be no more difficult for the children to choose from four words rather than three, so four words were used in the current experiment. Perhaps of most importance the use of pictures enabled the children to respond by pointing and a verbal response was not necessary. This ensured that any possible disadvantage to the phonologically disordered children was avoided.

5.3 THE MAIN EXPERIMENT

5.3.1 METHOD

Subjects

All forty two subjects took part in this experiment.

Materials

Ten sets of four brightly coloured pictures, each picture mounted on an individual card 15cm x 11cm, representing a monosyllabic word were used for the experiment. Each set consisted of three rhyming and one non rhyming word, for example *pear, bear, chair, fan.* Nine sets of the rhyming words shared both vowel and final consonant and in one set only the vowel differed. The full list of words can be found in Appendix 5.

The chosen words were easily picturable and within the vocabulary of four year old children. No specific detractor was provided, such as a semantic match, among the words.

Procedure

The subjects were introduced to the concept of rhyme by the experimenter and subject reciting and talking about a nursery rhyme, chosen either by the child or the experimenter. This was followed with a short game of rhyming snap and further discussion of words which "sound the same" or "go together". Four sets of unscored trial words and pictures, two sets of three and two sets of four, preceded the presentation of the experimental words.

The pictures for the trial and experimental items were laid out one set at a time in front of the child, the position of the non rhyming word being systematically varied for each set. Each picture was named twice by the experimenter, and the subjects were then invited to name them to ensure that they and the experimenter shared the same word for each picture.

The children were then asked which picture "doesn't sound the same", or "doesn't rhyme". Choice could be indicated by pointing or naming. A response was scored as correct if the subject pointed to, said, or picked up the picture of the non-rhyming word in the set. There was therefore a potential maximum score of ten for the task.

At the end of the experiment, as an informal extimate of auditory memory, the subjects were asked to repeat the names of three sets of pictures in the absence of visual cues after they were said by the experimenter.

5.3.2. RESULTS

There was no difficulty in demonstrating the nature of the task to the children. They appeared to enjoy the activity, understood what was required of them, and as the results will show they were frequently able to select the non-rhyming words.

a. <u>The children's approaches to the task.</u>

The majority of the children, whether they were successful in choosing the non-rhyming picture or not, appeared to spend a lot of time thinking about which picture to choose. With the exception of two children in the phonologically disordered group (A5 and A13) who tended to choose the first picture in each set there was no evidence to suggest that any factors other than rhyme had influenced picture choice.

A variety of strategies leading to final picture selection were observed. Some of the children would repeat the words aloud to themselves before selection and some would physically move the cards and put the rhyming ones together. It appeared that for some children the task itself taught them about rhyming and this was reflected in more rapid and accurate selection as the task progressed. A few of the children were able to match some pairs of rhyming words but could not match three words and were unable to reject the non-rhyming word. This behaviour suggests some degree of rhyming awareness but it was not possible to account for it in the scoring procedure. The semantic aspect of some pictures distracted some children and they would talk about the picture, usually in relation to their own experience, rather than concentrate on selecting the rhyming words.

b. <u>Comparison of rhyming ability between the two groups of subjects.</u>

The raw scores of each subject are presented in Appendix 6, Tables C & D. Table 5.1. shows the distribution of scores, means and standard deviations for both groups.

Table 5.1 shows that the phonologically disordered group (mean score, 3.4) were poorer at selecting the non-rhyming words than the normally developing group (mean score, 7).

The Mann-Whitney *U* Statistical Test was carried out to find out whether the two groups had been drawn from the same population for this task. This test revealed:

$U = 71$, $p < 0.01$, for $N = 21$ & $N = 21$ (two tailed tie corrected).

(See Appendix 7 for notes on the statistical analysis used in this study).

Table 5.1 Frequency Distribution, Means and Standard Deviations of Rhyming Scores for all Subjects

Score /10	Group PDG	Group NDG
10	-	4
9	2	1
8	1	6
7	-	2
6	2	1
5	1	3
4	1	3
3	4	1
2	5	-
1	3	-
0	2	-
N=	21	21
Mean	3.4	7
S.D.	2.7	2.2

Table 5.1. shows a wide range of scores within each group with the slightly larger standard deviation (2.7) occurring in the phonologically disordered group. No subject in this group reached ceiling on the task but two scored 9 out of a possible 10 correct. Two phonologically disordered subjects were not able to select any non-rhyming words and three others selected only one.

In the normally developing group all the children selected some non rhyming words and four children reached ceiling on the task. The lowest score in this group was 3.

c. Association between Rhyming ability and Phonological Ability

The Kendall Rank-Order Correlation Coefficient (*T*) was calculated to determine whether there was any relationship between rhyming scores and phonological ability, as measured by the E.A.T for the total population and each group. The results are presented in Table 5.2.

Table 5.2 Kendall Rank-Order Correlation Coefficients (*T*) between Rhyming Scores and E.A.T and other Pre-Investigation Variables

	Total Pop. N=42	PDG N=21	NDG N=21
EAT	0.47**	0.28	0.15
CA	0.34**	0.15	0.31
RDLS	0.45**	0.38*	0.48**
WPPSI	0.29*	0.41**	0.17
Aud. Mem.	0.16	0.13	0.19
Aud. Dis	0.36**	0.39*	0.24

** significant at 0.01 level
* significant at 0.025 level

Table 5.2 shows that there was a significant correlation (T = 0.47 . p<0.01) between the rhyming task scores and the E.A.T. for the total population. This result confirms the significant difference found between the two groups on the rhyming task.

In order to determine the possible effect of other variables on this association between rhyming and phonological ability Kendall Partial Rank-Order Correlation Coefficients ($T_{xy,z}$) were calculated to determine the independence of this association. The results of this test are presented in Table 5.3.

Table 5.3 Kendall Partial Rank-Order Correlations ($T_{xy,z}$) between E.A.T. and Rhyming with other variables held constant. (N=42)

Variable Held Constant	$T_{xy,z}$
CA	0.46
RDLS	0.38
WPPSI	0.46
Aud.Mem	0.45
Aud.Dis	0.45

Critical value for N=42 =.240, p<0.01.

All the values in Table 5.3 are above the critical value of .240 p<0.01 (N=42), demonstrating that when the effect of other variables was controlled statistically the association between rhyming scores and phonological ability remained significant. The small amount of variation between the correlation of 0.47 in Table 5.2 and the partial rank-order correlations for C.A, WPPSI, Auditory Memory and Auditory Discrimination in Table 5.3 shows that association between these two measures was relatively independent of these variables. Although the correlation between rhyming and phonological ability was still significant when R.D.L.S was held constant the change in value in Table 5.3 shows that the association is affected by this variable to some extent. When the results of the two groups of subjects were examined separately Table 5.2. shows that the correlation between rhyming and phonological ability did not reach significance for either group.

An examination of the results of individual children in the phonologically disordered group revealed no predictive relationship between severity of phonological disorder and level of rhyming ability. The children with the most severe phonological difficulties were not necessarily the children who were the poorest rhymers. A comparison of the scores in Appendix 6 Tables A & C shows that it is possible to be a good speaker and a poor rhymer (A20), or a relatively poor speaker and a good rhymer (A2) within this group. There is a similar lack of agreement between rhyming and E.A.T. scores in the normally developing group.

d. Association between the rhyming task and other measures

Table 5.2 (p.169) shows that there were significant correlations between the rhyming task and some other variables. The associations between rhyming and other variables were:

1. Chronological Age

There was a significant correlation of 0.34, $p<0.01$ between rhyming and C.A. for the total population. But correlations between these two measures were not significant when the results from each group were examined separately.

2. Auditory Discrimination.

Table 5.2 shows a correlation between rhyming and auditory discrimination of 0.36, $p<0.01$, for the total population and 0.39, $p<0.025$ for the phonologically disordered group. The correlation for the normally developing group was not significant.

When the results of individual children in the phonologically disordered group were compared on these two measures, (Tables A & C Appendix 6) there appeared to be a tendency for good rhyming to be associated with relatively good scores on the auditory discrimination task and poor rhyming ability to be associated with poor scores on this task. But relatively good discrimination ability did not guarantee good rhyming ability (A7 & A14). However there were no good rhymers who scored poorly on the auditory discrimination task.

3. Rhyming and Auditory Memory

There was no significant correlation between rhyming and auditory memory for the total population or for either group. It is however possible that the type of task used, memory for digits (Auditory Sequential Memory Section of the I.T.P.A) makes demands on memory that are different from the requirements of the rhyming task (see section 5.3.3).

4. Language Comprehension

There were significant correlations between the results of the R.D.L.S. and the rhyming task of 0.45, $p<0.01$, for the total population, 0.38, $p<0.025$, for the phonologically disordered group, and 0.48, $p< 0.01$ for the normally developing group.

As the correlations indicate that relatively good language comprehension is associated with good rhyming ability. In the phonologically disordered group children with poor language comprehension were also poor rhymers. No child in this group who had a standard score of 0 or less on the R.D.L.S scored more than 2 in this experiment. The only child in the normally developing group with standard score below 0 on the R.D.L.S scored 5 on the rhyming task, below the mean for his group, but not the lowest score.

5. Non-Verbal Intelligence (W.P.P.S.I)

There was a significant correlation between rhyming ability and non verbal intelligence for the total population (0.29, $p<0.025$) and for the phonologically disordered group, (0.41, $p<0.01$). The correlation for the normally developing group was not significant. When the results of individual children were compared no clear relationships were discernible. The child with the highest intelligence quotient in the phonologically disordered group (A11) scored only three on the rhyming task and subject A1 with an intelligence quotient of 99 was a good rhymer.

5.3.3 DISCUSSION

The results of this experiment showed that there was an association between phonological disorder and rhyming ability for this group of subjects. However, they also showed that rhyming and phonological ability are not necessarily associated, as the results of individual subjects demonstrated. Some children who were good speakers were poor at rhyming and equally some who were relatively good speakers were not able to rhyme.

Although there is no previous research that is identical to the present experiment, the current results provide general confirmation of previous investigations into the rhyming ability of language disordered children. They are comparable with the findings of Snowling & Stackhouse (Stackhouse & Snowling, 1985 and Stackhouse, 1985) who demonstrated a relationship between rhyming ability and developmental verbal dyspraxia (5.1.2). They also confirm the findings of Magnusson (1983) in that, although the current phonologically disordered group did less well than the normal group on this task, there was a lack of association between severity of phonological disorder and poor rhyming ability.

Discussion about the association between phonological disorder and rhyming ability must take account of the following points:

1. Significant correlations were also found between rhyming ability and other variables. However when the effect of these variables was controlled statistically the association between rhyming and phonological ability was found to be relatively independent of other factors.

2. The discussion of phonological disorder in Chapter 1 revealed a variety of possible causative factors and it is probable that this group is a heterogeneous rather than a homogeneous population. Rhyming ability may be a significant factor in the phonological development of some children in the study and not others.

3. There is a lack of knowledge about the role of rhyme in normal phonological acquisition (5.1.1.). However the cognitive model of phonological development does allow for a possible role for rhyming ability in acquisition and this will be discussed shortly.

Despite these unresolved factors, explanations of the association between poor rhyming and poor language ability have been suggested and they will be discussed in the light of the current findings.

a. Possible explanations of the relationship between phonological development and rhyming

Magnusson (1983) suggests two possibilities that may account for failure in rhyming tasks. She believes that some children may fail because they are not aware that words are analysable into phonemes. Alternatively some children may, she suggests, possess this awareness but may provide some incorrect answers in the task because their perceived form of a word may not match their stored representation, which she sees as equivalent to production form. She suggests that, in theory, such a possibility could be tested out by using some detractors that were homonymous with some of the presented rhyming words. Such a task would require to be individually designed for each child and it would, she admits be difficult to find suitable words. Her suggestion also makes assumptions about the child's stored forms of words which may not be correct. The possible nature of stored forms will be discussed in Chapters 7 and 8.

Lack of awareness of segmentation possibilities could not explain failure in the present task as, it will be argued shortly, it is possible to complete the task, without segmenting the words. The design of the current experiment does not permit any conclusions to be made about whether the children's production forms affects their ability to provide correct answers.

Rhyming as a specific auditory processing deficit

Stackhouse (1985) uses an information processing model in her consideration of the relationship between primary and secondary language skills and rhyming ability. She suggests that the problem lies in poor auditory processing. But it is unclear, as stated in 5.1.2 , whether she considers primary language to be a precursor to later rhyming and secondary language problems or whether some basic inefficiency in language processing exists which affects both primary and secondary language development.

Rack & Snowling (Rack & Snowling, 1985 and Rack, 1985) use an information processing model in their search for an explanation of dyslexia. Because of the known association between primary language difficulty and dyslexia it is appropriate to consider their hypothesis in relation to phonological disorder. They suggest that dyslexic children have a specific difficulty in accessing phonological (rhyming) codes in short term memory either in combination with semantic and visual memory codes to 'elaborate' the memory trace or as a cue to allow retrieval of information from long term memory (this hypothesis is discussed in more detail in Chapter 11).

These authors support their hypothesis with the results of an experiment conducted by Rack. He used two groups of subjects, dyslexic children and younger children who had equivalent reading experience. In a two part experiment the subjects had to first decide whether or not two pairs of written words rhymed. The pairs of words represented four different orthographic and rhyming conditions:

1. Rhyme and orthographic similarity (e.g. *farm-harm*),
2. Rhyme only, (*e.g. farm-calm*)
3. Orthography only (e.g. *farm-warm*)
4. Control pairs, with no relationship (e.g. *farm-sand*)

In the second part of the experiment the children were presented with one of each of the original word pairs and asked to remember which word had been presented with it. Rack and Snowling argued that the words the children could recall in this part of the task would provide information on the type of mental coding used by the child. They found that the normal children remembered the rhyming words best whilst the dyslexic children used the visual orthographical cues but did not use the rhyming cues.

Other researchers who have investigated the relationship between rhyming and secondary language abilities appear reluctant to enter into discussion about possible explanations of the relationship between the abilities. Bryant & Bradley (1985) look at their concept of sensitivity to rhyme only in relation to other observable factors and are not concerned with attempting to explain its possible relationship to underlying mental processes.

The hypothesis of an auditory processing deficit therefore appears to be the most detailed theoretical model available to explain differences in rhyming ability. It suggests an area of potential weakness in mental processing which can explain variations in rhyming sensitivity and its consequent effects on reading and spelling.

Because of the known association between primary and secondary language abilities and rhyming sensitivity it can be tentatively suggested that differences in auditory processing may be interacting with phonological development. This suggestion can be reinforced by the evidence from Bryant & Bradley and others which indicates that differences in rhyming ability precede and influence reading ability. These differences in rhyme sensitivity are therefore present during, at least, the later stages of phonological development.

There are however factors which limit the application of an hypothesis of auditory processing deficit to the association between rhyming and phonological development.

1. Reading and spelling are formally learnt abilities which require the matching of auditory to visual symbols, indicating a clear requirement for an efficient auditory processing system and the ability to access phonological codes. No formal learning process is required for phonological acquisition and we have no knowledge of whether specific phonological processing of the type described by Rack & Snowling is a requirement for phonological development. However it can be argued that theories of language acquisition which perceive the child as a an active problem solver will require the child to use some similar type of mental processing strategies for establishing rules about the organisation of language (see section 5.3.3).

2. Although it is possible to demonstrate that rhyming ability precedes reading ability such a directional connection was not indicated between rhyming and phonological disorder in the current experiment.

3. There was no evidence from the current investigation to suggest that there was any relationship between auditory memory and rhyming ability, or between auditory memory and phonological ability (see 4.5). It is however possible that the type of memory task used in this investigation, memory for digits, makes different memory demands than that required for the rhyming task. Other types of memory task may be found to be associated with rhyming ability. But in the informal assessment of memory at the end of this experiment ability to remember the words and ability to recognise rhyme did not appear to be associated.

The nature of the requirements for successful recognition of rhyme and their possible relationship to phonological disorder therefore remain problematical. It is only possible to conclude that the common observable characteristic across success on the different rhyming tasks and spontaneous rhyming activity is a sensitivity to the phonemic characteristics of words.

b. <u>Rhyming ability as evidence of metalinguistic awareness</u>

Such a conclusion may appear tautological but it is important to analyse further what activity is involved in participating in this task and to confirm that the experiment <u>is</u> assessing what has been defined as metalinguistic awareness and more specifically in this investigation awareness of the phonemic aspects of language.

For successful completion of the current rhyming task the child had to be able to recognise common phonemic features of the words, categorise them and reject the word which did not show those features. This procedure is also common to the ABX type of discrimination task used in this investigation.

A significant correlation was found between the two measures, an indication that they may require similar cognitive abilities. Both tasks require the subjects to perceive, memorise and recall the auditory patterns of the words and to concentrate on their structural rather than their semantic aspects.

The tasks also have different requirements. In the rhyming task common elements in words rather than whole words have to be matched and the word which does not fit the pattern determined. Four different, rather than two identical and one different word have to be remembered. Ability to discriminate is therefore essential to successful rhyming but in addition it is possible that it requires different or greater memory capacity or is in some other way more cognitively demanding than the ABX discrimination task.

It can also be argued that not all rhyming tasks make the same demands on subjects. Success on the current task could be achieved by matching the acoustic cues of the vowels in the rhyming words (see 6.1.2). Magnusson (1983) and Bryant & Bradley (1985) state that their experiments require subjects to segment the words to isolate common features. Segmentation is probably also required to carry out alliteration tasks which, it has already been noted, are more difficult than rhyming tasks.

Spontaneous rhyming activity involves extracting and changing phonemic segments of words to create novel forms. Children who carry out this activity must be sensitive to some extent to the phonemic composition of words, there is however the question of how conscious such activity is (see Garvey, 5.1.1).

These comparisons suggest that different degrees of phonemic awareness are required for task success. The current task was possibly the least demanding, whilst the alliteration task was probably the most difficult. These degrees of difficulty may reflect a developmental progression in phonemic awareness. The apparent progression from semantic to rhyming awareness cited in 5.1.2.. also supports this possibility.

Although it is possible to suggest a common factor of awareness of phonemic structure across various rhyming tasks, this suggestion does not explain rhyming ability. It provides no further information about the origins of the ability and what cognitive factors may be influential in this awareness. It is possible that failure to carry out experimental tasks can be attributed to a perceptual, memory or storage deficit, a combination of, or none of these factors. Discussion of the development of phonemic awareness is taken up in more detail in section 6.1.2.

The fundamental question still remains of whether phonemic awareness including rhyming ability is related to phonological acquisition and in particular to phonological disorder. In the introduction to this chapter the possible role of rhyme in language development was considered. The problem is left unresolved. In the absence of demonstrated predictive relationships between rhyming and phonological ability the results of the current experiment do not provide firm evidence to support Chukovsky's contention that rhyme is essential to language development. However because a difference in rhyming ability was revealed between the normally developing and the phonologically disordered children and because other authors have suggested an essential role for rhyme in language acquisition it is appropriate to speculate on the possible relationship between phonological acquisition and phonemic awareness reflected in rhyming ability.

c. <u>Possible developmental relationships between phonological ability and phonemic awareness</u>

Logically there are three broad hypothetical possibilities within a developmental perspective these can be stated as follows:

1. **Phonological proficiency will encourage sensitivity to the phonemic structure of language.** Children who have disordered phonology will therefore be less successful at rhyming tasks and other activities which involve paying specific attention to the phonemic structure of their native language.

2. **Phonemic awareness plays an influential role in phonological development.** Children who are relatively insensitive to the phonemic structure of language may show delay or disorder in phonological development.

3. **Phonemic sensitivity and phonological acquisition are mutually reinforcing.** A certain level of phonological expertise provides the building blocks for use in language play, including rhyming activity. Practice with available phonology enables the child to discover relationships between sounds and their combinatory possibilities, which in turn encourages further phonological development.

These possible interrelationships cannot represent absolute proficiency in the two abilities. As the analysis of the children's phonemic simplification patterns demonstrated in 4.6.3 the normal as well as the phonologically disordered children in the investigation were still in the process of phonological development. It is also probable that awareness of phonemic structure shows progressive development as children get older. This may be reflected in the ability to carry out more complex tasks and enable them to make explicit comment about phonemic structure.

Any discussion on the possible developmental interrelationship between phonemic sensitivity and phonological acquisition will also have to allow for other factors which can influence development such as environmental influences and the possible effect of different learning strategies. The possibility also exists that there is not necessarily any interrelationship between phonemic awareness, as demonstrated in rhyming activities, and phonological development. Some other factor may influence both phonological acquisition and phonemic sensitivity, for example memory or perceptual ability. Different levels of such abilities could account for different patterns of development. The results of the present experiment together with those from Magnusson and

Snowling & Stackhouse, do not allow clear rejection or acceptance of any of the possibilities.

Biological predeterminates of phonological acquisition

Any postulated developmental interrelationship would also have to take account of prespeech perceptual and sound production abilities. From the available evidence we know that children are constitutionally provided with considerable capacities to assist phonological development.

First infants have considerable perceptual and discriminatory ability. Eilers (1980) reviews the large amount of evidence from instrumental investigations which demonstrate this. Infants are able to distinguish between sound segments along parameters of voicing distinction, place and manner of articulation. They are also able to recognise similarities between phonemes occurring in different phonetic contexts or spoken by different speakers. This demonstration of perceptual constancy provides evidence that children have the potential to categorise as well as discriminate speech sounds. Kuhl (1980) says the children demonstrate

> " capability to recognise the abstract dimensions of sound in a task that has considerable "cognitive load" To complete the task the infant must be capable of abstracting a similarity between phonetic units even though the acoustic components of the exemplars are

not identical. In addition to abstracting this similarity, the infant must ignore very prominent, but irrelevant dimensions such as pitch contour, talkers and vowel context as well as constantly monitor the signal and recall the rules of the game"
(Kuhl, 1980, p. 62).

Second infants display many of the articulatory features of speech in prespeech sound production. Stark (1986) reviews the currently available information about this pre speech development, which has been obtained from phonetic transcription, feature description and acoustic analysis. She concludes from this review that although there are individual differences between children their sound productions have several universal aspects, possibly genetically determined and related to anatomical and neurophysiological development. She says

"most if not all of the articulatory features of speech are present in a remarkably well organised form... although they are not organized in a manner that resembles speech"
(Stark, 1986, p. 171).

Information about the extent to which infants vary in their constitutional predisposition to discriminate and categorise sound segments is not readily available from the experimental studies which have examined this very early behaviour. Any demonstration of constitutional individual differences, particularly if these could be related in longitudinal studies to later phonological development would be very influential in the discussion of phonemic awareness and possible explanations of phonological disorder.

Phonemic awareness and the start of phonological development

Although the available evidence suggests that children are constitutionally pre-disposed to recognise and analyse speech in an adult like fashion these abilities do not appear to be required in the early stages of lexical development (Menyuk, Menn & Silber, 1986). These authors describe children at this stage of development as identifying, storing and producing words as wholes, or gestalts, which are at first related to specific items and situations. No phonemic discrimination and analysis is required at this stage. The structure is not required to be divorced from the meaning. It is only when the child reaches what Menyuk et al describe as the "exploratory stage" of acquisition when he is developing rules about language that he requires to pay attention to phonemic structure. It is possible to speculate that at this stage the child has to learn to actively use his biologically determined discriminatory and categorical abilities; it is possible that phonemic awareness becomes influential at this stage of development.

The child's productive capabilities during the "exploratory stage" are not well developed and his attempts at words only approximate to the adult target. At the same time the available evidence suggests that children select on phonetic grounds words which they exploit whilst they avoid others (Menyuk et al, 1986). It appears difficult to account for this type of behaviour if the child is not employing a degree of phonemic awareness. The considerable variation between children in the choice of words they choose to exploit and avoid reinforces the view that in some way the children are actively selecting the structures they will work on.

These observations of exploitation and avoidance are used as evidence to support the Cognitive theory of phonological acquisition proposed by Macken & Ferguson (1983). Three types of behaviour are seen as essential to phonological acquisition within this model; selectiveness, creativity and hypothesis formulation. All these behaviours would seem to depend on the child being sensitive to the phonemic structure of language divorced from word meaning. To some extent it is possible to indicate where specific rhyming activity might be employed as part of this behaviour.

Selectiveness refers to the child's ability to focus on specific phonological information in particular the preference for favourite sounds and his particular receptivity to new vocabulary which employs the newly learnt structures. Rhyming activity could provide an opportunity to focus on such structures.

Creativity refers to the process of producing novel segments or structures which do not appear in the child's native adult language. Young children's rhyming activity provides many examples of a real word providing the. starting point from which novel structures are generated.

Macken & Ferguson state that within this model phonological acquisition is not automatic and that the child at some point must recognise similarities and formulate rules through experimentation. An actively useful role for phonemic awareness, including rhyming activity, can therefore be postulated within this model of acquisition. In relation to the three hypothetical possibilities suggested on P.186 the model provides support either for a role for phonemic sensitivity as an influencing factor in phonological development or for a mutually reinforcing interelationship between rhyme and phonological ability.

Kuczaj (1983) offers some support for a mutually reinforcing role between phonological development and phonemic sensitivity. He examines a variety of types of language play in a variety of situations, including crib speech (pre sleep monologues). He is not specifically concerned with rhyming activity but he suggests that crib speech (where rhyming is known to occur) is essentially useful for "post initial processing", in other words for working on and perfecting newly acquired knowledge. He speculates that

> ..."the accretion, tuning and restructuring of knowledge that occurs during crib speech may be particularly important to language learning children"
> (Kuczaj, 1983, p. 168).

This emphasis on post initial processing supports a mutually reinforcing position but it presumes that the phonological learning must precede the play that acts as a consolidating activity.

Bradley & Bryant (1985) interpret the results of their experiments in a way which could be seen as support for a mutually reinforcing position. In discussing the possible continuity between early spontaneous rhyming and later experimental activities they suggest that rhyme sensitivity can be developed through practice. In other words they believe that the ability is to an extent self nurturing. But these authors also believe that environmental influences, in the shape of early experience of and exposure to rhyme, are crucial in assisting the development of rhyming skills. They suggest that the children who are insensitive to rhyme represent the lower end of a continuum of rhyming sensitivity. They do not make clear however whether they believe sensitivity to be entirely environmentally determined or whether the children are in some way predisposed to some extent to their place on the continuum.

It is apparent that available observational and experimental evidence is open to a variety of interpretations which could, to a greater or lesser degree, lend support to any of the three suggested hypothetical relationships between phonological acquisition and phonemic awareness. The trend however appears to be towards phonemic awareness as a prerequisite or mutually influencing factor. And although description and interpretation of available evidence is inconclusive the cognitive theory of phonological acquisition provides the opportunity for such activity to be influential in the child's progression towards a fully developed phonological system.

As the descriptions of the children in Chapter 4 showed, apart from their phonological development, there was little to differentiate the phonologically disordered children from normally developing children, and their phonological behaviour was essentially like that of younger normal children rather than different in character. The phonologically disordered children could be described as being at the bottom end of a phonological development continuum. They also appear at the bottom end of the rhyming sensitivity continuum on the current experimental task.

It is possible that as younger children they were also relatively insensitive to rhyme and did not benefit fully from a possible mutually reinforcing rhyme, practice, phonological development cycle. In the current state of knowledge this can only be speculation. There is however a little anecdotal support for a role for early rhyming sensitivity in phonological disorder from the current experiment. Two of the mothers who were present during the presentation of the task were surprised at the children's obvious difficulty with this experiment. They both commented in a later session that the rhyming task had made them think about and realise that these children, when compared to their siblings showed an early lack of interest and appreciation of rhyme.

5.4 CONCLUSION

Poor performance on this experimental task was found to be related to phonological disorder, but it was not found possible to account for this relationship. The type of rhyming activity assessed in this experiment was found to be neither a necessary or sufficient explanation of the level of phonological ability reached by the children. The role of rhyme awareness in normal phonological acquisition was also discussed but remains unresolved although the cognitive theory of language acquisition provides for the possibility of such a role.

An explanation of rhyme insensitivity as a specific auditory processing deficit was considered. If such a deficit could be demonstrated in phonologically disordered children this would assist in explanation of the disorder but it was not possible to support or refute the theory of an auditory processing deficit within the design of the current experiment.

Some suggestions can be made for further investigation to advance explanation in the above areas. Such investigations might include longitudinal developmental studies and experiments directed towards determing whether using activities designed to encourage rhyming awareness can accelerate phonological acquisition.

Further information on the interrelationships between rhyming and other cognitive abilities could be obtained from experimental studies designed to investigate the child's ability to recognise and manipulate the same set of pictured materials in a variety of conditions constructed to assess attention, memory, recall, naming and rhyming. Preference for rhyming or semantic matching also requires investigation. In the current experiment the non-rhyming detractors were neutral; an experimental task which required the child to select pictures according to meaning or phonemic structure would assess the strength of the relative relationships.

If this type of task could be developed in a way which reflected the Rack experiment (section 5.3.3) but used some visual matching strategy other than the orthographic and was within the memory constraints of young children such an experiment would support or refute the possibility of an auditory processing explanation. Using the same set of materials in a variety of experimental conditions would clarify the specificity of rhyming sensitivity and or its interdependence with other cognitive abilities.

Such experiments would only demonstrate current sensitivity to rhyme and could not determine directional effect between sensitivity and phonological ability. It is possible that rhyming ability develops over time. It is also possible that it may have a role in the early stages of phonological development but may not be relevant in the later stages of acquisition. There is therefore a need for longitudinal developmental studies which include consideration of phonemic sensitivity including rhyming ability as well as phonological expertise.

Longitudinal developmental studies would increase knowledge of possible interrelationships between phonological development and phonemic sensitivity. There are few known longitudinal studies of phonological development and none which include consideration of the child's phonemic sensitivity. Phonologically disordered children are typically seen at one point in their development; little knowledge is available of their earlier development or of predictive relationships between early and later phonological development.

Two investigations which have been concerned with longitudinal phonological development (Menyuk et al, 1986, and Vihman, 1986) demonstrate that to some extent a predictive relationship does exist between early and later phonological development. Vihman found that children who were relativly advanced at twelve months were also advanced at three years.

Menyuk found that three children who performed below average throughout her investigation later required remedial help. However other children in the same investigation who started off below average in terms of phonological acquisition caught up with other children.

It is not known why such differences exist. Vihman suggests that relative phonological advance reflects "early maturity both in articulatory skill and sensitivity to the sound structure of adult language" (Vihman, 1986, P. 107). But it is not known whether this is constitutionally determined, reflects individual learning styles or speed of development or is environmentally influenced. An investigation of the interrelationship between level of phonological development and level of phonological sensitivity represented by rhyming and other play with language could throw some light on the possible role of this activity in acquisition but further investigation would be required to determine whether rhyming ability preceeded phonological acquisition.

This can possibly be determined by investigating whether rhyming ability or phonemic awareness could be developed and if so whether or not it would lead to acceleration of phonological development. Two possible types of subjects can be suggested for this type of research. Very young children in the process of phonological acquisition and phonologically disordered children.

The available observational evidence shows that children from around two years of age are known to be capable of rhyming activity; it should therefore be possible to devise activities to determine whether such behaviour can be actively encouraged. Ferguson & Macken (1980) suggest that encouraging phonologically disordered children to play with language would be an appropriate therapeutic strategy. There is already some clinical evidence to suggest that activities directed towards the development of phonemic awareness have resulted in changes in the child's phonological production (Hill, Howell & Waters, 1988 and In press, see also Chapter 11). These activities have been concerned with specific sound classes and have resulted in rather specific production changes. They do however suggest the possibility of attempting to develop awareness across the whole phonemic spectrum.

Although the findings remain inconclusive this experiment has shown that rhyming activity provides a potentially fruitful area for further investigation into the possible explanation of phonological disorder. The next chapter looks at the phonemic segmentation experiment and develops discussion of the relationship between metalinguistic awareness and phonological acquisition further.

CHAPTER 6

THE SEGMENTATION EXPERIMENT

The second experiment in the investigation was designed to find out about the children's ability to segment the initial phoneme from the rest of a word.

6.1 INTRODUCTION

Selecting a procedure to assess segmentation proved difficult because segmentation is arguably the most thoroughly investigated type of metalinguistic awareness. Research into the segmentation abilities of three to seven year old children has been carried out by Barton, Miller & Macken (1980), Bruce (1964), Calfee, Lindamood & Lindamood (1973), Fox & Routh (1975), Elkonin (1977), Hakes (1980), Helfgott (1976), Kamhi et al (1985), Liberman, Shankweiler, Fischer & Carter (1974), Whitworth & Zubrick (1983) and Zhurova (1973). It is these investigations, out of a larger number of segmentation experiments, which form the basis of the current discussion, selected because they most influenced the choice of task used in the current experiment. A more extensive review of segmentation research can be found in Nesdale, Herriman & Tunmer (1984) and Bryant & Bradley (1985).

The relationship between segmentation ability, chronological age and literacy is particularly pertinent to an investigation of the ability in this age group influencing both subject selection and task design and it will therefore be considered in the introduction to this chapter. A discussion of the small amount of information available about the relationship between segmentation abilities and language disorder will follow before the current investigation is described.

6.1.1 PREVIOUS SEGMENTATION EXPERIMENTS

Different degrees and types of segmentation and a variety of different types of subject responses have been required in previous segmentation experiments. Consequently the experiments vary in their complexity and the cognitive demands they make on their subjects. It is therefore not surprising that the results of the investigations reveal that task success is generally related to age. Most investigators have been able to demonstrate that by the age of seven the majority of children can successfully complete segmentation tasks regardless of the nature of the task. In contrast the youngest children previously investigated, (three to five year olds), appear to have had very variable success rates and some researchers have reported a complete lack of achievement on segmentation tasks by this age group.

The three to five year olds appear to be most successful at those tasks which demand partial rather than complete segmentation. Partial segmentation (Helfgott, 1976 and Lundberg 1978) describes activities where the subject is required to provide only one part of a presented word or sentence. These authors regard this as an easier task than complete segmentation, the division of a word into all its constituent phonemes.

One type of partial segmentation task requires the subject to segment progressively smaller units starting at sentence level. This method was first used by Fox & Routh (1975) with children aged between three and seven and later replicated by Kamhi et al (1985) in a comparative study of normal and language disordered children aged between three and six. In these experiments the subjects were first asked to break the sentence into words by being instructed to "say just a little bit of it" (Fox & Routh, p. 335). Using the same instruction and words taken from the original sentences the children were then asked to segment the words into syllables and then the syllables into phonemes.

Fox and Routh reported that three year olds had some success at segmenting words and sentences and that four year olds were little different from seven year olds at this task, many of them reaching ceiling.

Their results suggest that phonemic segmentation is a rather more difficult task than word and syllable segmentation, but even so three year olds successfully segmented 25% and four year olds 70% of the presented syllables. The children reached ceiling on this task between the ages of six and seven. In their replication of this experiment Kamhi et al obtained similar results from their normal subjects.

An alternative partial segmentation task requires the subject to segment the initial phoneme from the rest of a presented word. Zhurova (1973) used this type of task with three to seven year old subjects who were asked to say the first sound of a variety of animal names. This experimental design was later adapted by Barton et al (1980) as part of an investigation into four year old's awareness of word initial clusters.

Zhurova found that the three year olds separated the initial phoneme from the rest of the word with a pause, but then followed it with the rest of the word (for example [də.də.dɒgɪ]) The majority of four and five year old subjects could segment the initial sounds of words after training and subjects over five were successful without training. Barton reported successful segmentation by all twenty four of his subjects in his replication of the experiment.

Complete segmentation tasks appear to be much more difficult for this age group. Liberman et al (1974) used a complete segmentation task with subjects aged between four and eight. In this experiment half the children were asked to divide words into their constituent syllables and half to divide syllables into phonemes. The phoneme segmentation task was later replicated by Hakes (1980). Liberman reported that only half the preschool children (mean C.A. 4.11) could tap out all the syllables in a word and that none of them could tap out phonemes. Half the Kindergarten children (mean C.A. 5.10) could also tap out syllables and 17% were able to tap out phonemes. Hakes recorded a complete lack of success by four and five year old's in the phonemic segmentation task.

These experiments differed in another respect from those described earlier in this section. Instead of requiring a verbal response Liberman and Hakes asked their subjects to tap out the number of syllables or phonemes with a wooden rod. Other researchers have used a variety of non verbal responses or have asked their subjects to accompany a verbal response with another activity. Elkonin (1977) and Helfgott (1976) provided visual models of words by representing each phoneme of a presented word by a square drawn on a piece of paper. As the subjects said each phoneme they were required to place a counter in the corresponding square. Other objects have been used to represent syllables and phonemes such as coloured blocks (Calfee et al, 1973, Hook & Johnson, 1978, Lindamood & Lindamood, 1971 and Barton, et al 1980) or chips and counters (Ehri & Wilce, 1980 and Hook & Johnson, 1978).

Using visual models Helfgott (1976) investigated the ability of six year old children to carry out partial and complete segmentation tasks. Using the same cvc words one group of subjects were asked to divide the words into c-vc, one group into cv-c and one into c-v-c segments. She found a wide variation in ability between the children regardless of the task. A comparison of scores on the different tasks shows that c-v-c segmentation was most difficult, a third of the children were unable to segment any of the words in this way. Segmentation into c-vc was the easiest task and the majority of children could do this without difficulty.

Some segmentation tasks appear to require not only analysis but subsequent synthesis of the experimental material (Nesdale et al 1984). Bruce (1964) asked subjects with mental ages between five and nine to say what word was left if a particular sound was taken away from another word. Tasks like these appear to be particularly demanding. The five to seven year old children in the Bruce experiment had very little success at this task. The five and six year olds overwhelmingly tending to respond by providing a random sound or letter name. Bruce concluded from his results that children under the age of seven were unable to perform phonemic analysis.

As an alternative to providing a verbal or physical production of the desired segments some subjects have been asked to select words beginning or ending with specific phonemes. Whitworth & Zubrick (1983) used this method with children aged between 4.00. and 6.11. They presented their subjects with sets of pictured objects and asked them which one started or ended with a specific phoneme, for example *"dog, sun, church, pig"*. In another task they asked which word was the odd one out, for example *"pig, pins, pencil, moon (moon)"* (Whitworth & Zubrick, 1983 p.39). This odd one out type of task is similar to the rhyming and alliteration tasks described in Chapter 5.

Whitworth & Zubrick also asked their subjects to find words within words in a set of progressively more complex tasks. The tasks ranged from identifying two words within a bi-syllabic compound word, for example dividing "doormat" into door and mat to finding a final word component in a monosyllabic word, for example red in bread (Whitworth & Zubrick, p. 38).

This series of experiments provides an interesting demonstration of the development of segmentation ability between the ages of four and seven across a range of tasks. These authors found, for example, that 35% of four year olds were able to divide some bi-syllabic words into other words, but consistent success was not achieved until age 6.11 and no four year old was able to identify smaller words in mono-syllabic words compared with 45% of the 6.06.-6.11 age group. Ten per cent of 4.00-4.06 year olds could segment all initial sounds in presented words but 75% of this age group had no success at all on this task although the success rate was 100% by the age of 6.06. Whitworth and Zubrick conclude that their results support those of Fox and Routh (1975) and refute those of Bruce (1964). However the youngest children in the Whitworth and Zubrick experiment do appear to have been rather less successful at initial phoneme segmentation than those in the Fox and Routh experiment.

It appears therefore that for the three to seven year old age group partial segmentation is easier than complete segmentation and that syllable and word segmentation is easier than phonemic segmentation and that tasks that require synthesis appear to be particularly demanding.

6.1.2 POSSIBLE REASONS FOR AGE RELATED SEGMENTATION ABILITY

Various possible explanations can be suggested for age different responses. The possible influence of response to acoustic cues will be considered first.

a. <u>The influence of acoustic cues on segmentation</u>

Liberman et al (1974) discuss the word, syllable phoneme segmentation relationship in some detail. They suggest that segmenting sentences into words presents few problems in segmentation tasks because words are meaningful units that are required for understanding and using language. Although syllables are not meaningful units they believe that they are easier to segment than phonemes because each syllable contains a vocalic nucleus represented by a peak of acoustic energy. Although this acoustic peak does not help to mark syllable boundaries it is suggested that it assists the child by helping him to count how many syllables there might be in a word. In contrast the phoneme is an imprecise and abstract unit that does not correspond in any direct way to the speech signal. There are no constant, specific acoustic criteria to help the child distinguish individual phonemes; they are not produced as separate elements, successive phonemes within a syllable being transmitted almost simultaneously in a complex continuous signal.

Certain acoustic parameters also indicate the nature of the relationship between vowels and consonants within a syllable, for instance vowel length varies with the number of consonants that follow it. Chiat (1979) suggests that during the process of phonological development these acoustic parameters may help children to distinguish syllables and provide them with more information about the phonemes within the syllables. (The possible relationship between phonological acquisition and experimental segmentation tasks will be discussed in section 6.4.3.).

In addition to the differing acoustic cues needed for syllable and phonemic segmentation acoustic cues may also be influential in determining the relative difficulty of different types of phonemic segmentation. In investigations which have compared the ability to segment initial and final phonemes children of all age groups were more successful at segmenting initial phonemes, see the results of Helfgott (1976) and Whitworth & Zubrick (1983) reported earlier.

In those tasks where the subjects are asked to provide the first phoneme of a word or syllable they may in fact be being asked to provide the acoustically most prominent phoneme. Helfgott suggests that initial phonemes are more salient, more fully realised and are less influenced by surrounding phonemes and they may therefore be easier to detach. Treiman (1985) investigated the effects of syllable structure on the development of phonemic segmentation. She reports, quoting Treiman & Baron, (1981) and Treiman & Breaux, (1982), that young children perceive syllables as undifferentiated wholes and that five year olds are better at segmenting 'onset' (initial consonant group, c or cc) from 'rime' (following vowel or vowel and consonant, v or vc) than other types of syllable division. These findings, utilising linguistic theory, lend support to the possible role of acoustic influence in segmentation.

It therefore appears possible that different types of segmentation require the ability to use different types of acoustic cues. The association between task success and chronological age indicates that the development of, or ability to use these cues may be age related. Syllable segmentation in contrast to phonemic segmentation may be possible without the knowledge that words are composed of phonemes that are detachable and can be regarded as separate entities. In brief segmentation ability may in part be a reflection of a developing ability to respond to acoustic cues. A similar point was also made in the previous chapter (5.3.3) in relation to the degree of awareness required for successful completion of the rhyming task.

b. Task Complexity

Alternatively some younger children may be failing in some tasks because they are unecessarily complex and demand more than segmentation ability for successful completion. The Bruce (1964) experiment has been a particular focus of criticism (see for instance Fox & Routh (1975) Lundberg (1978) and Nesdale et al (1984)). These authors suggest that a number of mental operations in addition to segmentation are required to complete the Bruce experimental task of determining which word is left after removing a specific phoneme. The subjects must first appreciate the individual phonemic segments of the word, isolate and remove one of them and then reconstruct the remaining phonemes to form another word presumably drawing on their lexical knowledge to provide the new word. Such a combination of mental operations may be beyond the cognitive ability of young children. Consequently it is not possible to determine whether failure in this task is purely an indication of inability to carry out phonemic segmentation.

c. The Nature of the Experimental Response

It is difficult to determine what effect the type of response required from the subject might have on success at the experimental tasks. There is some controversy about whether the nature of the response required simplifies or complicates the tasks. Helfgott (1976) believes that the use of a visual modality, in her case the use of squares and counters, makes the task easier because it gives the subjects additional information about the number of phonemes in the word and allows for response in a visual kinaesthetic modality.

On the other hand Nesdale et al (1984) believe that tasks which involve manipulating blocks make the task more difficult by not consistently relating specific colours to specific phonemes. Lundberg (1978) suggests that tapping and repeating segments, required by Liberman et al (1974) complicates segmentation because simultaneous attention has to be paid to tapping the number of segments and identifying segment boundaries. It can also be argued that this task requires numerical, in addition to segmentation, ability. It is also possible that cross modality responses requiring the translation from auditory verbal to visual or kinaesthetic channels may also make tasks more complex.

d. <u>The Effect of Training</u>

Other aspects of the experimental method in addition to task related factors may also affect performance including the amount of training provided. A considerable amount of training appears to have been involved in some experiments where three to five year old children were reported to be successful. Zhurova (1973) spent a long time in training procedures as part of her experiment. This included segmenting the first sound of the children's own names, an activity which was probably motivating for the children, possibly focusing on the one word which they may have had experience of segmenting.

Zhurova also repeatedly prolonged and repeated the initial sounds of words for the children, an activity which may increase acoustic prominence in addition to providing information about the segmentation requirements of the task. Training of some kind may also have taken place, though more indirectly, during the Fox and Routh experiments. Asking the children to first segment a sentence followed by segmentation of progressively smaller units may have prepared them for success at the phonemic level. This last stage could possibly be seen as a continuation of providing smaller and smaller units rather than explicit phoneme segmentation (Nesdale et al. 1984).

Most researchers make little reference to the possible effect of training, but in some experiments training appeared to have little effect on task success. Hakes (1980), for instance, reports that four and five year old children could not carry out phonemic segmentation and did not learn to do so.

e. Motivation and Task Success

In section 5.1.4 the intrinsic attractiveness and relevance of a rhyming task and its consequent motivation for the younger children was seen to be important for success. There is little comment about the children's responses to the experimental tasks in the segmentation literature and it is only possible to speculate how motivating the different tasks might be for young children. The use of model animals and the child's name may have been motivating factors in the Zhurova experiment. Fox & Routh gave the children raisins as a tangible reward for success which may have motivated them to greater effort.

There are therefore a number of possible factors related to the nature of the task which may contribute to the success of young children in segmentation experiments. The knowledge and experience that children bring with them to the experimental situation will also contribute to their success. The acquisition of literacy, which will be discussed next, is likely to be a particularly influential factor.

6.1.3 SEGMENTATION AND LITERACY

The relationship between segmentation ability, and literacy revolves mainly around the issue of phonemic segmentation ability. In section 6.1.2, it was suggested that whilst phonemic segmentation requires knowledge of phonemes, word and syllable segmentation may be achieved by responding to meaningful units and peaks of acoustic energy respectively.

The relationship between phonemic segmentation and literacy is concerned with the question of whether knowledge of orthographic forms provides children with stable visual cues to assist in the identification of the individual phonemes within the stream of speech or whether the ability to segment phonemes provides the impetus to recognise orthographic forms and attach them to their auditory equivalents. To put it another way is phonemic segmentation ability the end point of a gradually developing ability or is it a special sort of ability arising out of or assisted by exposure to written language?

A strong correlation exists between reading and phonemic segmentation (Bertelson, 1986) but the direction of the influence between the two abilities, or their relation to a possible third underlying factor remains unresolved. Evidence exists for both influencing positions and Bertelson provides a detailed discussion of the relative positions. The case for phonemic segmentation ability as a precursor to literacy is most strongly supported by the work of Bryant & Bradley which was discussed in section 5.1.3, (see also 2.7.2). Support for the alternative position of literacy as an influencing factor on phonemic segmentation was discussed in 2.7.1.

It is not known to what extent the gradual development of segmentation ability between the ages of three and seven represents a process of normal development or is influenced by becoming literate. Lundberg (1978) utilising information from studies of the segmentation abilities of Scandinavian children who do not start formal education until the age of seven suggests that phonemic segmentation appears to be a reflection of cognitive growth rather than a literacy dependent ability.

Knowledge of the extent of children's formal education can only provide a crude indication of their exposure to written language and it is probable that children will have had different degrees and kinds of exposure in their respective environments. Even if the extent of a child's experience of written language can be determined, there is currently no indication of the amount or type of experience that might be required to develop or assist in phonemic segmentation activities. Similar reservations can be expressed about investigations of the ability in adult illiterates (2.7.1). In addition, for these subjects, there is a lack of knowledge about what other factors, in addition to lack of educational oppportunity might have affected their ability to learn to read and write.

The relationship between environmental influences and metalinguistic awareness was discussed in 2.9. Given the current state of knowledge it is not possible to determine the extent to which exposure to written language affects the segmentation ability of children who are about to or who have just started formal education. It nevertheless is a variable which should be considered when interpreting experimental results and controlled in experimental design.

6.1.4 LANGUAGE DISORDER AND SEGMENTATION ABILITY

Clinical observations of the segmentation ability of speech disordered children have been reported by Stackhouse (1985). These children were seen to have problems with tapping out the number of phonemes or syllables in a word. They also had difficulty with games such as 'I Spy', using the initial phoneme as a clue, and 'spoonerism' tasks which required the transposition of the first sounds of words in two word phrases to make another phrase, for example turning "bad manners" into "mad banners" (Stackhouse, op. cit. p. 105). Murray (1988) (see section 2.3.2) asked her subjects to find real words within pseudo words by extracting phonemes from the pseudo words (a task adapted from Rosner & Simon. 1971). She found that her language disordered subjects were inferior to both matched control groups on this type of segmentation task.

There appears to be only one published experimental investigation of the segmentation ability of language disordered children. Kamhi et al (1985) compared the segmentation ability of fifteen language disordered children with two groups of normally developing children. One normally developing group was matched to the language disordered group for mental age and the other for language age. The language disordered children were aged between 3.00 and 6.00 and their receptive and expressive language ability was reported to be at least a year behind their assessed mental age.

The procedure developed by Fox & Routh (1975) which required the children to divide a sentence into smaller and smaller segments was used to assess segmentation ability. The sentences and words used in the experiment were at a level approximately one year below the language age of the least linguistically developed child. Therefore no child was at a disadvantage by being expected to segment structures which they were not capable of understanding and using.

Kamhi et al are not specific about whether the children segmented the words into syllables or phonemes but the examples they provide suggest the former. They found that the language disordered children had particular difficulty in segmenting words into smaller units. Only two of the language delayed children, compared to over half of the language age matched children and 80% of the mental aged matched children could segment mono-syllabic words into smaller units. The language disordered children were also inferior to both groups of normally developing children in their ability to segment sentences and bi-syllabic words. These authors suggest that the results of their investigation indicate that language disordered children have inferior ability both in acquiring and accessing knowledge about the elements of language. They recommend as a result of their findings that metalinguistic objectives should form part of intervention procedures for language disordered children as a basis for future educational requirements.

This review of selected research into segmentation ability has shown that it is an ability that is in the process of development during the pre school years. The nature of the task appears to be an important factor influencing successful segmentation, phonemic segmentation being particularly demanding. Knowledge of written language and phonemic segmentation are known to correlate but the precise nature of the relationship between them is unclear. The small amount of information currently available indicates that speech and language disordered children appear to have inferior segmentation skills compared with children with both the same mental and language age. A segmentation task therefore appears to be a very suitable method for comparing metalinguistic ability in the two groups of children in the present investigation.

6.2 THE PILOT STUDY

The experimental task used in this study is based on the work of Zhurova (1973) and Barton (1980). Zhurova's task in which the child had to provide the initial phoneme of the animal's name as a password was replicated in the early stages of this pilot investigation using twelve model animals. This proved to be a very enjoyable activity for the children and they were highly motivated to carry out phonemic segmentation using this method, but several factors prevented it from being used as the final experimental task. The initial instructions to the children about the nature of the activity were cumbersome and it was also difficult to find a sufficient range of familiar model animals to represent a range of different phonemes. There was sometimes a lack of agreement between some of the children and the experimenter about the names of the animals, (particular difficulty was experienced with calling the goose a duck and the tiger a lion). Some children gave the sound the animal made rather than the appropriate phoneme, an understandable response given the nature of the activity, but one which further complicated the introduction and explanation of the task. The experiment was therefore modified using Barton's adaptation to the experiment, by using pictures and a range of objects instead of animals. This resulted in a gain of easier application, avoidance of disagreement, access to a greater variety of initial phonemes and a clearer scoring procedure but a loss of some of the enjoyment of the original experiment.

A total of twelve children took part in the final version of this task in the pilot study, six girls and six boys. They had a mean age of 4.02 years, with a range from 3.10 to 4.10 years. Scores, out of a possible maximum of twelve correct responses, ranged from 0 to 12, with a mean of eight. The child who scored nothing understood the concept of segmenting but segmented the initial phoneme and following vowel rather than the initial phoneme of each word. The children found the task enjoyable and they all made some attempt to segment the words in some way it was therefore thought to be a suitable task for inclusion in the main investigation.

6.3 THE MAIN EXPERIMENT

6.3.1 METHOD

Subjects

All forty two children in the investigation took part in this experiment.

Procedure

The material consisted of twenty single object pictures representing monosyllabic words presented on cards 17 x 11cm. Twelve of the words were presented to and scored for all subjects. Six words started with stops, four with fricatives, and one each with a nasal and an approximant. In order to determine whether a particular class of phonemes was more difficult than others to segment eight other words, four starting with vowels and four with clusters were used with some children in both groups but not scored.

Before being asked to segment the experimental words the children took part in a training procedure similar to the one used by Zhurova (1973). They were introduced to the task by asking them if they knew what a sound was. The experimenter then provided some examples of single phonemes. A composite picture of the seaside was then used to demonstrate that different words begin with different sounds. For example the examiner would point to the sea and the sand and say that they began with the same sound /s/ and invited the child to find something else beginning with /s/. In this initial stage the sound was prolonged and emphasised. The process of sound discovery was then reversed. Using the children's and the experimenters first names the children were asked if they could say the sounds they started with. Two trial pictures (sock and ball) were then used to highlight the segmentation of the initial phoneme. These phonemes were first emphasised or lengthened by the experimenter when saying the word and then said several times at the start of the word (b..b..b..ball). The children were then invited to say the first phoneme of the trial pictures.

After the initial training period was completed the test pictures were presented singly and named by the experimenter and the children were asked what sound each word started with. If the children gave no response or said they didn't know the word was repeated once but no further training was given. The responses were transcribed phonetically and checked later with a simultaneous tape recording. The full list of words can be found in Appendix 5.

Scoring Procedure

A response was scored as correct if the child provided the first phoneme of the presented word in isolation or if accompanied by a schwa (the normal response when producing stops in isolation). If a phonologically disordered child provided his own substitution instead of the adult target, for example [tʌn] in response to the request to segment "sun", this was recorded and also scored as correct.

6.3.2. RESULTS

Most children found this an interesting although difficult task and they were cooperative during both the training period and the presentation of the experimental words. A few children in both groups appeared rather bored by the activity, possibly because they found it difficult. No child refused to cooperate but it is possible that in some instances lack of motivation has resulted in scores that may not fully reflect their segmentation ability.

Scoring of the children's responses did not present any difficulty. It was possible to determine quite clearly whether a response represented a correct phonemic segmentation.

a. <u>Comparison of segmentation ability between the two groups of children.</u>

The phonologically disordered group found this a more difficult task than the normally developing group. The raw scores for each child can be found in Tables C & D Appendix 6. If the total scores for each group are compared it can be seen that the phonologically disordered children successfully segmented 42 (17%) out of a possible 252 words, whilst the normally developing group segmented 95 words, (38%) of the total.

The distribution of scores, means and Standard Deviations of both groups can be found in Table 6.1.

Table 6.1 Frequency Distribution, Means and Standard Deviations of Segmentation Scores. All Subjects.

Score /12	Group PDG	NDG
12	-	2
11	-	1
10	-	-
9	-	2
8	2	1
7	-	-
6	-	1
5	1	2
4	2	2
3	1	1
2	3	2
1	4	3
0	8	4
N=	21	21
Mean	2	4 5
SD	2.6	4.1

A Mann-Whitney U Test was calculated to determine whether the subjects were drawn from the same population with regard to segmentation ability. This test showed that the difference between the two groups was just significant, the result was:

U = 137.5, $p<0.05$ for $N_1=21$ and $N_2=21$ (two tailed tie corrected)

As Table 6.1 shows many of the subjects in both groups found it a very difficult task, with most of the scores clustered in the bottom half of the table, eight children in the phonologically disordered group and four children in the normally developing group failing to phonemically segment any words. The highest score in the phonologically disordered group was 8, and two subjects in the normally developing group reached ceiling on this task.

Distinguishing between the two groups of subjects solely on their ability to provide phonemic segmentations of the experimental words provides only a gross measure of ability. It was therefore decided to examine the nature of their responses in more detail to see if there was any developmental trend in segmentation ability. The results of this analysis can be found in section 6.3.2.

b. <u>Relationship between Segmentation and Phonological Ability</u>

Kendall rank-order correlation coefficients (τ) were calculated to determine whether there was any relationship between segmentation and phonological ability. The results can be found in Table 6.2.

Table 6.2 Kendall Rank-Order Correlation Coefficient (T) of Segmentation Scores with EAT and other Pre-Investigation Variables

	Tot. Pop N=42	PDG N=21	NDG N=21
EAT	0.25*	0.01	0.16
CA	0.27**	0.20	0.18
RDLS	0.37**	0.25	0.42**
WPPSI	0.34**	0.25	0.30
Aud. Mem	0.08	0.12	0.03
Aud. Dis	0.31**	0.35*	0.26

** significant at 0.01 level
* significant at 0.025 level

This table shows a low but significant correlation of $T = 0.25$, $p<0.025$ between segmentation and phonological ability as measured by the results of the E.A.T for the total population. The correlations between these two variables did not reach significance when the results of the two groups of subjects were examined separately.

Kendall partial rank-order correlation coefficients were calculated for the total population to determine the independence of this association from other variables. The results are presented in Table 6.3.

<u>Table 6.3</u> Values of Kendall Partial Rank-Order Correlation Coefficients ($T_{xy,z}$) for E.A.T and Segmentation, other Variables held Constant

Var Held Constant	$T_{xy,z}$
CA	0.23
RDLS	0.14
WPPSI	0.21
Aud. Mem	0.24
Aud. Dis	0.22

Critical value for n=42 is .203 $p<0.025$

All the values in Table 6.3 with the exception of the RDLS are above the critical value of .203. Therefore when these variables are controlled statistically the association between segmentation and phonological ability remains significant. The small amount of change in these values from the correlation of 0.25 (Table 6.2) indicates that these variables have little influence on the association. However Table 6.3 shows that the association between segmentation and phonologically ability ceases to be significant when the RDLS is controlled statisitically.

c. <u>Association between Segmentation and other Measures</u>

Table 6.2 shows the correlations between the segmentation task and pre-investigation variables.

1. **Chronological Age:**

There was a significant correlation between segmentation and chronological age of $T = 0.27$, $p < 0.01$ for the total population. There was no significant correlation between these two measures when the groups were examined separately.

2. **Auditory Discrimination:**

Table 6.2 shows that there was a significant correlation between segmentation and auditory discrimination, $T = 0.31$, $p<0.01$ for the total population. There was a correlation of $T= 0.35$ $p<0.025$, between these two measures for the phonologically disordered group. The correlation between these two measures for the normally developing group did not reach significance.

When the results of individual children are compared on these two measures the best segmenters in the disordered group are also among the best discriminators. But good discrimination does not guarantee segmentation ability. Several children in both groups who obtained good discrimination scores were poor at segmenting. There is a tendency therefore for the better discriminators to be the better segmenters but it is not possible to predict segmentation ability from discrimination ability and vice versa.

3. Auditory Memory

There were no significant correlations for the total population or for either group between segmentation and auditory sequential memory. As Table 6.2 shows the correlations between auditory memory and segmentation were the lowest of all the correlations.

4. Language Comprehension:

Table 6.2 shows that for the total population there were significant correlations between segmentation and language comprehension (RDLS) of r $=0.37$ $p< 0.01$ for the total population and 0.42 $p<0.01$ for the normally developing group.

Comparison of individual scores on these measures show that the best segmenters in the phonologically disordered group all scored above the mean for the group on the R.D.L.S. The four children in this group who had a standard score below 0 on the R.D.L.S, also scored below the mean in this experiment. In the normally developing group the best segmenters all scored above the mean on the R.D.L.S. The one child in this group who had a standard score below 0, did not segment any words. There appears, therefore, to be a general trend for children who have good language comprehension to be good segmenters, but good language comprehension does not predict good segmentation and although poor comprehension does appear to be associated with poor segmentation it does not prevent it.

5. Non Verbal Intelligence:

Table 6.2 shows that the correlation between non-verbal intelligence (W.P.P.S.I) and segmentation was 0.34 $p<0.01$ for the total population. The correlations between these two measures when both groups were examined separately were not significant.

The results of individual children shows that relatively high non verbal intelligence is associated with but does not guarantee segmentation ability in either group. The two children in the phonologically disordered group who had non verbal intelligence quotients below 100 both failed to score on the segmentation task. Two children in the normally developing group also had below average non verbal intelligence, one of them failed to segment any words and one segmented three.

The nature of the association between segmentation and the pre-investigation variables suggests that there is no simple relationship between any one factor and segmentation. The association between the two metalinguistic tests described so far will be discussed next.

d. Association between Segmentation and Rhyming

The Kendall rank-order correlation coefficient was calculated to determine whether there was any association between segmentation ability and rhyming. The results are presented in Table 6.4.

Table 6.4 Kendall Rank-Order Correlation Coefficient (T) between Rhyming and Segmentation

Total Pop N=42	PDG N=21	NDG N=21
0.53**	0.45**	0.51**

** = Significant at the 0.01 level

This table shows a significant correlation between the results of these two experimental tasks for the total population and both groups separately at the 0.01 level of significance. The correlations between the two experimental tasks were considerably higher than those between segmentation and other variables both for the total population and each group.

If the results of individual children are compared the best rhymers tend to be the best segmenters. But it is possible to be a good rhymer and not be able to segment, A15, and an above average segmenter but a relatively poor rhymer, A10. In the normally developing group a similar pattern of relationships emerges most of the children however tended to be better rhymers than segmenters. This possibly provides some indication of a developmental trend between the two tasks.

e. <u>The nature of the responses.</u>

The phonetic transcriptions of the children's responses were examined. It was found that they could be divided into the following categories.

A. Phonemic segmentation.

B. Segmentation of the initial phoneme and the following vowel, that is cv segmentation. For example [va] in response to "van".

C. Incorrect single phoneme.

D. Semantic definitions.

E. Naming the presented picture.

F. No response / Don't know.

G. Other.

The distribution of the different types of responses for each child can be found in Appendix 6, Tables E & F. These tables show that on the whole individual children in both groups tended to favour certain types of response rather than move indiscriminately from one type of response to another. Figure 6.1 illustrates the relative distribution of the different types of responses for each group, the different types of responses apart from phonemic segmentation are discussed in more detail below.

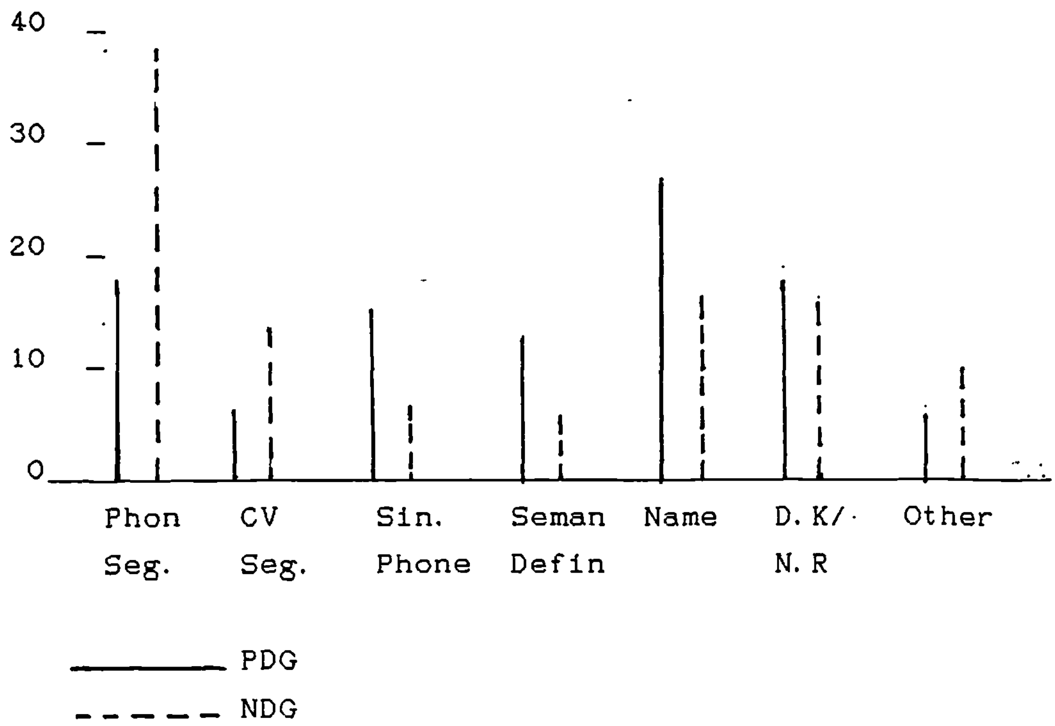

Figure 6.1 Percentage Distribution of Different Types of Responses to Segmentation Task. All Subjects

C.V. Segmenting:

The phonologically disordered children provided 16 (6%) examples of cv segmenting, subject A1 providing nine of these. The normally developing group gave a cv response to 33 (13%) of the total words. Ten of the responses from subject B15 were of this kind.

When the word was a cv structure, for example "key", the children who favoured a cv response tended to provide the whole word. All the experimental words were monosyllables so there was no measure of possible syllable segmenting. All the children who gave cv responses also provided some examples of phonemic segmentation.

This co-occurrence suggests that phonemic and cv segmentation are associated. This type of response compares with that of some of the results from the Fox & Routh (1975) and Kamhi et al (1985) experiments. It is possible that it reflects a stage between syllable and phonemic segmentation. The whole word response to cv structures is a possible indication that the children were still responding to the acoustic salience of the vowel. Treiman (1985) suggests that segmenting the onset and rime as a whole may be an intermediate stage in segmenting. Because all the words used in the current experiment were monosyllables no examples of syllable segmenting were collected.

Production of Incorrect Single Phonemes:

This category of response included random production of phonemes or persistent use of one phoneme, particularly /s/ a phoneme that had been used in the training tasks. The disordered group provided a total of 40 (16%) responses of this kind compared with 14 (6%) from the normally developing group. It is not possible to say whether this type of response represents a specific effort to accomplish the task, possibly reflecting some stage in segmentation development, or no understanding of the task but purely imitation of the testers' productions used in the training period. It is possible that children who favoured this type of response but who also provided the correct phonemic segment in one or two instances may have hit upon these by chance.

Semantic Definitions:

This type of response was also more common in the disordered group who provided 34 (13%) examples, compared to a total of 11 (4%), provided by three children, in the normally developing group. This type of response may represent inability to detach structure from meaning discussed in section 5.1.2.

Naming:

This was the most frequent response from the phonologically disordered group, sixty five (26%) of their responses, fell into this category. Fourteen of the children provided some responses of this kind which for five of them formed the majority of their responses. It was also a common response from the normally developing children they provided 40 responses of this kind, 16% of the total. If this type of response predominates for a child it possibly reflects a lack of understanding of the task or lack of cooperation. Isolated examples may represent specific difficulty with that word.

No Response / Don't Know:

Forty three (17%) of the responses from the phonologically disordered children and 35 (14%) of the responses from the normally developing children were of this kind. Isolated examples of this response amongst other successful attempts probably represents specific difficulty with that word. Where this type of response predominates for a child it could be for a variety of reasons, failure to understand the task or lack of cooperation because of boredom, for example.

Other:

The responses categorised under this heading included seven instances of naming colours on the pictures from subject A15 and probably represent a failure to understand the task. Subject B13 presumably misinterpreted the task and made eleven attempts at producing the sort of sounds the pictured objects might make, often exercising considerable ingenuity to do this.

The types of response made to the words presented for segmentation has received little attention in the previous literature with the exception of Bruce (1964). The majority of his five year old subjects responded to his task by providing a random sound or letter name. He concludes that this response shows that children of this age do not differentiate between the concepts of words and sounds.

f. Phoneme related segmentation

Different phonemes and classes of phonemes have different acoustic characteristics, they may therefore differ in the ease with which they can be segmented. The training items may also have had a specific rather than a general influence on segmentation ability. For example the fricatives were possibly more prominent than the stops because they could be prolonged and exaggerated with greater ease. It is also possible that because /s/ had figured largely in the training period children had been trained to specifically isolate this phoneme.

A comparison of the distribution of the segmentation of the stop and fricative words failed to reveal any single phoneme or class of phonemes that was apparently easier or more difficult to segment than the others. The number of successful segmentations was fairly evenly distributed across all twelve words.

Children who had had some success with segmenting fricatives and stops were also asked to segment the other eight words, four starting with vowels and four with consonant clust ers. Ten phonologically disordered and eleven normal children attempted this task. Most of the children who had been successful at segmenting the initial stops and fricatives could also segment initial vowels but consonant segmentation did not predict vowel segmentation.

There was considerable variability in the phonetic accuracy of the children's reproductions of the segmented vowels. This is possibly an indication that certain phonemes, including vowels, may be more difficult to segment and consequently produce in isolation because of the extent to which their constituent acoustic parameters are affected by surrounding phonemes. It is known that a complex variety of acoustic parameters are available to be utilised in identifying phonemes and it is not known whether children are making use of the same parameters as adults (Strange & Broen, 1980).

Alternatively the poor performance on vowels may have been a reflection of the experimental design. These sounds had not figured in the training procedure and consequently may not have been perceived by the children as appropriate candidates for segmentation.

In general the children who could segment single phonemes could also segment clusters from the following vowel. Some of them were able to provide the initial phoneme of the cluster a more advanced stage of segmentation according to Barton et al, (1980) and Treiman, (1985). It was not possible to predict in any way from the results of the main part of the experiment whether children would segment the cluster or the initial phoneme. The children who tended to be cv segmenters did however tend to segment the cluster with the following vowel, a response not mentioned by Barton. The results of this supplementary part of the experiment support the general developmental pattern of segmentation observed by Barton and Treiman.

6.3.3 DISCUSSION

The results of the segmentation experiment demonstrate that the phonologically disordered children as a group are significantly poorer than the normally developing children at segmenting the initial phoneme from the rest of a word. The severity of the phonological disorder however is not predictive of the level of segmentation ability and some phonologically disordered children did as well as some of the normally developing children.

The pattern of correlations between segmentation ability and other measures, such as chronological age and non verbal intelligence, are similar to the type of correlations obtained in the rhyming experiment. The most significant factor which emerges from the results of this experiment is the high correlation between segmentation and the rhyming task, both for the total group of children and for both groups separately.

The results of the current experiment confirm those of Kamhi et al (1985) and Murray (1988), who also found that language disordered children have inferior segmentation ability when compared with normally developing children. This confirmation holds good despite the use of different experimental tasks.

If a comparison is made between the current experiment and the previous experiments which used the same tasks it is found that both the phonologically disordered and the normally developing children performed less well than the normal children in the Zhurova (1973) and Barton (1980) experiments. Complete comparisons however are not possible because a different training strategy was used in the current experiment. These differences in training can probably, at least in part, account for the difference in the results obtained from the current and previous experiments. The role of training will therefore be considered later in this discussion.

There are a variety of possible reasons that may account for differences in segmentation ability between children. This discussion will focus on three main possibilities, phonological processing and cognitive variations and the possible association between phonological acquisition and segmentation. Before these are considered in more detail the similarities and differences between the rhyming and segmentation tasks will be discussed.

a. <u>Comparison of Rhyming and Segmentation Tasks</u>

It can be argued that segmentation and rhyming are highly correlated because they share common features and make similar cognitive demands on the subjects. To a large extent this is true and rhyming activities particularly those used by Bryant and Bradley (1985) referred to in the last chapter, are often cited as evidence of segmentation ability and rhyming tasks have been referred to as partial segmentation activities (Lundberg, 1978). In this discussion it will be argued that although segmentation and rhyming tasks share common features the specific tasks used in the current investigation also make different demands on the subjects.

The two tasks are also different in that the rhyming task is based on and is a continuation of a universal spontaneously occurring activity. Explicit segmentation activities of the kind used in the current investigation do not appear to have been reported as an activity which occurs spontaneously in young children. However evidence that some children may use this activity in play did emerge from the current experiment (see page 266).

Both tasks require auditory perceptual ability and some appreciation of the phonemic composition of words. In the last chapter it was argued that success in the current rhyming task required the knowledge that words shared common phonemes that could be matched and categorised. But it was also suggested that successful completion of the task did not require the ability to detach these phonemes from the other phonemes in the words. This ability is required however for successful completion of the segmentation task where the subject is required to determine the specific characteristics of the initial phoneme and extract it from the co-occurring acoustic characteristics of the other phonemes in the word.

In the rhyming task the child has to remember the four presented words long enough to compare them and reject the one that does not share the common features of the others. Memory requirements are different for the segmentation task, the subjects have only to hold one word in memory, but for long enough to recognise the acoustic parameters of the phoneme they are required to reproduce.

The two tasks also differ in the type of response they require from the subject. In the rhyming task the child has to point to the picture he is rejecting, in the segmentation experiment he is required to verbally produce the segmented phoneme. To summarise, the phonemic segmentation task differs from the rhyming task in that the subject is required to perceive the acoustic characteristics of a phoneme, abstract those characteristics from the stream of speech and reproduce them. In addition the segmentation task may also differ from the rhyming task on the demands it makes on memory. Possible differences in phonemic processing ability will now be considered in more detail starting with production ability.

b. <u>Phonemic Processing and Segmentation Ability</u>

Possible Production Constraints.

It is possible that difficulty with phonological production may inhibit the phonologically disordered children from providing the appropriate phonemes. This possibility seems unlikely however on the basis of the information obtained from the current experiment. If production constraints were a predominant influence on task completion it would be expected that the children would segment those words which were not affected by their simplifying processes and not segment those that were. This could not constitute a sufficient explanation, the majority of the phonologically disordered children could not segment any of the words or were able to segment only one or two of them. The children in this group who were able to segment some of the words produced their own substitutions as the segmented element where these might be expected and did not appear to be constrained by their production limitations.

Observation of the children did indicate one possible exception to this general pattern however. Subject A11, who used a simplifying process of initial consonant deletion for all phonemes except alveolar stops, appeared rather worried by this task although he did persevere and provided [m] and [s] as the first segments of "milk" and "sock" quite clearly. The examiner felt, from the pattern of the child's behaviour on this particular task, that production constraints may have affected the child's segmentation performance adversely (see also 7.3.3 in relation to this subject).

More work is required to examine the possible influence of production constraints on segmentation ability. One experimental possibility would be to use words for segmentation that were known to represent specific phonological difficulties for the subject and compare the segmentation of these with those that did not. This would require specific tasks to be devised for each child, something that was not possible in the current comparative investigation.

Possible Perceptual Constraints

In common with the results of the rhyming experiment a significant correlation was found to exist between the auditory discrimination task and segmentation. The general discussion on the relationship between rhyming and auditory discrimination is also applicable to segmentation (see 5.3.3).

The perceptual demands of the segmentation task are however different in some respects to the requirments of the rhyming task. As has already been stated the subject is required to attend to the specific acoustic characteristics of one phoneme rather than make auditory comparisons between words. It is possible that the subject may be unable to segment specific phonemes because they present specific auditory perceptual demands. To test this possibility further tasks would have to be devised to assess the relationship between the perception and segmentation of specific phonemes in the manner suggested above for assessing possible production constraints.

An analysis of the data from the current experiment (section 6.3.2) provided no evidence of a relationship between perception and segmentation of specific phonemes in the main experiment for either group of children. However the responses to the vowel items in the unscored section of the test did suggest that these may have been treated differently by the children. The possibility of experimental influence cannot be ruled out here but further investigation of responses to specific phonemes may be indicated.

Recognition of the specific acoustic characteristics of individual phonemes however constitutes only one part of the perceptual requirements of segmentation activities. The subject has also to be able to extract these from the continuous stream of speech.

Examination of the combined results of previous segmentation experiments shows a developmental progression in segmentation ability from word to syllable to phoneme to cluster division. The high level of agreement between the results of different experiments provides strong support for this developmental progression. In section 6.1.2 evidence was presented to suggest that this development was related to the specific acoustic demands of each type of segmentation.

Differences in segmentation ability may be related to variation in the ability to focus on the appropriate acoustic cues. Earlier it was stated that speech recognition could be accomplished by attending to a variety of acoustic parameters and that children and adults may be different in the number and type of parameters they attend to. Segmentation, in contrast to speech recognition, may require attention to a different or a greater number of cues that may not be within the children's capabilities.

Qualitative analysis of the responses in the cluster segmentation experiments of Barton et al (1980) and the nature of the spelling patterns of young children (Read, 1978) reported in section 5.1.3 indicates that certain phonemes may not be perceived in the same way by children and adults.

A different type of evidence which can be used to support the suggestion that children make use of different perceptions and storage of acoustic parameters comes from a comparison of child and adult malapropisms. Aitchison (1987) suggests that in mental representation the beginnings and ends of words are of most importance for adults whilst for children the rhythmic pattern and stressed vowel are more important and she adds, quoting Vihman (1981) that the younger the child the more important the rhythmical pattern.

The analysis of the responses in the current experiment did not reveal a clear developmental trend in segmentation ability. However the experiment was not designed to examine development and it is only possible to make the following tentative observations. For individual children c and cv segmentation tended to co-occur and the cv responses were more common from the normal children than the phonologically disordered children. This suggests a relationship between the different types of segmentation which may reflect a developmental progression (see also Chapter 10).

As a counter argument to the possible role of perception in segmentation Snowling (1987) describes and reviews the available information on the perceptual abilities of dyslexic subjects who, it was seen in the last chapter, also have problems in segmentation. She concludes that their difficulty is not at a sensory level.

Further investigation is required to determine if perceptual constraints affect young children's segmentation abilities. The following possibilities are suggested:

Longitudinal as well as cross sectional investigations into segmentation ability.

Investigation of the ability of subjects with known segmentation difficulties to extract acoustic cues from auditory material.

Comparisons between the ability to respond to specific acoustic parameters and carry out segmentation activities.

Dividing perception from mental storage for discussion purposes does not reflect reality, the acoustic information available to the child will be reflected in his mental store. Mental representation and memory will be considered next.

Segmentation and Memory

The following discussion will be confined to some general comments. Because the nature of mental representation is a central focus of discussion about all metalinguistic tasks further discussion of the possible mental processing involved in segmentation will be left until the final chapter when its relationship to all the metalinguistic tasks will be discussed.

In the last chapter, (section 5.3.3) it was suggested that rhyming, as an aspect of auditory processing, was dependent on the type of mental coding used by the subject and a specific memory retrieval deficit for phonological information was postulated (Rack 1985, Rack & Snowling, 1985). That discussion is also pertinent to the segmentation task. The results of the segmentation experiment, like the rhyming experiment, cannot be used to support this theory. The lack of a significant correlation between task and auditory memory measure was repeated in the current experiment. At the most simplistic level it could be suggested that phonologically disordered children who in most cases are operating with a reduced phonemic system will have less stored phonemic information to draw upon. But this presumes a very simple correspondence between mental representation and production which is by no means certain and ignores the earlier discussion on perception. A more productive direction for discussion is the consideration of memory and mental representation in association with perception during the process of phonological acquisition.

c. Phonological Acquisition and Segmentation

In the earlier part of this discussion it was suggested that differences in phonemic segmentation ability could be related both to sensitivity to the acoustic parameters of individual phonemes and the ability to extract this information from speech. In the previous chapter (in section 5.3.3) which was concerned with the relationship between phonemic sensitivity and phonological acquisition, the discussion started with reports of the child's innate predisposition to attend to and discriminate the acoustic characteristics salient for speech. In this chapter the discussion of acquisition will be extended to a consideration of the syntagmatic aspects of phonological acquisition, which, it will be argued can be specifically related to segmentation ability.

Chiat (1979) observes that the major investigatory focus in phonological acquisition research has centered overwhelmingly on paradigmatic contrasts, the features which serve to distinguish one word from another. She says that it is also necessary to pay attention to the syntagmatic aspects of speech and states

> "the child's primary task is to break up the speech chain, to isolate meaningful units, rather than to determine how such units are distinguished from one another. (p. 592).

> Later she goes on to say
> " A schematised (and hence oversimplified, though not, I think, distorted) view of the child's phonological development is that it starts by ABSTRACTING FORMS FROM the stream of speech and ends up with a store of words WITH WHICH IT TACKLES the stream of speech. It starts with the syntagmatic problem of segmenting a sequence and ends with the paradigmatic problem of distinguishing the elements so segmented"
> (Chiat, 1979, p. 606).

Chiat is essentially concerned with the process by which children acquire words, but she supports her argument with a discussion on the type of acoustic cues which the child might employ. These include both paying attention to stress and to aspects of the internal composition of words such as vowel length and phonetic features which distinguish syllable initial and syllable final phonemes. It is suggested that these auditory cues first help the child to divide words into syllables and then in turn to abstract more specific properties which themselves provide cues for further syllable isolation.

The importance of the syntagmatic aspect of speech is seen in two theories of language acquisition those of Peters (1983) and Waterson (1981). These theories provide some indication of the possible developmental progression of segmentation in phonological acquisition. Peters provides a considerable amount of evidence to suggest that in the initial stages of language acquisition the children extract and memorise comparatively large unanalysed chunks of speech frequently larger than single word length. Only gradually through experience she suggests does the child learn to segment these chunks into words and later into smaller units using clues such as intonation contour and the rhythmic patterns of speech.

Waterson's model is based in prosodic phonology, in summarising her model she says

> "The theory behind the model, that of pattern recognition and pattern matching, is compatible with what is known at other levels of human perception. The phonetic patterns and phonetic features used to describe them are compatible with much of the acoustic information available in relation to speech"
> (Waterson, 1981 p. 332).

She believes that the child processes utterances by scanning them and breaking them into smaller chunks on the basis of intonation patterns. This is followed by further scanning first to focus on stress and accent and then phonetic patterns. Development of adult representation is accomplished by progressively paying attention to more aspects of the system.

The age related developmental progression observed in segmentation experiments from word to syllable through to phonemic segmentation reflects the hypothesised process of segmentation in phonological acquisition, the extraction of progressively smaller chunks of utterances. The same kind of acoustic cues are also used to explain the developmental patterns in both kinds of behaviour; the importance for instance of stress and the predominance of the syllable as a salient unit discussed in section 6.1.2.

The common features of the syntagmatic aspect of phonological acquisition and the requirements for successful completion of segmentation tasks suggests a developmental association and strengthens the case for possible developmental differences raised in 5.3.3 in relation to rhyming ability. Further investigation is required, longitudinal studies to examine the relationship between acoustic perception and phonological development may be enlightening in this respect.

Postulating a common process of responding to and extracting relevant acoustic cues in the process of phonological acquisition and in segmentation tasks ignores the fact that these activities are taking place at different chronological ages. Chiat, Waterson and Peters are on the whole discussing children aged between twelve months and two and a half years, although Peters uses many examples of children failing to segment words from each other up to the age of seven. The current experimental population had chronological ages between 3.08 and 5.05. However 17 of the phonologically disordered group had age equivalent scores on the E.A.T. of less than three years. But this does not answer the fact that both in the current and previous experiments phonemic segmentation was found to be a difficult task for most normally developing children of this age. Even an age equivalent E.A.T. score greater than six years did not guarantee segmentation ability in this experiment. On the other hand in section 5.1.1 it was observed that spontaneous rhyming activity, known to occur in children from eighteen months upwards requires the ability to isolate individual phonemes. It is suggested that these different behaviours have different cognitive requirements.

d. Cognitive Ability and Segmentation

Cognitive ability in relation to segmentation will be considered on two levels, first the general ability to respond to and understand the task and second the specific ability required to carry out the task.

The significant correlation between non verbal intelligence and segmentation ability for both the total population and the normally developing children suggests, as might be expected, that segmentation is associated with general intellectual ability for some of the children.

Although this was probably the most difficult task in the investigation there was no evidence to suggest that any of the children were totally incapable of cooperating in this experiment and no child was excluded from it. However the nature of the responses the children gave to the words perhaps gives some indication of different levels of understanding about the nature of the task.

These responses were analysed in section 6.3.2 where it was suggested that children who said they didn't know or failed to respond to a large number of the words may not have understood the task. Children who named the picture may have understood that a verbal response of some kind was required but did not have the concept of sounds. Children who provided random sounds may have had the concept of sounds but were not able to segment, alternatively these last two types of response may represent imitation of the examiner.

Discussion of the specific mental operations required for success on this task will be considered again in the final chapter in relation to all the metalinguistic tasks. The present discussion will be confined to a comparison of the possible cognitive requirements of phonological acquisition and the current segmentation task.

The syntagmatic aspects of phonological acquisition and spontaneous rhyming activities are child motivated and implicit, brought about, at least in part, by the desire to communicate. Experimental segmentation activities on the other hand are externally controlled and require specific constrained responses. Such activities are explicit and conscious and for successful completion require not only the ability to attend to acoustic patterns but also the ability to cooperate with the experimenter, attend to instructions and provide a specific response. The fragility of experimental task design for this age group was discussed in section 5.1.4.

e. Training and Segmentation

At the start of this discussion it was reported that both groups of children in the current investigation generally performed less well than the children in the Zhurova (1973) and Barton et.al (1980) experiments. This difference could at least in part be attributed to the nature of the training in the respective investigations. A discussion of the possible effect of training however is relevant not only in relation to its influence on experimental results but also as an aid to the discussion of possible reasons for task success or failure.

In the first instance it can help to determine whether success or failure resulted from perceptual limitations. If this was the case task training would be unlikely to result in rapid experimental success. If training is successful in influencing task success it is an indication that children have both the requisite cognitive ability and the appropriate phonemic knowledge. In other words training may bring implicit knowledge to consciousness, the knowledge may be available to children but they may never have thought of using it in this way. Read (1978) raises a number of issues related to training. He suggests that linguistic awareness is an unstable attribute that moves in and out of consciousness and that training may bring a latent ability to awareness.

In both the Zhurova and Barton experiments the children were trained until they were successful at the task. Their subjects were provided with as many examples and specific instructions as they required. Zhurova does not give any detailed information about the number of trials each child needed but Barton reports that only seven of his twenty four subjects required more than two examples a figure that suggests a latent segmentation ability and possibly superior segmentation ability in his group of children when compared to those in the current experiment who were all provided with two training trials.

The relationship between success at segmentation and the type of responses the children gave in training during the current experiment was examined to see if any training effect could be discerned for either of the two groups of children. The relationship between the ability to respond to and carry out the training activities and success in the experimental tasks was not clear cut and it was not possible to determine any differences between the groups which could be related to the influence of training.

Some children in both groups had no difficulty in performing some or all of the training tasks, demonstrating that they had some concept of phonemes, but they did not appear to transfer their knowledge to the segmentation task, this lack of transfer appeared to be particularly marked in the phonologically disordered children.

In contrast there was evidence from other children that they increased their knowledge of phonemes and apparently utilised it in the segmentation task. These children demonstrated their increasing awareness by enthusiastic and spontaneous provision of other words that began with the trial phonemes and in response to the experimental words would make comments like "milk starts with [m] but juice starts with [dʒ]". It is also possible that a change from cv segmentation to initial phoneme segmentation as the experiment progressed, noted in some children, is evidence of learning from the task itself. For some children therefore the training did appear to facilitate segmentation, but for the majority it did not guarantee segmentation task success.

Because no clear findings emerged to indicate whether training influenced task performance in this experiment it was of no help in determining whether task success was the result of differences in basic knowledge or of access to that knowledge either for individual children or for each group as a whole. However the current experiment was not specifically designed to investigate the effect of training and it was only possible to examine it indirectly. It is possible that the type of training that was provided developed the children's knowledge of the paradigmatic aspects of phonology and not the syntagmatic aspects. In this regard the provision of only two items for specific segmentation practice was probably insufficient. Further experiments are required both to determine the general effect of training and the effect of different types of training. Finally task success cannot be divorced from the child's existing knowledge.

f. Segmentation and Environmental Experience

The child's existing general knowledge of language and his specific experience with manipulating phonemes may influence task performance. It was known that none of the children had had any formal education but it was impossible to establish what other influences there might have been on segmentation ability either from general exposure to language, particularly written language such as provision of books in the home or informal writing practice, or from specific segmentation activities. Some mothers of the children in both groups commented that their children often wanted to write and would ask them how to spell some words and they mentioned commercial games that appeared to require some segmentation ability. One boy in the pilot group spontaneously provided evidence of specific segmentation activity. He said that he played "this game" with his elder brother and went on to give several examples of the words they segmented.

6.4 CONCLUSION

In their investigation of the segmentation ability of language disordered children Kamhi et al (1985) were principally interested in the implications of their results for future management of language disordered children. They did not attempt any explanation of their findings except to suggest that language disordered children were poor at both accessing and using phonemic knowledge.

If the discussion of segmentation ability is extended to compare the process of segmentation in the experimental task with the requirements of the syntagmatic aspects of phonological acquisition new directions for research into the relationship between segmentation and phonological disorder become available. In the current state of knowledge it is not possible to state whether there is a cause and effect relationship between delayed phonological development and performance on segmentation tasks or whether some underlying factor can account for differences in both areas. It is possible that some factor influences both phonological development and segmentation task performance or that relative maturity in the syntagmatic aspect of phonological development influences segmentation. It is appropriate to consider what factors might be influential and the following hypothetical possibilities are offered:

1. Children vary in their constitutional predisposition to pay attention to salient acoustic cues of speech. (The high correlation that exists between auditory discrimination, rhyming and segmentation tasks may indicate that these tasks all require some kind of general pattern matching ability rather than sensitivity to phonemes).

2. Ability to recognise appropriate acoustic cues may still be in the process of development. Children may therefore vary in their ability to utilise available acoustic parameters. Possible variations in development may result from physiological differences such as hearing acuity.

3. Children may vary in their ability to store and recall the appropriate acoustic information. In other words they may have a specific verbal memory deficit of the kind suggested by Rack & Snowling (1985) which was discussed in chapter 5.

4. Variation in children may result not from the perception or storage of acoustic parameters themselves but from variability in the learning process in terms of an inability to utilise the available acoustic information.

5. External factors may affect development, such as amount of exposure to written language. Possible environmental influences on metalinguistic awareness were discussed in section 2.9.

Further investigation is required to explore these possibilities and to clarify firmer links between phonological acquisition, phonological disorder and segmentation ability. These investigations would include finding out more about segmentation and examining the relationship between acoustic sensitivity and phonological acquisition. Some research possibilities have been suggested earlier in the chapter and these can now be brought together.

Research into segmentation could include the investigation of training on segmentation with specific attention to the nature of the training tasks. Confirmation of the developmental progression of segmentation ability is required both from longitudinal and further cross sectional investigations. Segmentation tasks essentially assess the ability to use acoustic information, this ability could be compared with the ability to respond to specific acoustic cues, possibly synthetically generated.

Phonological acquisition research could utilise longitudinal investigations of the kind suggested in chapter 5 and include comparisons of the ability to respond to acoustic information with the level of phonological development. Further investigation is required into the acoustic ability of young children, possibly comparing good and poor segmenters, by looking at not only the ability to discriminate between sounds but also the ability to extract them from a stream of other sounds. Without this type of information it is not possible to extend any of the foregoing discussion beyond speculation. The next chapter is concerned with the third metalinguistic experiment, the ability to recognise phonological errors in the speech of others.

CHAPTER 7
THE ACCEPTABILITY EXPERIMENT

7.1 INTRODUCTION

This experiment assesses the ability to make judgements about the pronunciation of presented words. Within the Clark taxonomy (Clark, 1978) this activity is most closely related to that of commenting on and correcting the utterances of oneself and others, an aspect of the metacognitive ability of "Checking the Result of an Utterance". Clark describes this ability as developing relatively early within metacognitive development. This experimental task should therefore be rather easier for the children than the rhyming and segmentation tasks. This introduction will be concerned with observations of spontaneous comment about pronunciation ability, previous experiments which have investigated acceptability of other aspects of language and the available information about the linguistic judgement capabilities of language disordered children.

7.1.1 SPONTANEOUS COMMENTS ON AND CORRECTION OF PRONUNCIATION

There appear to be no previous experimental investigations concerned with making judgements about pronunciation acceptability but various examples of spontaneous comment about and correction of pronunciation can be found in the language acquisition literature. These provide evidence of children's awareness of variation in pronunciation.

Clark quotes several examples of this behaviour and suggests that children are able to correct themselves from about eighteen months old and can comment on and attempt to correct the pronunciation of others from about the age of four. Weir (1966) provides several examples of her eldest son Anthony aged five commenting on and attempting to correct the phonology of his two younger brothers. For example

> "David: I don't have a raser, Antony. I don't have dis.
> Antony: David you need an *e*raser (overstressing the omitted syllable)."
>
> Weir, 1966 p. 165).

Other indications of this ability occurring at a younger age can be found in Iwamura (1980). In this investigation Iwamura recorded conversations between two female subjects who were aged, 2.09 and 3.00 at the start of a five month period of recording. She reports examples of syntactical, lexical and phonological corrections. The phonological correction activites she reports are often prolonged exchanges including comments about the correctness or otherwise of each other's pronunciation of certain words. In discussing the pronunciation of the word "please", for example, they are able to discuss correct pronunciation, make corrections and consider alternative ways of articulating the same sound. Savic (1980) reports the same kind of correction activities occurring between sets of twins, phonological correction being reported from the age of 1.10.

Between the ages of 2 and 4 Smith's son Amahl demonstrated the ability to comment on his own speech - "Daddy I can say [kwɩk]" - and make comparisons between his own and his fathers pronunciation - "only Daddy can say [dʌp] (jump)" (Smith, 1973, p. 10).

It is not known whether the examples quoted above are isolated events or whether they represent a universal ability to comment on pronunciation. Experimental investigations provide the opportunity to assess the extent of such ability. Although there appear to be no experimental investigations of pronunciation judgements the ability of young children to make syntactic and semantic aceptability judgements has been demonstrated experimentally. These experiments will be described because they can provide additional information about judgement capabilities and may provide methodology which can be used to assess pronunciation judgements.

7.1.2 PREVIOUS ACCEPTABILITY EXPERIMENTS

Gleitman, Gleitman & Shipley (1972) carried out a syntactic acceptability experiment with three two year old girls. These children were asked to say whether simple sentences read out by their mother or the experimenter were "good" or "silly". The sentences either had the serial order of words correct or had noun and verb reversed, for example "song me a sing" (Gleitman et al p.146). All three children demonstrated some ability to make appropriate syntactical judgements about these sentences. Two of the children also provided appropriate corrections and one of them invented sentences for the experimenter to judge.

This investigation demonstrated that these very young children had some metalinguisitic knowledge of grammatical structure which could be assessed in an experimental situation. Only three children took part in the experiment however and the authors are careful to point out that their subjects were highly articulate and may not be typical of the two year old population as a whole.

De Villiers & De Villiers (1972) modified the Gleitman experiment to include semantic as well as syntactic judgement tasks and to take account of the level of linguistic development of the subjects. They used eight subjects aged between 2.04 and 3.09 measuring the comprehension and expressive language level of each one. These authors used syntactically and semantically anomalous sentences. The syntactically anomalous sentences were similar to those used by Gleitman et. al. and the semantically anomalous sentences had correct word order but inappropriate word combinations. For example noun combinations such as "Bread the train" (DeVilliers & DeVilliers, 1972 p. 302).

Puppets were used to present the sentences. The children were told that one of the puppets could not talk properly and that the other puppet would help him to talk. The children were invited to judge whether the sentences were "right" or "wrong" and as an assessment of correction ability asked to help the second pupppet in the teaching task.

The ability to make judgements was found to be correlated with language development as measured by mean length of utterance (M.L.U). These investigators found that only the most linguistically advanced children could make significant grammatical judgements and corrections. Less linguistically developed children were only able to judge and make corrections to semantic anomalies.

The studies of Gleitman et al and DeVilliers & DeVilliers were the first reported investigations of sentence acceptability and they used very young subjects. There have subsequently been several other investigations with older children using variations of the original experimental methods, see for example Howe & Hillman (1973), Pratt, Tunmer & Bowey (1984), and Scholl & Ryan (1975 and 1980).

Hakes (1980) carried out the most extensive investigation. He assessed the acceptability judgements of one hundred children divided equally among the five age levels between four and eight years. Using a modification of the DeVilliers task he asked his subjects to judge acceptable and syntactically and semantically deviant sentences. Sentence acceptability was found to be age related. The subjects reacted differently to the deviant and non deviant sentences at all age levels, but certain types of sentences (for example those involving word order changes) were detected as being deviant at an earlier age than others.

Hakes hypothesises that these responses suggest that as they get older children base their judgements on an increasing number of criteria. Initially sentences appear to be accepted or rejected simply on whether they are generally meaningful to the child. At about four years of age acceptability is based more specifically on content, what the sentences assert. By the age of seven or eight years judgement is based almost entirely on linguistic criteria with understanding and content playing a subsiduary role.

Ultimately the basis on which judgements are made can only be determined when subjects are able to give reasons for their responses. In the experiments cited above it was found that few children under the age of five were able to give such reasons. When children of this age did give reasons for their judgements they were invariably semantic rather than grammatical. That is their focus appeared to be on content rather than structure, but this does not provide incontrovertible evidence that children below this age are unable to reflect on structure. They may sense that a sentence is grammatically unacceptable but not know why, or they may lack the appropriate vocabulary to explain why they think it is wrong.

Before considering whether these experiments can be adapted to assess phonological judgements the small amount of available information about the linguistic judgements of language disordered children will be considered.

7.1.3 LANGUAGE JUDGEMENT AND LANGUAGE MODIFICATION ABILITY OF LANGUAGE DISORDERED SUBJECTS.

The few available investigations which have been concerned with the linguistic judgement abilities of speech and language disordered children were reviewed in 2.3.2. No information is available about judgement of pronunciation, but in making judgements about other aspects of language, language disordered children have usually been found to be inferior to normally developing children.

Liles et al (1977) compared the grammatical judgement ability of normal and language disordered children aged between 5.04 and 5.07. These authors constructed sentences containing three types of errors, syntactic agreement errors, lexical errors and word order errors. They found that the language disordered children were poorer than the normal children at recognising and correcting grammatical and word order errors. In some cases they were able to recognise but not correct errors. The language disordered children were usually able to both indicate and correct lexical errors and their performance matched that of the normal children. This pattern of response from the disordered children is in general agreement with the developmental pattern observed in the experiments cited in the last section.

Several experimental studies have sought to establish the sensitivity of language disordered children to listener and situational characteristics. These provide indirect evidence of implicit language awareness of a kind which can be classified, alongside making judgements about language. This sensitivity is usually assessed by analysing children's changes and modifications to their language output in response to specific events or situations. The investigations are concerned with changes to different aspects of language, including speech style, length of utterance and phonological change. These investigations were described briefly in 2.3.1. and will be enlarged upon here.

Gallagher & Darnton (1978) replicated a study with language disordered children which had previously been used with normal children (Gallagher 1977). These authors analysed spontaneous language samples collected from three groups of language disordered children who were at Brown's stages 1, II or III of linguistic development, (respective mean C.A.'s were 3.06, 4.01 and 5.04). The samples were collected during a conversation in which the experimenter periodically interjected "what" into the conversation. When the language responses of the language disordered children were compared with those from the normal children in the original experiment it was found that both groups of children were sensitive to requests for clarification. But the language disordered children are described as behaving in a way that is qualitatively different from the normal children. That is phonetic revisions predominated at Stage I in both groups of children but there were differences in subsequent progression towards different types of revision at later language stages.

Weiner & Ostrowski (1979) studied the phonetic revision behaviour of fifteen phonologically delayed children, aged between three and five. These children were asked to name a set of pictures. The experimenter pretended to mishear some of the words in a pre-determined fashion. The children were then asked to name the pictures again. Significantly fewer errors occurred on those words the experimenter had pretended to mishear. Weiner & Ellis (1980 reported in Leonard, 1983) carried out another investigation into the revision behaviour of phonologically disordered children (aged 3.09 to 6.03). In this experiment the children were presented with two sets of words containing pairs of potentially homonymous words (e.g. *tea* and *key*, which could be realised as [ti]. In one list homonymous words appeared immediately after each other and in the other they were randomly distributed. It was found that the children were less likely to produce the words as homonyms when they appeared together.

These investigations show that in general language disordered children are sensitive both to listener and situational characteristics and they are able to modify their speech and language accordingly. Phonetic modifications appearing to present the children with least difficulty. This finding that phonologically disordered children are able to make phonetic changes to their speech and the fact that they do so in particular situations is a possible demonstration that such changes result from active review and reflection.

Phonetic change in response to situational influences is by no means certain however. McCartney (1981) investigated the response of three "speech disordered" children to requests for clarification of their mis pronounced words made by their mothers during conversational situations. She found that although all three children were able to make phonetic changes to their output they usually failed to do so (see also Gardner 1989 for a more extensive investigation of this kind). In McCartney's investigation the type of clarification request from the mothers that did result in phonetic change always contained the correct adult target of the child's mispronounced word. McCartney suggests that this type of request may have produced change because the children used it as a model to modify their own utterances. In other words they modified their utterances through imitation. However imitation alone cannot explain the modifications, ability to recognise the mismatch is also required. And imitation would not explain the phonetic changes that the children made in the Weiner & Ostrowski experiment where no adult model was provided.

Although these experiments do not provide direct evidence of linguistic awareness they do show that phonologically disordered children are able to make phonetic changes to their production. If these children are able to make modifications in their own speech they should also be able to make judgements about the speech of others. Clinical evidence and anecdotal data from normally developing children (the 'fis' phenomenon) which shows that children do not accept imitations or recordings of their own speech production errors indicates sensitivity to incorrect phonological forms. These indications that children are sensitive to phonological errors and that phonetic modification appears to be easier than other types of modification suggests that it should be possible to design an appropriate experiment to assess the judgement of phonological form in the current experimental population.

7.2 THE PILOT STUDY

Because the Gleitman et al (1972) and the DeVilliers & DeVilliers (1972) syntactic and semantic acceptability experiments were successful with young children they were used as a basis for the current experiment.

To assess phonological acceptability, the subjects were presented with pre-recorded spoken words which were represented by pictures. Some of the words were correctly pronounced and others contained phonological errors, (for example 'shoe' realised as /tu/). The subjects were asked to say whether the pronunciation of the word was right or wrong and to make a correction if they judged it to be wrong. (Full details of the materials and presentation can be found in Section 7.3).

In the early stages of the pilot study puppets were used to elicit judgements and make corrections in the way used by DeVilliers & DeVilliers. The puppets were later abandoned as they presented two kinds of difficulties. First the children wished to make the voices of both puppets themselves and could not be induced just to listen to one of them. Second it proved too difficult with only one experimenter to devise a method of satisfactorily manipulating the puppets, provide the appropriate picture and operate the tape recorder at the same time. In the final version of the task the children were simply asked to judge the presented words, recorded by an adult male speaker, against the presented pictures. This was found to be a very satisfactory experimental task.

The children were also asked to give reasons for their answers during the pilot study. Very few of them were able to say why they had judged a particular word to be right or wrong. If they were able to provide a reason they usually said something like "he said [pun] instead of [spun]", or "because he's a silly man".

Answers such as these do not reveal how the subjects have determined their judgement. The first example does make implict reference to phonological structure change but no child went beyond this level of answer and specified the exact nature of the change, that is which phoneme was omitted or incorrect. Providing such explanation is a much more difficult and complex task involving not only whole word comparison, but segmentation of the word, reference to phonological rule organisation and the ability to articulate the conclusion of this complex procedure. It is probably a task beyond the cognitive ability of all four year olds. Requesting justification of the children's answers was therefore abandoned, but the children were asked more general questions about pronunciation immediately after the completion of this experiment. (These questions formed part of Experiment 5 and will be discussed in Chapter 9.).

The only other change made during the pilot study was a change of two words. The word 'ship' was dropped because there was disagreement about whether the picture represented a ship or a boat. Toothbrush presented as /tufbrʌʃ/ was also changed because most of the children appeared to regard it as an acceptable realisation.

Thirteen children participated in the final pilot version of this experiment, six males and seven females, with chronological ages ranging from 3.10 to 4.10 (mean 4.03). Out of a possible 18 phonological errors the children recognised between 11 and 18 (mean score 16). These results suggested that it was a suitable task for use in the main experiment.

7.3 THE MAIN EXPERIMENT

7.3.1 METHOD

Subjects

All the subjects took part in this experiment.

Material

Twenty five words and two trial words within the vocabulary of four year old children were used in the final version of the experiment. The words, spoken by an adult male, were tape recorded in optimum recording conditions to ensure consistent presentation for each child. Each word was represented by a coloured picture mounted on a 10cm x 16cm. card.

Eighteen of the words were produced using common simplifying developmental processes. For example, stopping of fricatives, with scissors being produced as /tɪdəz/, or cluster reduction, with spoon produced as /pun/. The remaining seven were pronounced using the normal adult target. The full list of words, including the phonemic transcription of the error words. can be found in Appendix 5.

Presentation

The experimenter introduced the experiment to the children by saying:

"I would like you to listen to somebody on my tape recorder. This man told me what all these pictures were but he can't say all his words properly".

The two trial words one with correct and one with *incorrect pronunciation* were then administered followed by the experimental words. After the presentation of each word and its accompanying picture the children were asked to say whether it was "right" or "wrong". If a word was judged to be pronounced wrongly the child was asked to say what the man had said and invited to correct the word to help the man say it properly.

The experiment therefore provided measures of the ability to:

1. Make judgements about phonological structure
2. Imitate the presented structure
3. Provide a correction where appropriate.

The tape was stopped after each word and the children were given as much time as they needed to make their judgement, reproduce the presented word and correct it if required. If the child said he hadn't heard a word, it was replayed, but this was only necessary on one or two occasions.

The children's right/wrong judgements were recorded together with a phonemic transcription of their imitations and corrections. It would have been preferable to tape record the children's productions of the words for later comparison and make a more detailed phonetic transcription. Presenting the task, making on line transcriptions and operating two tape recorders, although it was tried, was too complex an operation to make this a feasible proposition. In the event the phonemic transcription was satisfactory and provided a large amount of information.

7.3.2 RESULTS

The quantitative results and information about the ability of the subj ects to imitate and correct the experimental words will be covered in this section of the chapter.

a. Responses to the Task

This was an enjoyable and relatively easy task for the children. They were all willing to make the required judgements, and most of them attempted to imitate the experimental words and provide corrections where appropriate. They experienced little difficulty in focussing on the phonological structure and ignoring the semantic aspects of the words. But there were occasional instances where a subject would suggest an alternative word for a picture (for example "rose" for flower) or provide a prefix as a correction (for example "newspaper") but these instances were very rare and even in these cases the phonological structure of the presented word was judged appropriately. One notable exception to this general pattern was subject B21 who wherever possible made semantic rather than phonological judgements.

The subjects were very definite in their answers and there was no difficulty in determining raw scores for each child.

b. Judging Acceptability

Scores were obtained for both the total number of presented words (25), and the phonological error words (18). Comparisons between the two groups of children will however be made on the basis of scores for phonological error words only. The majority of children in both groups judged the correctly pronounced words appropriately but it appeared from their comments and corrections that when a child did judge one of these words to be wrong the judgement was semantically motivated. For example, "he should have said skipping rope". Because of the potential confusability of semantic and phonological judgements of the correctly pronounced words the responses to these were ignored.

Table 7.1 shows the distribution, means and Standard Deviations for both groups of subjects. Individual scores can be found in Appendix 6, Tables C & D.

Table 7.1 shows that both groups obtained essentially the same mean score on this task, the phonologically disordered group, 12.6 and the normally developing group 13.4. The S.D. of 5.1 for the phonologically disordered group, compared to S.D. 3.2 for the normally developing group reflects the slightly wider distribution of scores amongst the disordered population.

Table 7.1 Frequency Distribution, Means and Standard Deviations of Acceptability Scores. All Subjects.

Score /18	Group PDG	NDG
18	3	-
17	4	3
16	2	3
15	1	4
14	2	4
13	2	1
12	-	1
11	-	1
10	1	2
9	-	-
8	1	1
7	3	-
6	-	-
5	-	-
4	-	1
3	-	-
2	2	-
1	-	-
0	-	-
N=	21	21
Mean	12.6	13.4
S.D	5.1	3.2

When the scores of individual subjects are examined (Tables C & D Appendix 6) it is not possible to discern any irrefutable reason for the poor responses of A11 and A19. Both children appeared to understand the task and concentrated well. The experiment was re-administered with All at a later date with the same result. It was thought that during the experimental period he was becoming sensitive to not being understood and this may have affected his responses. Subject A19 was a very quiet child who seldom volunteered any spontaneous speech and although she was always cooperative during the various tasks and assessments did not score very highly in any experimental task and was below the mean on all the pre-investigation assessments and she had the lowest RDLS score (-1.4) of the total experimental population. The possibility of a hearing loss was raised but informal testing and the parental questionnaire did not indicate any problems in this area. There are therefore indications that her difficulties were not confined to the phonological aspects of language, although she satisfied the expressive language criteria as measured by the elicited LARSP. The low scoring normally developing child, B21 referred to above made only 4 phonological error judgements, the rest of her judgements appeared to be made on semantic criteria.

c. Association between Acceptability Judgements and Phonological Ability

The Kendall rank-order correlation coefficient was used to examine the association between performance on this task and level of phonological ability, as measured by the E.A.T, for the total population and for each group. The results can be found in Table 7.2.

Table 7.2 Kendall Rank-Order Correlation Coefficient (T) of Acceptability Scores with EAT and other Pre-Investigation Variables.

	Tot. Pop. N=42	PDG N=21	NDG N=21
EAT	0.07	0.21	0.14
CA	0.21	0.33	-0.01
RDLS	0.22	0.17	0.46**
WPPSI	-0.02	-0.16	0.23
Aud. Mem	0.19	0.15	0.29
Aud. Dis	0.13	0.27	-0.16

** significant at 0.01 level

Table 7.2 shows that the correlations between EAT and the Acceptability scores were in all cases very low and failed to reach significance.

As would be expected when the results of this experiment and the E.A.T were compared for individual children in both groups there appeared to be no clear relationship between these scores.

d. Association between acceptability judgements and pre-investigation measures

Table 7.2 shows that there were no significant correlations between the results of this experiment and pre-investigation variables for the total population or the phonologically disordered group. The only significant correlation for the normally developing group was between the experimental task and language comprehension (RDLS), T = 0.46, p<0.01.

e. <u>Association between Acceptability and Segmentation and Rhyming tasks</u>

Kendall rank-order correlation coefficents were calculated to determine whether there was any association between scores on the current experiment and the rhyming and segmentation tasks. The results are presented in Table 7.3.

<u>Table 7.3</u> Correlations between Judgement of Acceptability and Rhyming and Segmentation Scores

	Tot. Pop N=42	PDG N=21	NDG N=21
Rhyme	0.16	0.22	0.26
Segment	0.02	-0.13	0.26

This table shows that the highest correlations occur for the normally developing group, but none of them reached significance.

An examination of the results of individual children in both groups (Tables C & B Appendix 6) shows that there appears to be no relationship between success on this task and the rhyming and segmentation tasks.

The statistical results therefore show no differences between the groups on this task, only one significant association between the task and other variables and no significant association between the current task and the rhyming and segmentation tasks.

f. <u>Ability to Imitate and Correct the Experimental words</u>

Nine words common to this experiment and the E.A.T were used to assess the subjects imitation and correction abilities. (The nine words were: fish /piʃ/, yellow /lɛlo/, glove /glʌp/, thumb /bʌm/, flower /faɷwəɾ/, scissors /tɨdəz/, red /wɛd/, spoon /pun/). Evidence of ability to imitate and correct the target words provides support for the decisions that are made in the judgement task and provides information about ability to make conscious changes in phonetic production.

Imitation

Each subject's imitations of the nine words (i.e. a maximum of 189 words per group), given in response to the request "what did he say?", were categorised under the following four headings

1. Identical production of the experimental word

2. Production of the child's own realisation

3. Production which differed both from the experimental realisation and the child's own production

4. No response.

The third category consists mostly of inaccurate attempts to imitate the target but also includes a few instances of adult realisations where these differed from the children's own production. The no response category includes both those instances where an imitation would be inappropriate because the child had already judged the word to be correct and those where the subject refused to attempt imitation.

The distribution of the types of imitation responses from each group (with conversion to percentage occurrence) is shown in Table 7.4.

This table shows that both groups of subjects usually attempted to imitate the word and there were relatively few examples of repetitions of the subject's own realisations. Perhaps rather surprisingly children in the normally developing group provided almost twice as many of these (32, 17% of the total) compared to the phonologically disordered group (17, 9%). Apart from this there was little difference between the groups in the distribution of types of responses.

Table 7.4 Distribution of Responses to Imitation Request for Nine Experimental Words (Percentage scores in Brackets)

Group	N	Imitation Category Iden. Prod.	Child Form	Other Prod.	No Resp.	Total
		(%)	(%)	(%)	(%)	(%)
PDG	21	57(30)	17(9)	70(37)	45(24)	189(100)
NDG	21	57(30)	32(17)	58(30)	42(22)	189(100

The data from the individual children from both groups was examined to determine the distribution of response patterns. Most children had responses in all categories but some children in each group stood out as better imitators. One phonologically disordered child (A19) could not be induced to imitate any of the words and in the normally developing group two children failed to provide imitations for seven of the nine words. But there was no child in either group who simply repeated their own production forms for all the nine words.

Some words were apparently easier and some harder to imitate than others. Imitation of /bʌm/ (thumb) and /pun/ (spoon) was relatively easy for children in both groups. /bʌm/ was probably a highly salient word, the children found it particularly enjoyable to imitate, often commenting that the man was 'rude' or that it was a 'rude' word. Imitation of /pun/ was possibly relatively easy because it involved deleting rather than changing a segment and like /bʌm/ it involved an initial consonant. The explanation of why some words, notably /piʃ/ (fish) and /glʌp/ (glove) were apparently more difficult to imitate is less obvious. It is possible that the feature change involved in both cases from labiodental fricative to bi-labial stop is not very prominent.

Correction

Perhaps of greater interest is the children's ability to correct the same nine experimental words by modifying their imitations of the words. The following categories were used to categorise responses to the request "what should he have said"?:

1. Change between imitation and correction

2. No change, imitation and correction identical .

3. No response.

The no response category includes refusals and those instances where correction would be inappropriate.

The distribution of responses according to these categories can be found in Table 7.5.

Table 7.5 Distribution of Responses to Correction Request for Nine Experimental Words (Percentage score in brackets)

Group	N	Correction Categories (%Scores) Change	No Change	No Resp.	Total
		(%)	(%)	(%)	(%)
PDG	21	88(47)	16(8)	85(45)	189(100)
NDG	21	102(54)	13(7)	74(39)	189(100)

Compared with their imitation attempts the children were less willing to provide corrections. This is illustrated by the large percentage of words in the no response category in Table 7.5. However when corrections were attempted there were very few instances where no change between imitation and correction took place. This is possibly the most interesting finding in the experiment and demonstrates that the two groups were identical in their ability to make phonetic modifications. Only 16 (8%) of the corrections from the phonologically disordered group and 13 (7%) of realisations from the normally developing group were identical to their imitation forms.

Further analysis was carried out to compare the children's correction forms with their own realisations. The most important findings are summarised below.

Comparison between Correction Forms and Children's Habitual Realisations

Where the subjects own forms were the same as the adult target these were usually provided as the correction. Not surprisingly given their superior phonological ability these were much more numerous from the normally developing group.

Of greater interest was the fact that both groups of children were able to demonstrate some ability to achieve a correct adult target even when it was not their normal production form. The phonologically disordered group produced 25 (13%) and the normally developing group 7 (4%) instances of this.

The phonologically disordered group provided more evidence of their ability to modify their own production with a further 49 (26%) corrections which did not match the adult target and only 23 (12%) instances of producing their own non-adult realisation as a correction.

There was some variation within the phonologically disordered group in the ability to alter production, A1 and A8 both successfully produced 4/9 adult targets. Six children produced no adult realisations and six were reluctant to attempt any corrections.

The normally developing group provided 10 (5%) examples of non-adult realisations which were different from their customary production and in 16 (8%) instances repeated their own non-adult representations.

The imitation and correction data reflects to some extent the different phonological ability of the respective groups of children. But it also shows that there was little difference between the groups in their willingness to attempt these aspects of the experiment and it demonstrates the ability of phonologically disordered children to make modifications to their own production forms often in the direction of the adult target.

7.3.3 DISCUSSION

The results of this experiment show that there was very little difference between the two groups of subjects on this task, both quantitatively and qualitatively. Both groups were equally successful in judging the correctness or otherwise of the experimental words and children in both groups showed ability to make modifications to their own speech when imitating and correcting the experimental words. The only substantial difference between the groups was the greater success of the normally developing group in producing adult targets as correction forms.

The discussion will be concerned first with comparing the results of the current experiment with those of previous investigations and with comparing this task with the requirements of the rhyming and segmentation tasks. The imitation and correction abilities of the subjects will then be discussed in relation to a developmental model of single word production Hewlett (in press).

a. Comparison with Previous Investigations

The results of this experiment are in agreement with the observations of spontaneous comment about pronunciation reported in 7.1.1 and they support the previous experimental studies of Gleitman et al (1972) and DeVilliers & DeVilliers (1972) which have shown that very young children are capable of making judgements about other aspects of language, (section 7.1.2).

The ability of almost all the present subjects to modify their habitual productions in their attempts to imitate and correct the experimental words provides evidence, of an awareness of the nature of the task and support for the credibility of the judgements they made. At the very least it appears that most of the children were actively trying to solve the problem presented rather than making arbitary guesses.

The ability of phonologically disordered children to modify their production supports the reports from Leonard (1983) and the experimental findings of Weiner & Ellis (1980) and Weiner & Ostrowski (1979) and appears to refute the findings of McCartney (1981) (Section 7.1.3).

Only very general comparisons can be made between these investigations and the current experiment however because of the different experimental tasks employed. In the previous experiments the subjects ability to make spontaneous changes to their own production in response to external factors such as listener misunderstanding were assessed. In the current experiment the subjects were given explicit instructions and asked to make judgements about and correct the speech of others. No specific communicative purpose was involved. It is possible that any of these factors might have affected phonological modification differently in the current and previous investigations.

The current results are also in accord with a therapeutic intervention approach which has been found to be effective in remediating phonological disorder (Hill et al 1988, and in press). This approach is directed towards increasing metalinguistic awareness, both through focussing on phonemic characteristics, and increasing the child's awareness of the listener. This approach combines the different factors which were the focus of the current experiment and the previous investigations cited above. But it is currently not possible to determine which aspect of the intervention procedure, focus on increasing communicative awareness or focus on phonemic knowledge, is more influential in effecting change, or whether both have some effect or whether some other variable is responsible for the changes (see Chapter 11 for further details of this therapeutic approach).

b. Judging acceptability compared with rhyming and segmentation tasks.

The high rate of success achieved by most of the subjects in this experiment contrasts with the significant differences between the two groups found in the rhyming and segmentation experiments. The results confirm that children are able to carry out judgement tasks before they are successful at rhyming and segmentation tasks. The lack of correlation between acceptability judgement and rhyming and segmentation scores fits the hypothesis of a developmental progression of metalinguistic awareness suggested by the Clark taxonomy and is in agreement with the suggestion made at the start of this chapter, that this task is rather easier than rhyming and segmentation activities.

A comparison of the possible requirements for success at the respective tasks may help to account for their relative difficulty. First it could be argued that the acceptability task may be less demanding than the other tasks because it is more 'natural', in that making sense of what others say is an everyday activity even though children are not usually called upon to verbally express judgements about it. In contrast they are not normally expected to provide segmented phonemes or match rhyming words. The particular enjoyment and enthusiasm with which nearly all the children approached this task may in part be accounted for by the ease with which they accomplished it.

Second there are more specific requirements for each task. All three tasks require some level of auditory perceptual ability and the ability to make use of stored mental representations of words. There are probably differences however in what perceptual cues are required for each task. The current task can be succesfully accomplished by listening to the presented word and comparing it to a stored mental form of that word. No knowledge that words can be detached from what they represent or that they are composed of individual phonemes is required.

For success at rhyming and segmentation tasks it is probable that mental representations of the experimental words are required which include more detailed information about their phonemic composition. An ability to match phonemes across words or detach them from the rest of the word is also required for these tasks which may be influenced by the way mental representations are grouped and organised. It is possible therefore that the difference between success on the current task and the rhyming and segmentation task can be accounted for by both the less exacting linguistic and cognitive demands it makes on the subjects.

Because all the tasks require the child to make comparisons of the experimental words with their own mental representations of those words, and because a developmental relationship between the tasks has been postulated it is appropriate to consider the current task in relation to what is known about the development of mental representation.

c. Development of Mental Representation

Aitchison (1987) outlines the possible developmental progression of mental representation. The earliest stages of development, in the process of isolating words from the stream of speech probably involves recognition of rhythm pattern and stressed vowel. To accomplish the present task children would need to be beyond this stage and be aware of at least some consonantal aspects of a word even if their judgements were based only on how meaningful the word was to them.

It is not possible to draw any inferences about the precise nature of the subjects mental representations from their judgements of the experimental words. It is only possible to say with certainty that when the experimental words were unacceptable to the subjects it is presumably because they did not match their own representations. The current results do not specifically support any of the perception/representation suggestions made by Stoel-Gammmon & Dunn (1985), (listed in section 1.4.2).

An examination of the responses to individual words showed that most of the children were able to identify and recognise as errors some quite subtle changes to the normal adult form, for example /glʌp/ instead of /glʌv/ (glove). This indicates that the children were perceptually sensitive to the general pattern of the word. But it is not possible to assume awareness of individual phonemic segments.

Some general assumptions can be made about the possible nature of the subjects mental representations of the experimental words from their own realisations of these words (see section 7.3.2). In those instances where realisation matched the adult target an adult like representation can be assumed (but see Strange & Broen, section 6.3.2). Where the children had non-adult like production forms but judged the experimental word to be unacceptable it is possible to assume that they did not have a stored form that matched the experimental word, but not whether they had an adult like representation.

No specific theoretical models of representation have been presumed in this discussion. But those cases where the child's form was identical to the experimental word and the child judged it to be wrong appear to provide support for individual representations for perception and production (see also p 315).

It is therefore possible to suggest that the differences between making judgements about pronunciation and the ability to carry out rhyming and segmentation tasks reflects a developmental progression. To postulate purely a developmental explanation is however too simplistic and presumes that the different tasks represent a developing continuum influenced by common underlying factors. If this were the case significant differences between the two groups would not have occurred in the rhyming and segmentation experiments. Some additional factor must therefore be operating to bring about the inferior performance by the phonologically disordered group on these tasks.

It is not possible to determine from the results of the current experiment what criteria any of the children were using. The basis on which judgements are made can only be determined with certainty when the subjects are able to give explicit reasons for their answers. It is however possible to speculate that different children may be using different strategies to determine whether a word is acceptable or not. The requirements for success on the acceptability task described above could be said to represent minimum requirements and it is possible that some children were using more sophisticated strategies to determine their judgements. There may therefore be differences between the subjects which have not been revealed by the quantitative task scores obtained in the current experiment.

Comments of other researchers and the results of previous investigations (reported in 7.1.2) provide support for this possibility. For example Hakes (1980) argues that the basis of children's judgements changes as they get older. In other words the nature of linguistic judgements appears to reflect linguistic knowledge and ability, and De Villiers & De Villiers (1972) found that judgement of grammatical acceptability was related to level of language development.

If, as seems probable, linguistic ability does influence judgements the phonologically disordered group may have achieved similar scores to the normally developing group on the present task using different criteria, dependent upon their level of phonological ability. The responses of some children may have been based on the minimal criteria of judging the word simply on meaningfulness, and for some on recognition, or otherwise, of a general familiar word shape. In other instances children may have been applying knowledge of phonemic structure and attempting some explicit analysis of a word into its constituent phonemes. If subjects were using different criteria to make judgements it could help to account for the lack of significant correlations between the task score and the E.A.T. and other variables.

d. <u>Syntagmatic and Paradigmatic Processing in Judging Acceptability</u>

In the last chapter a possible association between segmentation ability and the syntagmatic aspect of phonological processing was postulated Syntagmatic and paradigmatic processing can also be considered in relation to acceptability judgements. In very general terms paradigmatic processing could be said to equate with comparing the experimental word against a mental representation of that word. Breaking the word up into phonemic segments for more detailed analysis equates with the syntagmatic aspect of phonological processing. If it was possible to demonstrate that subjects did carry out this task using different levels of analysis it would be possible to relate such behaviour to the discussions in the conclusion of the the previous chapter (6.5) and the consideration of a possible relationship between rhyming and acoustic sensitivity discussed in 5.3.3.

e. Comparison of Imitation and Correction Abilities

The phonologically disordered and normally developing subjects displayed equal ability to imitate the experimental words and make modifications to their own production forms (section 7.3.2) The differences between the two groups only became apparent when the nature of their corrections was examined. As would be expected the normally developing children provided their own adult like representation as a correction for most of the experimental words. When the phonologically disordered children habitually used the adult realisation of a word they also provided it as a correction. But when their own usual realisations of the experimental words were different from the adult target rather than simply providing these as corrections they were much more likely to modify their own production to successfully provide the non-habitual adult target or some other non-adult realisation.

It is possible to infer from this behaviour and the similarity between the two groups, in their ability to imitate and attempt correction, that there is no difference between them in general perceptual and motor production ability and that they were exercising similar strategies to approach the task.

Even though the phonologically disordered children did not always succceed in achieving the adult target when correcting the experimental words their ability to readily modify their usual production forms suggests that these children have some sensitivity to the phonemic composition of words. This finding weakens the suggestion made earlier in this discussion (7.3.4) that differences in phonemic knowledge may result in different criteria being used to make acceptability judgements. And it requires further consideration of the suggestion made in Chapters 5 and 6 that poorer facility to pay attention to the phonemic composition of language may influence not only rhyming and segmentation ability but also phonological development. However there is a theoretical model which can account for the strategies being used in imitation and correction in the current experiment and allow for differences in phonological knowledge.

f. <u>A theoretical model of phonological processing</u>

Hewlett (1988 and in press) proposes a model of phonological processing and phonetic production for single words. (He presumes an input and an output lexicon, rather than a single mental representation of a word to support his model). He postulates a motor processing component which puts together the required sequence of articulatory gestures for pronounciation. Two alternative routes to the motor processer are hypothesised, the normal faster automatic route from output lexicon and another slower route from the input lexicon via the motor programmer. These alternative routes are proposed to highlight the automaticity of speech. The model is reproduced as Figure 7.1. The second route

> "...is slower and more laborious because the motor programmer does not operate with learned combinations of commands; rather, it is the task of this unit to devise the motor plans appropriate for the articulatory implementation of the perceptual categories provided from the input lexicon. Once a motor plan is finalised it can be programmed into the motor processing component. The information is also transmitted to the component responsible for the mapping rules whereupon the relevant rule(s) can be revised"
>
> (Hewlett, in press p. 45).

When this model is applied to the current experiment the child's own habitual production of the word is accounted for by the faster automatic route from the output lexicon. The experimental tasks of imitation and correction are accomplished through the slow route and the input lexicon. The motor programmer is employed to devise a motor plan to imitate the experimental word, presumably drawing on short term memory as well as input lexicon to produce

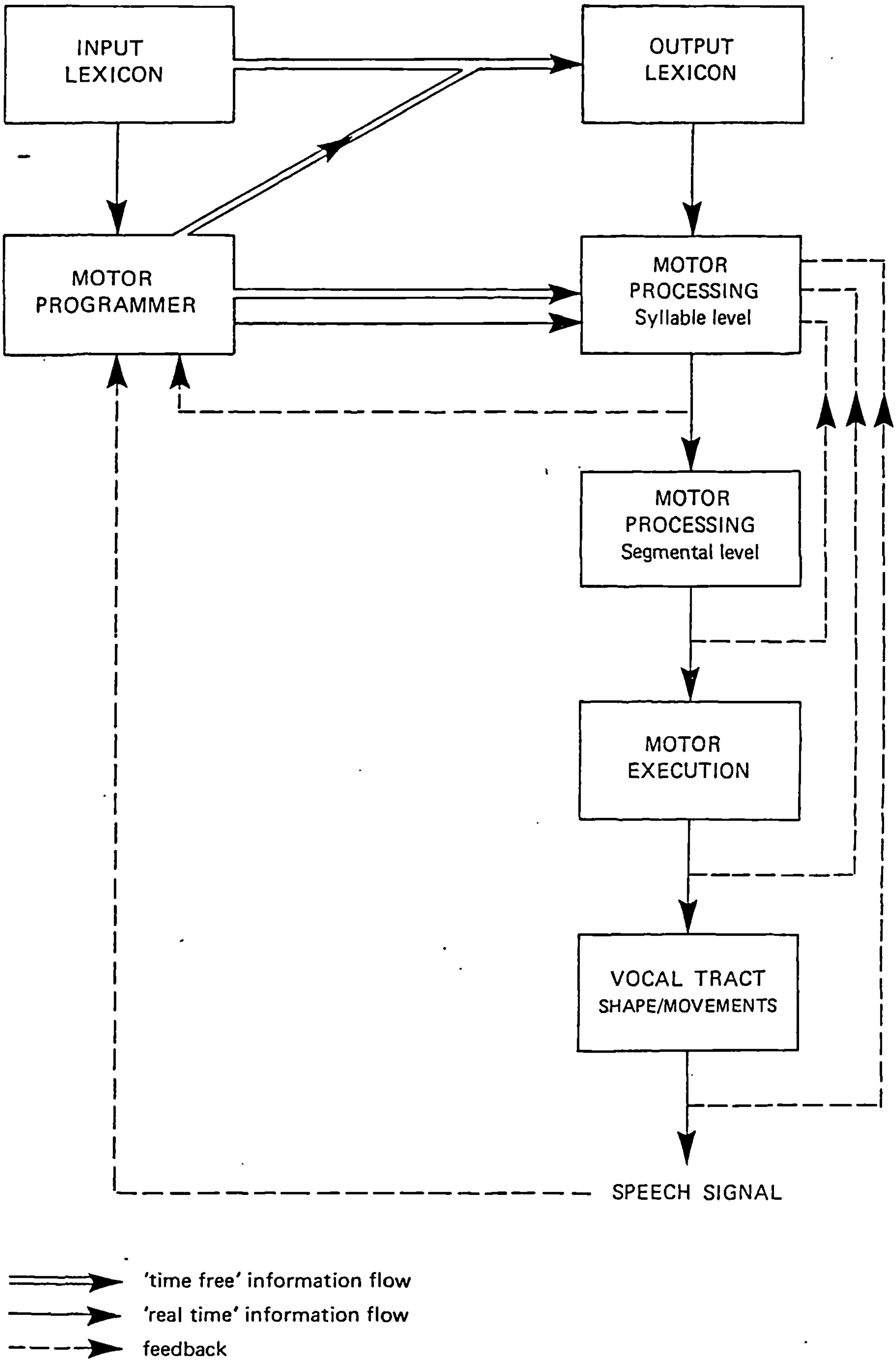

Figure 7.1 A Model of Speech Processing in the Child

(Hewlett, In Press)

an imitation. To correct the experimental word the same route is employed to devise a different motor plan by using information currently available in the input lexicon.

This dual route can account both for the similarities of the two groups in their ability to make modifications when imitating and correcting the experimental words and the differences in the correction forms that they produced. Where the child has the adult representation of a word, input and output lexicons will contain the same information and the correction will be appropriate. In those cases where the child provides a correction that is not his habitual realisation, whether or not he achieves the adult target, he is using available information from the input lexicon, but this realisation is not an automatic learned combination.

Hewlett says that once a lexical representation has been established pronunciation can only be revised through the input lexicon and the slow route. He adds that the following four conditions, at least, must be met for revision; awareness of insufficiency of current production, a desire to change, knowledge of crucial articulatory targets and sufficient dexterity of vocal apparatus to implement them.

In the current experiment the first two conditions are provided by the experimental situation. The available evidence about the nature of phonological disorder (see Chapter 1) and the imitation and correction ability displayed in the current task would suggest that the group of phonologically disordered children have sufficient articulatory dexterity (and see also Chapter 8). The unknown factor appears to be knowledge of crucial articulatory targets. Lack of knowledge therefore may account both for the failure of the child to provide habitual adult realisations and unsuccessful attempts to correct the experimental word.

In those situations where the child achieves an adult target in the experimental situation, that he does not use habitually, it is possible that he may now possess the required knowledge, which he may once have lacked, at an earlier stage of development. But he may not yet be aware of the communicative insufficiency of his current production and consequently has not yet revised and established a new adult motor plan. This model can also account for the modifications observed in previous investigations, the activating process occuring when the child perceives listener confusion.

Both groups of children have demonstrated convincingly through their imitation and correction attempts that they were capable of devising motor plans that were different from their own productions. This model provides a possible account of how children responded to the experiment. What it can not clarify however is precisely what information each subject was able to draw upon and how they reached their judgements of the experimental words. In the Hewlett model the input lexicon is said to provide the perceptual categories for motor programming, but the organisation of these perceptual categories is not stated. It remains possible that differing success in realising the adult target in correcting the experimental word is a reflection of ability to access specific phonemic segments or features.

7.4 CONCLUSION

It was suggested earlier that the success of both groups of children in this experiment could be attributed to the proposition that making judgements about language is a developmentally easier metalinguistic task than those assessed in the earlier experiments in the investigation. This cannot however, as was also stated, be taken as evidence that development alone can account for metalinguistic differences.

One overriding problem in relation to the interpretation of the results of this experiment is the inability to determine the basis on which children were making judgements. Before any results from this type of experiment can contribute further to a consideration of the nature of metalinguistic awareness and phonological disorder some way must be found to determine how the children analyse the experimental words. To do this further information is required both about what phonemic knowledge is available to the child and how he uses that knowledge.

In the current experiment only very broad and general comparisons of imitation and correction forms were made. It is possible that a revised experimental method designed to take account of the children's specific error patterns and including a much more detailed comparison of the children's realisations in different aspects of the experiment would provide information about their knowledge base. For instance narrow phonetic transcriptions and/or acoustic analyses of the three conditions of spontaneous production, imitation and correction of experimental words could be compared to see if they provided any clues to the nature of the perceptual categories that the child was accessing.

Assessing the ability to classify or group errors provides a possible alternative approach to determining phonemic knowledge. For example could children group all reduced clusters together and would they see these as greater errors than say stopping of fricatives or final consonant deletion?. A first step in testing the feasibility of such tasks would be to use words that were realised as adult targets by the child, that is those words which he presumably has most knowledge about. The experiment could then be extended to words which were not realised appropriately by the child. Any differences in judgement between the two groups of words can provide a possible indication of differences in phonemic knowledge.

The following suggestions may also provide some method of determining how children use available knowledge. Although it was argued (section 7.2) that providing reasons for judgements (the only sure way to determine how a decision was made) was possibly beyond the capabilities of four year olds a less rigid experimental framework, where reasons are sought through shared discussion with the experimenter may be more successful. Such techniques have been used alongside other problem solving activities, see for example Karmiloff-Smith (1984). The therapeutic intervention programme referred to earlier (Hill et al 1988) resulted in many spontaneous comments about phonemic features and word composition from phonologically disordered children (see Howell & Dean, 1987 and Howell & McCartney in press for some examples). These comments demonstrate that these children are able to reflect and comment about phonological structure (see also Chapter 9).

Although the results of the current experiment are inconclusive they have raised several interesting points which are of relevance to the current consideration of the relationship between metalinguistic awareness and phonological disorder. The next chapter describes experiment four which was designed to investigate whether violation of the phonotactic rules of English influences word choice.

CHAPTER 8
THE PHONOTACTICS CONSTRAINTS EXPERIMENT

8.1 INTRODUCTION

This experiment investigates implicit knowledge of the permitted phonemic structure of English by asking subjects to choose between and imitate pairs of nonsense words, one of each pair of words respecting and the other violating permitted phonemic sequences. Because it was not known how adults would respond to this particular experimental task the experiment was also carried out with 21 female adult students.

8.1.1. PREVIOUS INVESTIGATIONS

The only known investigation of young children's knowledge of permitted phonemic sequences was carried out by Messer (1967) He set out to investigate Whorf's proposition that

> "In the English speaking world every child between the ages of two and five is engaged in learning the pattern expressed by this (structural) formula, among many other formulas. By the time the child is six the formula has become ingrained and automatic, even the little nonsense words the child makes up conform to it exploring its possibilities but venturing not a jot beyond them"
>
> (Whorf, 1956 p. 223-224).

Messer carried out his experiment with twenty nursery school children aged between 3.01 and 4.05 (mean 3.07). The children were presented with pairs of nonsense words, one of each pair being a possible

(P.E) and the other an impossible (I.E) word in English and they were asked to say which one sounded more like a word. There was a significant tendency for the children to choose the P.E words and to pronounce the I.E. words less accurately than the P.E. words. The pronunciation changes to the I.E. words were such that the words were usually changed to conform to permitted English sequences.

a. <u>Experiments with Adult Subjects</u>

Experiments assessing adults knowledge of permitted phonemic structure are more extensive, and have been concerned with both the recognition and invention of phonemic sequences. Brown (1958) asked his subjects to invent novel words. He found that most of the resulting words conformed to permitted English structure. Greenberg & Jenkins (1964) asked subjects to rate nonsense words in relation to how closely they thought they resembled English words. It was found that subjects could reliably make this type of judgement and that there was a high level of agreement between their judgements. In a related word association experiment subjects responded to P.E. nonsense words with real words that had identical consonantal sequences (e.g. kleb -> club).

Brown & Hildum (1956) asked two groups of subjects, one group described as "linguistically naive" (i.e. Normal adult speakers) and the other as having some academic linguistic training, to write down how they heard three different types of words. The words were unfamiliar real words, P.E. nonsense words and I.E. nonsense words. Most mistakes by both groups of subjects were made in the responses to the I.E. words, linguistically naive subjects making many more mistakes than those with linguistic knowledge. Both groups, but especially the naive group, tended to write down the I.E. words as P.E. forms.

These experiments demonstrate that regardless of the task used both child and adult subjects are predisposed towards preferring and producing P.E. forms. Results of this kind have been interpreted as evidence of a sub-conscious knowledge of permitted phonemic organisation. Brown & Hildum state

> "when subjects uninstructed in linguistics hear speech that is expected to be in their native language their perceptual identifications are directed by their knowledge of sequential probabilities in the language as well as by the acoustic stimulus" (Brown & Hildum, 1956 p. 417).

This suggestion that both knowledge and acoustic cues are combined in making identifications is supported by Greenberg & Jenkins. They also state that

> "perceptual sensitivity...is uniform across the entire length of the scale as opposed to being highly sensitive to small departures from English and less and less sensitive for

differences between very different 'words'"
(Greenberg & Jenkins, 1964, p. 167)

8.1.2 DEVELOPMENT OF PERMITTED COMPLEXITY KNOWLEDGE

Although it has been shown that children from aged 3.00 have implicit knowledge of permitted structural complexity the process by which this knowledge might become internalised is not specifically addressed in the above literature. The general assumption appears to be that exposure to the child's native language determines the internalisation of permitted complexities and leads to the types of responses found in the quoted experiments. Although Brown (1958) does not discuss the process of internalisation he says that in order to learn to use speech something must be learnt about the probabililties of various phonemic sequences. These he adds can only be discovered through recognising re-occurrence of certain sequences and distinguishing them from other sequences.

Waterson (1987) provides a tentative model of phonological representation which can account for the acceptance of P.E. and the rejection of I.E. structures and which incorporates a possible explanation of the development of the internalisation process.

The fully developed adult model consists of two levels of representation; a phonetic level (LR1) which consists of a store of possible phonetic patterns without meaning and a store of lexical-phonological patterns (words) (LR2) with full phonetic specification. LR1 is responsible for reception and recognition of speech and LR2 for interpretation and production. Waterson says that

> It is at LR1 that words will be accepted or rejected as conforming to the phonological system of the language. For instance...'fleek' will match the FLVP pattern to which 'flip' 'fright' and 'fleet' belong ...but 'fsog' will be rejected because there is no FSVP pattern in English"
> (Waterson, 1987, P. 111).

According to Waterson the child starts with no LR1 or LR2. Development is dependent upon increasing perceptual and memory ability and is concerned with the ability to recognise and match auditory patterns. Patterns of LR1 and LR2 are constructed and reconstructed on the basis of the maximum perceptual information available to the child at any one time until they resemble the adult representations.

8.1.3 PHONOLOGICAL DISORDER AND KNOWLEDGE OF PHONEMIC COMPLEXITY

There appear to be no published investigations of the knowledge of phonemic complexity in any group of language disordered subjects. If, as Brown suggests, phonological development requires the ability to recognise phonemic sequences, and if, as Waterson suggests, levels of representation are constructed by the child it is possible that phonologically disordered children will have less ability to recognise recurring phonemic sequences and less well developed levels of representation. Such a possibility can be related to earlier discussion, (particularly in Chapter 6), which was concerned with the suggestion that during the process of acquisition the child requires the ability to pay attention to both the syntagmatic and paradigmatic aspects of speech and that differences in the ability to recognise and respond to salient acoustic cues may affect acquisition.

If differences exist between phonologically disordered and normally developing children in recognition of phonemic sequences and the development of internal representations differences in the ability to distinguish between P.E. and I.E. forms may result. It would also be expected that there would be an association between sensitivity to permitted phonemic sequences and rhyming and segmentation ability. An experiment to investigate knowledge of permitted phonemic sequences was therefore thought to be appropriate in this investigation.

8.2. THE PILOT STUDY

Previous experiments have shown that knowledge of permitted complexity can be inferred either from subjects responses to presented stimuli or from their ability to generate novel sequences. Several of the experimental tasks that have been used, however, are beyond the cognitive capabilities of four year old children; for instance, providing written responses and using rating scales. But Messer has demonstrated that this age group are capable of choosing between words and it is known that they can generate novel words (section 5.1.1.).

Asking subjects to generate novel structures has the advantage, over choosing between presented words, of tapping internal knowledge by avoiding the possible influence of differences in current perceptual sensitivity. It was therefore decided initially to assess knowledge of permitted phonemic sequences from analysis of novel structures which would be produced by the subjects. These words were to be obtained by replicating experimentally the spontaneous rhyming play discussed in Chapter 5. Such activity would test out Whorf's proposition quoted earlier and also the observation of Ferguson & Macken (1980) that demonstration of the ability to play with sounds can provide "...evidence of phonological competence and awareness" (p. 150). Unfortunately despite using several different approaches it was not possible to persuade the majority of the pilot study children to carry out such activities. They usually responded by saying they "didn't know" or "couldn't do it".

An alternative experiment was devised based on Messer (1967) which required responses to presented stimuli. Ten pairs of monosyllabic words were constructed, one of each pair conforming to and the other violating the permitted phoneme sequences of English. The children were asked to choose one word from each of the presented word pairs as a name for a location on a pictorial map. They were then asked to imitate each word in the pair. Full details of the materials and procedure can be found in the description of the main experiment (8.3.1).

Although the children had previously proved reluctant to invent words, an opportunity for novel word generation was retained as part of the final version of the experiment. This took the form of inviting the children to invent names for some places on the map but it was not an essential requirement of the experiment.

Nine normally developing children took part in the final version of the pilot study, four males and five females. Their ages ranged from 3.10 to 4.10 (mean

4.03). No difficulty was experienced in persuading the children to choose and imitate the words.

Choice of P.E. words ranged from 4 to 9/10 (mean 7). All the children pronounced the P.E. words accurately but they all made some errors. on the I.E. words. The total of mispronunciations ranged from 3 to 10 (mean 4). In all instances the children reproduced the words as P.E. constructs.

The final pilot group children, in response to the experiment produced a total of fifteen novel words. These were mostly of a cvc, cvcv or a ccvc structure and always obeyed the constraints of English. The longest word produced was [tepwemget], but more frequently the children invented forms of a simple addition to a known word (for example [hausa] for house). It is perhaps notable that when words were provided they were always novel forms and never real words.

8.3 THE MAIN EXPERIMENT

8.3.1. METHOD

Subjects

All forty two children in the investigation took part in this experiment.

Materials

Twenty pairs of nonsense words were constructed, twice the number used in the pilot study. One of each pair of words respected (P.E.) and the other violated (I.E.) the phonotactic possibilities of English as described by Gimson (1980). The constructed words were checked by a linguist who confirmed their respective agreement and violation of English. Fifteen of the pairs were monosyllabic words, for example /wəmp/ and /wɛvp/ and five were bisyllabic words (for example /bɒflɛb/ and /bɛfmab/. The full list can be found in appendix 5. The five bisyllabic words were included to determine whether they would be treated differently to monosyllabic words. Although the I.E. clusters within these words do not occur in English it is possible that the pronunciation of these clusters will be affected by the probability of the syllable boundary falling between the two elements of the cluster.

Because it was necessary for the child to indicate choice by saying the words certain constraints influenced their construction. The words were constructed as far as possible to accommodate to the pronunciation limitations of the phonologically disordered children by using the consonants that presented them with least difficulty. As far as possible the words were composed of bi-labial and alveolar stops and nasals together with some fricatives and continuants. Velar stops, alveolar fricatives and affricates were not used.

Ideally to ensure that choice is made on the basis of the P.E. and I.E. segments alone rather than some other phonemic variable the word pairs should be identical apart from these segments. However to ensure clear identification of the subject's choices by the experimenter it was decided to use a different vowel sound for each word in the pair.

Each word was printed in large letters on a 8cm x 5cm card. A large hand drawn, brightly coloured, pictorial map of an island was prepared. This had on it a variety of locations that could be given names, farms, stations etc. This material was adapted from an experimental task designed by Campbell (1982).

Procedure

The children were told that a friend of the experimenter had drawn the map and that he would like the children's help in deciding what names to give to the places he had drawn. There were two trial items, followed by the twenty test items. The experimenter showed the child the pair of words for each location and asked:

"Would you like to call this (for example) "wəmp" farm or "wɛvp" farm?"

Each word was repeated twice. The presentation of the P E and I.E. words within the pairs was randomly varied. The same order of presentation of the word pairs and the words within the pairs was used for all subjects. The written representation of each chosen word was attached to its respective location.

When subjects had finished choosing all the words they were asked to repeat them using the following instructions

"You chose x, can you say it again for me?, You didn't choose y, would you like to say that one?."

A phonemic transcription and a tape recording were made of the responses. At the end of the experiment each child was invited to make up names for four locations that had been left blank.

Three types of quantitative information were available from the subjects responses:

1. The number of P.E. and I.E. words chosen by each subject.

2. The number of correct and incorrect pronunciations of each type of word.

3. The number of I.E words where the mispronunciation changed the word into a permitted English form.

Qualitative information about the nature of the subjects pronunciations was also available from the transcripts.

Too few words were generated by either group of subjects to merit further consideration.

8.3.2 THE ADULT EXPERIMENT

Although the results of previous experiments had shown that adults tend to favour P.E. words no information was available about how they would respond to this particular method of presentation. The experiment was therefore replicated with adult subjects.

Subjects

Twenty one female entrants to a degree course in Speech Pathology and Therapy volunteered to take part in the experiment. They had an age range of 17.06 to 46.01 (mean age 22.03). Fifteen of these subjects were school leavers and six were mature students, three of this group were graduates. All the subjects had some knowledge of a foreign language acquired from school but none of them considered themselves to be bilingual. None of them had any formal knowledge of linguistics and the experiment was administered before the start of the course.

Materials and Procedure

The same twenty pairs of words were used. The subjects were told that the experimenter wished to compare their choice of words with that of pre-school children and that there were no right or wrong answers to the experimental items. The activity used with the children was described briefly to each subject using one of the trial words as an example. The other trial pair was then presented followed by the twenty experimental items. Choosing and repeating the words then followed the same procedure as that used with the children but without the location map. At the end of the experiment these subjects were asked if they had been able to determine how the words within each pair differed.

For ease of comparison between the child and adult subjects the results of this experiment will be presented alongside the results from the child subjects.

8.3.3 RESULTS

a. Responses to the Task

The children understood the task and with one exception (A12) they were all willing to choose from the pairs of words. All the children attempted imitation of both types of words but there was variation in the total number of words each child was willing to imitate.

Although the children co-operated in the task it appeared to be the least enjoyable part of the investigation. Few of them showed the active enthusiasm with which they had approached the other tasks; they tolerated being asked to choose and imitate words but several of them became restless and persuasion was required to maintain co-operation.

b. Choosing words.

The total number of P.E. and I.E. words chosen by each subject can be found in Tables G & H in Appendix 6. The monosyllabic and bisyllabic words are examined and discussed separately.

The distribution of the number of P.E. choices from the monosyllabic word pairs made by each subject was compared across the three groups of subjects. The distribution, mean and standard deviation for each group is shown in Table 8.1.

Table 8.1 Frequency Distribution, Means and Standard Deviations of P.E. Monosyllabic Word Choices for Child and Adult Subjects.

Total /15	PDG	Group NDG	Adult
15	-	-	4
14	-	-	2
13	-	-	2
12	1	-	3
11	-	-	3
10	1	2	1
9	4	4	1
8	4	3	2
7	3	8	-
6	3	2	2
5	4	1	1
4	-	1	-
3	-	-	-
2	-	-	-
1	-	-	-
N=	20†	21	21
Mean	7.4	7.4	11.1
S.D.	1.9	1.5	3.0

† One subject could not be induced to choose.

Table 8.1 shows that the two groups of child subjects had an identical mean choice of 7.4 P.E. words from the monosyllabic pairs, and there was a tendency for the P.E preferences of both child groups to cluster around the mean. Neither group of children therefore showed a preference for P.E. rather than I.E. monosyllabic words. In contrast the adult group showed a tendency to choose P.E. words (mean 11.1).

However there was a wide variation within this group, four subjects choosing the P.E. word from all fifteen pairs and one subject choosing only five P.E. words.

Examination of the choices made by both adult and child subjects between the bisyllabic word pairs showed no preference for either P.E. or I.E. words by any group. Preference for P.E. bisyllabic words in all three subject groups ranged from 0 to 5, with means of 2.8 (phonologically disordered group), 3.2 (normally developing group) and 2.9 (adults).

Because neither group of child subjects showed a preference for either P.E. or I.E mono or bisyllabic words no statistical comparison of these results with other results or pre-investigation variables was undertaken.

c. Imitation of words

The total number of accurate imitations of all four types of words, for each subject in all three groups was obtained from the data and is presented in Appendix 6 Tables I (PE words) & J (IE words). Imitation accuracy across the different types of words and between different subject groups was compared by converting the total number of accurate imitations of each type of word by each group into a percentage accuracy score (Table 8.2).

Table 8.2 Mean Percentage of Accurate Imitations of All Types of Words by All Subject Groups

Group	I.E. Words Mon.Syl	I.E. Words BiSyl	P.E. Words Mon.Syl	P.E. Words BiSyl
PDG	7%	37%	41%	55%
NDG	12%	58%	81%	79%
Adult	69%	97%	99%	100%

Table 8.2 shows that adult subjects have the highest level of imitation accuracy for all types of words followed by the normally developing group with the phonologically disordered group having the lowest scores.

This table also shows that all groups found the I.E. monosyllabic words by far the most difficult type of words to imitate. The outstanding feature to emerge from these figures is the very low level of accurate imitation of the I.E. monosyllabic words by both groups of children.

The imitation of the P.E. and I.E. monosyllabic words by both groups of children was examined in more detail Table 8.3. provides frequency distributions, means and standard deviations of imitation accuracy of both types of words by both groups of child subjects.

Table 8.3 Frequency Distribution of Numbers of Accurate Imitations of I.E and P.E Monosyllabic Words by PDG and NDG Subjects.

I.E Words		No.	P.E Words	
PDG	NDG	/15	PDG	NDG
-	-	15	-	2
-	-	14	1	5
-	-	13	1	6
-	-	12	-	2
-	-	11	3	2
-	-	10	-	1
-	-	9	1	1
-	-	8	1	1
-	-	7	-	1
1	-	6	4	-
-	1	5	-	-
1	1	4	3	-
1	4	3	4	-
2	5	2	1	-
6	7	1	2	-
10	3	0	-	-
N= 21	21		21	21
M= 1.0	1.8		6.1	12.2
SD=1.5	1.5		3.8	2.1

The distribution of scores in Table 8.3 confirms that imitation of I.E. monosyllabic words was a very difficult task for all the children. Both groups of children found it easier to imitate P.E. words but there was a large difference between them in the number of accurate imitations they provided. Accordingly a Mann-Whitney statistical test was carried out to see if this difference was significant. The result was

U = 46.5 P<0.001 (for N_{21} and N_{21}, two tailed, tie corrected).

The difference between the two groups for imitation of P.E words was therefore highly significant. Differences in ability to imitate the I.E. words was just significant at (U = 136.5 P<0.10, for N_{21} and N_{21}, two tailed, tie corrected).

d. <u>Realisations of Mispronounced Words</u>

The data from the three groups of subjects was examined to determine how the words which had not been accurately imitated were produced. That is whether the resulting realisations were P.E. or I.E. forms. Table 8.4. shows the number and forms of mispronunciations of each word type for each subject group.

The total numbers of mispronunciations in Table 8.4 confirms the differences between the pronunciation ability of all three groups for different types of words discussed in the previous section. More specifically it shows that when a word of any type was mispronounced by either type of child or adult subject it was usually realised as a P.E. form. The majority of the non-English segments in the I.E. words were changed to P.E. forms. Two hundred and seventy one (98%) mispronounced monosyllabic I.E words from the phonologically disordered group, 264 (98%) from the normally developing group and 92 (94%) from the adult group were realised as P.E. forms.

Table 8.4 Total No. of Mispronunciations of I.E and P.E. Words, Monosyllabic and Bisyllabic, for each Group of Subjects, Classified as I.E. or P.E. Realisations.

Word type	Subj. group	Type of Mispronun. I.E	P.E.	Total
I.E Mono	PDG	6	271	276
	NDG	7	264	271
	Adult	6	92	98
P.E Mono	PDG	21	146	167
	NDG	15	37	52
	Adult	0	3	3
I.E Bisyll	PDG	5	55	60
	NDG	5	37	42
	Adult	0	3	3
PE Bisyll	PDG	11	31	42
	NDG	8	12	20
	Adult		0	0

e. <u>Phonemic change to monosyllabic I.E. words</u>

The type of changes that were made to the mispronounced I.E monosyllabic words was examined in more detail. There was a tendency for all the child subjects to change the words in similar ways and to realise them rather differently from the adult subjects. There was no indication that any of the words presented greater difficulty than the others for the children, but the adult subjects mispronounced certain words much more frequently than others.

Most of the mispronunciations of all three groups could be accounted for by one of the following types of change:

Cluster Reduction, usually by dropping the first segment (for example /dlɛf/ -> /lɛf/

Replacing a sound with another of the same class (for e.g. /bwen/ -> /blen/)

Inserting a schwa between two consonants

(/bnɛp/-> /bənɛp/)

Predictable patterns of realisation were detectable for certain types of words within subject groups. For instance most normal and many phonologically disordered subjects realised words starting with bi-labial stop or labio dental fricative + /w/ with correct initial sound + a different approximant usually /r/ following /b/, /l/ following /p/ and /l/ or /r/ following /f/ (e.g. /pwep/ -> /plep/. All the adult subjects realised these types of words accurately.

Initial alveolar stops + /l/ presented most difficulty for adult subjects and in all instances they changed the alveolar stop to a velar (e.g. /dlip/ -> /glip/). In contrast the children usually realised this type of word by changing the approximant (/dlip/-> /drip/).

Words with initial clusters containing nasals were usually mispronounced by the adult subjects with the insertion of a schwa (/bnεp/ -> /bənεp/. Some of the children also used this form but substitution of /n/ by /l/ was also common across all child subjects (/bnεp/-> /blεp/.

The realisations of the phonologically disordered subjects were the least predictable. The forms they produced might represent their own simplifying processes or realisations that were common across all subjects. A particularly frequent form of mispronunciation from this group was the reduction of an I.E. cluster to one phoneme; a mispronunciation that was also common in their realisations of the P.E. experimental words and their own speech.

In those instances where the bisyllabic I.E. words were realised inaccurately there was considerable variation in the realisations and no clear trends emerged apart from a tendency for normally developing children to substitute one approximant for another to create P.E. forms.

The few examples of inaccurate imitations of both P.E. and I.E. experimental words which were realised as I.E. forms usually occurred as unique realisations.

They followed no discernible pattern either across words or within the realisations of individual subjects. An exception to this was the realisation of /tlɔm/ as /θlɔm/ by four adult subjects.

8.3.4 DISCUSSION

The results of the current experiment support the findings of previous investigations in some respects but not others. Subjects in the experiment behaved in very similar ways to those in earlier investigations in their imitations of the experimental words, but there was a difference between the current and previous investigations in relation to preference for P.E. words. Although adult subjects tended to choose P.E. rather than I.E. words, word choice by both groups of child subjects appeared to be arbitrary, showing no preference for either type of word. The suggestion that there would be differences between the two groups of children in their responses to this experiment (8.1.3) was not supported by these results.

Imitation of the experimental words will be discussed first followed by a consideration of word preferences. The results will then be discussed in relation to Waterson's model of representation and the previous experiments in the investigation. Suggestions for further investigation will be considered in the conclusion.

a. <u>Imitation of experimental words.</u>

The finding that all subjects found the pronunciation of the I.E. words more difficult than the P.E. words and the almost total realisation of these mispronunciations as P.E. forms confirms the pattern of earlier investigations discussed in the introduction.

Of the three patterns of phonemic change described in 8.3.3, only one, replacing one sound with another from the same class has been discussed in any detail in earlier investigations. Messer (1967) used a distinctive feature analysis to examine such mispronunciations. He found that the majority of changes were minimal usually confined to one feature (for example /ʃkib -> /skib/). Brown & Hildum (1956) found that most of the written errors of their subjects involved change of a single phoneme and usually one distinctive feature change to that phoneme. In a different type of experiment, involving memory for unfamiliar words by children aged between 4 and 9, Aitchison & Chiat (1981) found that mistakes in recalling words usually involved the substition of one sound by another from the same class.

Explanations of the Nature of Imitations

The close agreement between current and previous experiments with regard to the extent and nature of the mispronunciations of I.E. words provides strong support for the influence of internalised knowledge of permitted phonemic sequences on perceptual identification. The precise mechanism of this process however is not clear, but it is known that it is not caused by by some sounds being easier to hear than others (see Greenberg & Jenkins, cited in section 8.1.1).

Messer suggests that subjects knowledge of the permitted organisational structure of their native language creates a predisposition to misconstrue heard I.E. words. Whilst Brown & Hildum suggest that subjects expectations lead them to make errors. It is not possible to determine from their discussion whether these authors believe subjects actually mishear the words or whether they reproduce what they would expect to hear.

Production limitations do not appear to have been considered as possible explanations of mispronunciations. The available evidence suggests, at least as far as adults are concerned, that motor constraints do not account for the mispronunciations of I.E. words. For instance Brown & Hildum found that written responses to experimental words contained the same types of errors as those reported in verbal responses.

There appears to be little physiological justification to support a motor constraints explanation. Most of the I.E. combinations of phonemes used in this experiment appear to have been recorded in other languages (see for example Greenberg)

Casual speech breaks P.E. constraints and contains many I.E. realisations (Hewlett 1981), as do young children's babbling patterns and early word forms. The pronunciation expectations from the subjects therefore, although unfamiliar, are not physiologically impossible, and as the experiments require imitation of single words the results are likely to reflect optimum production effort.

Although physiological limitations appear to be an unlikely explanation of the mispronunciations, it is however possible that unfamiliarity with and lack of practice of I.E. forms affects their production. One of the most striking features to emerge from the current investigation was the lack of difference between the two groups of children in their imitation of I.E. words. Both the groups found this a very difficult task, the phonologically disordered group mispronouncing 93% and the normally developing group 88% of these words compared to 31% mispronounciation by the adult subjects. It is possible that children of this age, regardless of their proficiency with familiar words have less articulatory control over unfamiliar less practised forms than adults. It is known for instance that children's production of newly acquired forms, particularly consonant clusters, breaks down in unfamiliar and more complex contexts. Campbell (1982) says that phonological competence in spontaneous speech

> "...does not indicate the total acquisition of the skill (it is) ...highly dependent on the word in which it is produced ...and the length of time the cluster has been within the child's repertoire"
> (Campbell, 1982, p.119).

She goes on to say that when errors occur they follow the same patterns of simplification heard in the speech of younger children. If acquisition of normal permitted phonological forms is a gradual process it is probable that initial production of novel forms will also be a difficult task for all young children. The resulting mispronunciations suggest that when faced with production expectations beyond their current capability children utilise existing internal representations. In the case of the I.E. words in the current experiment these will be customary combinations of similar features as in the examples in 8.3.3 During phonological development newly acquired sound combinations will revert to earlier simplification patterns when they occur in more complex phonetic environments.

So far this discussion has been concerned with the similarities between the two groups of child subjects. It is also appropriate to consider the differences between the groups. That is the highly significant difference in the ability to accurately pronounce the P.E words. This difference occurred despite the fact that care was taken to construct the experimental words using phonemes that were as far as possible within the competence of the disordered group. (It was not of course possible to accomodate to the structural limitations of their system and avoid consonant clusters, and Cluster Reduction was a predominent simplifying process for this group). The greater incidence of P.E mispronunciations in this group, although they were not so extensive as I.E mispronunciations, supports the view that this group have either less well developed phonological rule systems or are less able to access such rules. It does in fact highlight the nature of the phonological disorder. The poor pronunciation abilities highlighted in this task, where the child had to rely on phonological rules, constrasts markedly with their ability to modify output to correct real words demonstrated in the acceptability experiment (Chapter 7).

It would appear that perceptual predisposition resulting from existing internal representations could account for the pronunciation changes of both groups of child and adult subjects. But there is also some evidence to suggest that the changes made, particularly by child subjects, could also be influenced to some extent by production constraints. The interrelationship between pronunciation change, perceptual and production constraints and internal representation will be taken up in more detail after a discussion of the results of the word choice part of the experiment.

b. <u>Choice of Words</u>

The failure of both groups of children to show a preference for either P.E. or I.E. words is contrary to the findings of Messer (1967). In contrast the preference for P.E. words demonstrated by adult subjects confirms the results of earlier experiments. The similarity of response by both groups of child subjects suggests that level of phonological development cannot account for the difference in results between the current experiment and Messer's findings. Although the phonologically disordered children probably had a lower level of phonological development than his subjects this is unlikely to be the case for the normally developing group who all had above average phonological development as measured by the Edinburgh Articulation Test.

The nature of the instructions given to the subjects in the two experiments appears to be the most probable reason for the difference in results. It is possible that the specific instruction to Messer's subjects to choose the experimental word most like a word made a crucial difference to their preference for

P.E. words. Such an instruction possibly encouraged his subjects to use their existing lexical knowledge and search for comparisons.

The tendency of the adult subjects to choose P.E. words in response to the instructions in the current experiment suggests a developmental progression. It is possible that in the absence of specific instructions adults are better able to devise a strategy to determine choice. Possibly by guessing at the experimenter's hypothesis. The inability of the adult subjects to say what the difference was between the words and the wide variation in their preference for P.E. words suggests that such a strategy was not consciously devised. Only one adult said that she thought the words were possible and not possible English, a few others said they thought one of the pair was easier than the other but most said they did not know how the words differed. The probability that reference to existing lexical knowledge influences word choice is supported by the finding that nonsense words used in word association tasks led to recall of similar real words (8.1.1).

The possibility that child subjects may have been prevented from utilising their existing knowledge in stating a preference for P.E. and I.E. forms is reinforced by the probability that internal representation is different in children and adults. It has been suggested that initially children store words as individual forms rather than general rule patterns (see Chapters 5 & 6 for more detailed discussion). Additional support for this possibility comes from Aitchison & Chiat (1981). In their investigation of memory for words they found that children

> "...needed to consider the word as a whole rather than a string of isolated syllables" (p. 315)

It therefore appears that the instruction in the current experiment which was deliberately designed to focus attention on the structure of the experimental words may have assumed too much about the children's knowledge of phonological structure and failed to encourage them to access their available knowledge. This possibility is strengthened by considering the experimental findings in relation to Waterson's model.

c. Application of Waterson's Model

This model of phonological representation (section 8.1.2) can be used to examine and summarise the possible factors influencing both word choice and the nature of the mispronunciations.

Waterson suggests that the phonetic patterns of words will be examined at LR1 and that I.E forms will be rejected at this level. The behaviour of adult subjects in the experiment supports this possibility. These subjects tended to reject I.E. words presumably because they had no equivalent phonetic form stored at LR1.

The children's random responses to the words may be attributed to the possibility that their phonetic forms at LR1 are not so well developed as those of the adult. Children of this age will have sufficiently well developed representations at LR1 to analyse familiar real words but this may not automatically extend to the unique phonetic patterns used in the experiment.

Detailed pattern matching is not required for recognition of familiar words but in response to the novel nonsense forms, and in the learning of new words in the process of development, detailed attention to all the constituent features is required. The experimental instructions probably did not alert the children to the need for close analysis of the presented words. If they had done so it is possible that the children would have been encouraged to use what knowledge was available to them both at LR1 and LR2 to make a more detailed analysis of the words. In the absence of specific instruction it is suggested that the children paid attention only to general patterns recognising in both of the pairs of words common features such as nasalisation or frication but not the specific combinations and ordering of such features and as a consequence chose arbitarily between them.

These suggested possibilities are in accord with Waterson's contention that there is progressive and continued restructuring of both LR1 and LR2. Continued development of LR2 takes place, she says, even in adulthood with the acquisition of new vocabulary. She does not specify when and whether LR1 becomes completely formed and static, but it could be argued that anyone learning a foreign language will need to make reformulations at this level (Waterson suggests each language requires its own LR2). The findings of Aitchison & Chiat (1981) which suggest that full adult phonological representation may not be achieved before the age of nine also provide support for the suggestions made above.

The difficulty experienced in imitating I.E. words can also be considered against this model. According to Waterson the self devised levels of representation at LR2 forms the basis for production. Because the experimental words are novel forms new representations at this level will have to be devised for them. Furthermore they will be based on a limited exposure of two hearings to which only limited attention may have been paid. Imitation of P.E. words will be more accurate than I.E. words because the subjects already have similar stored representations to draw upon. But no child, normal or phonologically disordered will have any representations which resemble the I.E. words.

The application of Waterson's model is not considered to be contrary to her explanation of why children's imitations of familiar words is often more correct than everyday usage. She suggests that the adult form

> "...is given detailed analysis (as in the learning of a new word) [her brackets] and is then synthesised as for LR2 but it is produced directly as phonetic nonsense...not stored in the network"
> (Waterson, 1987, p. 119).

The lack of accuracy in imitating the experimental words can therefore be accounted for by their novel nature and the possibility that the experimental instructions did not encourage the subjects to employ their optimum analytical ability. Imitation of novel experimental words, particularly the I.E forms, can be equated with the early stages of phonological acquisition where the chld is encountering new patterns and where perceptual limitations among other factors results in initial reproductions which do not contain all the elements of the adult model. Comparison is limited however because unlike new words in the language the new form is not subsequently stored at LR2.

The process of imitating the experimental words can also be considered against Hewlett's model of word production (section 7.3.4). The unique motor plans required will be specified by the motor programmer drawing upon information from the input lexicon. Because the words are new entrants to the lexicon information may only be available in terms of very general feature specifications. The resulting motor plan will therefore be devised on the best available perceptual information matched to currently stored articulatory feature specifications. This possibility would accord with the type of changes found in the mispronunciations of the I.E. words. Within this perspective it can be understood why producing novel I.E. forms will be a difficult task for all the subjects.

Lack of preference for P.E. words and difficulty in imitating I.E. words can therefore be discussed with reference to theoretical models of development, representation and production. Within this framework the difference between the adults and childrens imitative ability may be attributed to a combination of factors. Adults may have better perceptual ability in terms of being able to employ finer analysis of the presented word, they will have more extensive, more complex phonological representations to aid recognition and formulation of new patterns and more articulatory control.

d. <u>Comparison of Current and Previous Experiments in this Study</u>

Although it is not possible to make any statistical comparisons between the results of the current and previous experiments in the current investigation, general comparisons of the requirements of each experiment are appropriate.

There was little difference between the results from the two groups of child subjects on both this task and the acceptability task (Chap. 7). It is possible to argue on the basis of the current results and discussion that neither group of subjects had reached the developmental level required to carry out the experimental tasks. In contrast it was argued in Chapter 7 that both groups of subjects had progressed beyond the developmental level required for success on the acceptability task.

Both these experiments required the subjects to make judgements about and imitate phonetic forms. However the current experiment used novel nonsense words and provided no guidelines to assist the children in determining the basis of their choice. In contrast the acceptability experiment used only familiar P.E. real words and real words containing P.E.

simplifications. These words were also accompanied by visual representations. The basis for accepting or rejecting these words was also made explicit in the experimental instructions.

It can be argued that judgements about the words used in the acceptability experiment can be made on the basis of general pattern matching and the extent to which they match existing representations. This pattern matching will take place at LR1 on the basis of Waterson's model, or at the Input lexicon, within the Hewlett model, (detailed analysis of all features will not be required). In contrast, as already argued, detailed feature analysis will be required in the current experiment.

The use of real words as opposed to nonsense words is also an influential factor in the imitation sections of the experiments. The motor plans required to imitate and correct words in the acceptability experiment can be modified by existing representations. A greater level of success would therefore be expected in these imitations compared to the imitations in the current experiment where unique motor plans are required for the production of I.E. nonsense words.

In broad terms the suggested explanations for the relative ease and difficulty of the acceptability and the current constraints experiment are compatible with the discussions on the possible association between phonological development, phonological disorder and metalinguistic awareness to be found in the rhyming and segmentation chapters. The subject's responses to all the experiments can be accounted for within a framework of phonological development which includes the necessity of paying attention to both syntagmatic and paradigmatic aspects of speech input, and the need for both general pattern matching and detailed analysis.

8.4 CONCLUSION

Although it is possible to interpret the results of the current experiment in a way that does not contradict the results of other experiments in the investigation it is also necessary to consider whether these results provide any additional information about phonological disorder and metalinguistic awareness and the possible association between the two.

There was no evidence to suggest that the normally developing group made better use of the available perceptual information than the phonologically disordered group, either in choosing or imitating the experimental words. There was also no evidence to suggest that there were any differences between the groups that could be attributed to production constraints. And the similarity of mispronunciations of the I.E. words by both groups suggests that they used the same general strategies for planning and producing these words.

Although differences between phonologically disordered and normally developing children do not exist at the level of imitating I.E novel forms (at least as far as the current experiment is concerned) it is possible that phonologically disordered children would have more difficulty in learning and storing such forms. It was suggested earlier (8.3.4) that imitation of experimental words could be equated with the early stages of phonological acquisition. There are however essential differences between the current experiment and the process of acquiring phonology. In acquiring phonology the children are learning about their native language, in Watersons terms they are storing forms which become part of the representational network. These forms will be continually revised and extended on the basis of additional knowledge. In the current experiment the nonsense words do not have to be learnt, they are isolated forms which will not require permanent representation.

The possibility that the phonologically disordered children's problem may be one of learning and storing is supported by their relatively poor ability to imitate P.E forms and is compatible with the discussion on accessing phonemes in the rhyming task (5.3.3). This possibility could be explored by extending the current experiment to compare children's ability to learn and recall novel P.E and I.E forms. Any differences between phonologically disordered and normally developing children in such an experiment would support the possibility of learning differences. An adaptation of the Aitchison & Chiat (1981) experiment would provide a possible experimental task. It must however be remembered that both groups of subjects were poor at imitating I.E forms. The ability of this age group to learn new forms can only be assessed by analysis of their pronunciation attempts at presented forms. As a consequence any demonstrated differences in learning these forms could be attributed either to perceptual or cognitive factors (see also conclusion of segmentation experiment 6.5) or motor learning differences.

It was suggested earlier that, inadequate instructions may have been responsible for arbitrary choice of words by both groups of child subjects. This possibility can be examined by further investigation. The following experimental method provides one possibility. Two matched groups of subjects could be used with the same words administered to both groups. For one group they would be accompanied by explicit instructions, for example directing the subjects to choose the novel word which sounded most like a known word. The other group would receive similar instructions to those used in the current experiment. Alternatively a single subject group could be compared in their responses to explicit and non-explicit instructions.

The responses of phonologically disordered and normally developing subjects to explicit instructions, could also be compared. Any differences between these subject groups in response to such instructions may indicate differences in stored representations or ability to access such representations. A preference for P.E. words, given explicit instructions, may provide some indication of ability to access stored forms.

The next Chapter looks at a very different type of ability, the ability to talk about talking.

CHAPTER NINE

TALKING ABOUT TALKING

9.1 INTRODUCTION

This experiment is different from the other experiments in the investigation. It examines the children's ability to talk about language by using a series of questions about pronunciation and learning to talk, rather than asking them to manipulate and make judgements about single words. Talking about language provides the most explicit demonstration of metalinguistic awareness. To be able to talk about any topic children must have some knowledge or conception of the topic and be able to draw inferences from and choose appropriate language to convey this knowledge.

Within the Clark taxonomy comment about language can be variously categorised according to the metalinguistic skill being employed and the aspect of language that is being talked about. For example commenting on the utterances of oneself and others, could be categorised as 'Checking the Result of an Utterance', whilst judgement and explanation of linguistic structure could be categorised as Reflecting on the Product of an Utterance'. This discussion will review observational and experimental evidence about children's ability to talk about language and discuss the use of question forms as an experimental procedure.

9.1.1. OBSERVATIONAL DATA

Observational data has provided the main source of information about the ability to talk about language. Spontaneous comments about language by pre-school children have been reported by several authors. Most frequently these are reports of discussions between child and adult (see Clark, 1978, Elkonin, 1971 Shatz & Gelman, 1973, Slobin, 1978 and Weir, 1966). Discussions between children have been reported rather less frequently (see for example Garvey, 1984 and Iwamura 1980 and sections 2.2.2. and 7.1.1 this volume).

The reported conversations have usually, but not exclusively, been concerned with the structural aspects of language, in particular with pronunciation. Slobin's daughter Heidi, at 3.03 was aware of and commented on foreign accents. But she also talked about other aspects of language, for instance vocabulary. From 2.09 onwards she is reported as frequently asking "What do you call X?" and "What the word for X?" (Slobin, 1978, p. 46). Heidi however was perhaps a special case. From an early age she had been exposed to several languages in addition to her native English, a situation which is known to encourage linguistic reflection (2.9.2). Garvey (1984) reports a discussion about a more subtle aspect of language, a conversation about voice change as one grows older, between a boy aged 4.05 and a girl aged 4.09.

Certain experiences or situations appear to trigger comment. For instance M, aged 3.06, usually a proficient speaker, became concerned about her inability to pronounce the /sw/ cluster, in particular when it occurred at the beginning of "swan". She would spontaneously attempt several different fricative/continuant variations in an attempt to find one that satisfied her. She accompanied these pronunciation attempts with comments about the difficulty of these sounds and others, asking why some sounds were difficult and requesting assistance with pronunciation (personal observation).

This particular observation is of interest because it demonstrates the simultaneous occurrence of several aspects of metalinguistic awareness, one aspect perhaps encouraging discussion of other aspects. M, not only practised and commented on her own pronunciation but at the same time talked about and requested information about sounds in general.

This apparent triggering of conversation about language was also observed in the current investigation. Several of the children made spontaneous comments and asked questions about language, particularly during the piloting of the acceptability experiment (Chapter 7). Their remarks would usually take the form of comment or question about the man on the tape not talking properly. Phonologically disordered children have also been known to make spontaneous comments about pronunciation during remediation (see 7.4).

The comments about language cited above have been collected incidentally whilst observing other aspects of language or behaviour, or have been provided by parents or others who were particularly interested in language. It is not known whether they represent common behaviour in young children. However because it appears that certain situations or events may encourage comment it may be possible to trigger such activity in the experimental situation.

9.1.2 PREVIOUS INVESTIGATIONS

In experimental situations asking children questions provides a more direct method of determining children's knowledge than waiting for spontaneous comment. This is a technique that has been used to study children's knowledge of various aspects of behaviour in particular metacognition by Flavell and his colleagues (see for example Flavell & Wellman, 1977, Flavell, Speer, Green & Auguast 1981, Flavell, Green & Flavell, 1986 and Markman, 1977).

Questions have been used to investigate knowledge of various aspects of language, such as pragmatic awareness (Bates, 1976), awareness of rules governing determiners and reference (Karmiloff-Smith, 1979b & 1986a) and syntactic and semantic acceptability of sentences (Carr, 1979). (See also 7.1.2).

The only known investigation which has used questions to investigate understanding of the speech act was carried out by Edwards & Curtis (1983). They interviewed 80 children aged between five and 14 years. Their subjects were asked questions such as "How do children learn to talk?" and "Can babies talk?" The responses were then categorised according to content.

9.1.3 QUESTIONING AS AN EXPERIMENTAL METHOD

Although it appears to be a useful investigatory method, using questions to elicit information is not without its drawbacks. It is possible that the complexity of children's language will be reduced when they are placed in the, possibly unfamiliar, situation, of being expected to answer specific questions. As a consequence the child's actual knowledge of a subject may be underestimated.

Tizard, Hughes, Pinkerton & Carmichael (1982) and Tizard & Hughes, (1984) express several general concerns about using questions, (they use the term "cognitive demands"). These authors have reservations about whether using this technique is efficient either at eliciting information or encouraging the child to reflect. They suggest that many children between the ages of three and five are uneasy in, and have difficulty in taking part in, this type of situation. The concern of these authors is primarily with the educational use of questions but their comments may be equally applicable to the type of investigatory studies reported above.

Providing a verbal answer to a question demands more complex behaviour than that required in many other experimental activities. To answer a question in such a situation the child must understand the nature of the experimental activity, interpret the question, formulate an answer and then provide a verbal response. In the current study, for example, the other experimental tasks all required less complex behaviour, such as pointing (rhyming) or choosing between two words (constraints experiment).

Answering questions about language may pose particular difficulties in that a response about an abstract entity rather than a concrete object is required. Providing such a response requires the ability to think and talk about language in a way not usually required in normal communicative interchanges.

Despite these potential difficulties because comment about language can explicitly demonstrate awareness and because some of the children had spontaneously demonstrated an ability to talk about language it was decided to carry out a pilot study to determine whether answering questions was a suitable method of assessing metalinguistic awareness. The use of questions appeared to be the only feasible means of obtaining comment about language in any systematic fashion. And Blank, Rose & Berlin (1978) and Tizard et al have demonstrated that three and four year old children are able to participate in question and answer discourse.

9.2 THE PILOT STUDY

Three interrelating factors were taken into account when devising the pilot study:

1. The particular aspects of language to be talked about - the topic.

2. The experimental format

3. The form of the questions

Each of these factors will be considered below.

The Topic

Pronunciation ability was chosen as the first topic for the experiment (in the children's terms -the ability to talk properly). This had been the focus of most of the spontaneous comment from the children during the study and it is also, in the shape of phonological disorder, the central focus of the investigation.

Learning to talk provided the second topic. During the course of the current study baby brothers and sisters, or cousins, were frequent topics of child initiated conversations, showing that they were a familiar and important part of their lives. There are also published reports of young children showing interest in the language abilities of babies (e.g. Dunn & Kendrick, 1982).

Another aspect of pronunciation was also considered for investigation. Two of the children in the study had made spontaneous comments about accent; this was something that had also excited Heida (Slobin, 1978). Therefore a tape of two adults conversing and reading a passage in different accents (Australian and Scots) was played to the children. They were then asked questions about how many people they could hear and whether the people sounded the same or different. The response to this activity was very disappointing and elicited few responses and was subsequently abandoned. It is possible that the tape was not sufficiently interesting, the voices not sufficiently different or the questions not understood.

The Format

The children had found listening to the tape recorder very motivating throughout the investigation. Tape recordings were therefore used as the starting point for asking questions about both topics. The tape of mispronunciations used in the acceptability experiment (Chapter 7) providing a basis for the questions about pronunciation in this experiment.

A recording of a twelve month old baby and its parents was used as the starter for the second topic. This tape, lasting about two minutes, consisted of vocal interaction between the baby and both parents and contained fairly long stretches of rhythmical sound play from the baby.

The Questions

The questions used in the final version of the experiment resulted from general conversations between the children and the experimenter in the initial stages of the pilot study about the pronunciation of "the man on the tape" and about what could be heard on the baby and parent tape. Those questions which had elicited most response during these conversations provided eight final questions.

These comprised five questions about pronunciation ability , for example:

"Why do you think the man can't say his words properly?"

and three questions about learning to talk. (The full list can be found in Appendix 5).

The answers from both sets of questions were recorded and analysed according to a procedure based on Blank et al, 1978 and Tizard et al 1982. This procedure is outlined in the main experiment (9.3.1) and the detailed scoring procedure can be found in Appendix 5.

The final versions of both sets of questions were administered to ten children, six boys and four girls aged between 3.11 and 4.08 (mean CA 4.04) who had not taken part in the initial conversations about the tapes.

All the children listened attentively to the tape recordings and five of them provided appropriate answers to the questions. This response was felt to be sufficiently encouraging to justify the inclusion of this experiment as part of the main study.

9.3 THE MAIN EXPERIMENT

9.3.1 METHOD

Subjects

Sixteen phonologically disordered children and 20 normally developing children took part in this experiment. The experiment was abandoned with four children (A1, A3, A4 and B7). These children became upset or refused to listen to the whole of the tapes. It is possible that they did not understand the task, or the questions, or that they were too tired to participate at this particular stage in the experimental procedure.

It was inappropriate to ask the first five questions to two other phonologically disordered children (A11 & A19) because they only acknowledged two errors during the acceptability experiment. They did listen to the baby tape however and were asked the last three questions. Their answers to these questions were noted but their scores were not included in the quantative analysis of the results.

Materials

The materials for the final version of the experiment consisted of the Experiment 3 tape and the baby and parent tape and eight questions. Questions 1 to 5 were concerned with pronunciation, for example:

Q.4 Do you know anyone who can't say their words properly?

and Questions 6 to 8 with learning to talk, for example

Q. 7 How do you think babies learn to talk?

The full set of questions and the instructions for administering the task can be found in Appendix 5.

Procedure

The children were asked the first five questions immediately after the completion of the acceptability experiment. They were followed by the baby tape and questions 6 to 8.

All the questions were presented in a conversational manner. No help was given in answering them apart from asking "how" or "who" to encourage expansion of an answer. If the child digressed from the subject matter or asked the experimenter questions the response was non-committal and the child was gently steered back to and asked the next question.

This approach probably sacrificed the richness of some of the children's conversation but allowed their answers to be compared and categorised. If a child failed to make a response to a question or replied that he "didn't know" he was asked the next question. The task was terminated in a general conversational way by telling the children some of the answers other children had given.

The answers were recorded verbatim; tape recording was not possible because the children were distracted by the introduction of a second recording machine. In the event written recordings were satisfactory for all except the most talkative children. In these instances only the comments specific to language were recorded.

The Scoring Procedure

A scoring procedure based on Blank et al (1978) and Tizard et al (1982) was used to provide a quantative score of the content of the answers.

Non-productive and productive answers were differentiated. Non-productive answers (Score = 0) are those which are judged to provide no evidence of an ability or willingness to continue with discussion (e.g."I don't know"). Productive answers are those which are judged to be capable of allowing conversation to continue. These score from 1 to 3 depending upon the amount of active reflection and information they are judged to provide. Full details of the scoring procedure can be found in Appendix 5.

Because each question makes different demands on the children and represents different degrees of difficulty, for instance some require a yes/no answer and others an explanation, the scoring system cannot reflect equal levels of reflection across the questions. It can however provide a very general indicator of the ability to answer questions about pronunciation and language development. The scoring is not intended to reflect the correctness or otherwise of the answers as judged against an adult's knowledge.

9.3.2 RESULTS

This section covers the quantitative results of the experiment and reports on the content of the answers. The majority of children who took part in this experiment appeared to enjoy the task and were very willing to answer the questions.

a. <u>Quantitative Results</u>

The raw scores obtained in response to each question by the 16 phonologically disordered and the 20 normally developing subjects who participated in the whole of the experiment are presented in Appendix 6 Tables K and L.

The responses were scored independently by the investigator and two speech therapists who had no other involvement with the investigation. There was an 80% agreement between the three assessors. There was no disagreement between them in deciding whether an answer was productive or not, but difficulty arose in determining the degree of productiveness, particularly whether an answer should score 2 or 3. In cases of disagreement the majority decision prevailed.

Group Comparisons

Table 9.1 shows the distribution, means and standard deviations of the scores from the two groups of subjects.

Table 9.1 Frequency Distribution, Means and Standard Deviations for Question Scores, All Subjects.

Score /24	PDG	NDG
	Group	
24	-	-
23	-	-
22	-	-
21	-	-
20	1	-
19	2	2
18	1	5
17	-	1
16	1	3
15	1	2
14	1	1
13	-	-
12	-	2
11	1	-
10	-	1
9	-	1
8	1	1
7	3	-
6	-	-
5	-	-
4	1	-
3	-	-
2	-	-
1	-	1
0	3	-
N=	16	20
Mean	10.5	14.5
SD	7.1	4.3

This table shows that the phonologically disordered group had a lower mean score (10.5) than the normally developing group (14.5). The greatest spread of scores was obtained by the phonologically disordered group, with a standard deviation of S.D 7.1, compared to 4.3 for the normally developing group.

A Mann-Whitney Statistical test was carried out. There was no significant difference between the two groups, the result was: $U=108$ $p>0.05$ for N_{16} and N_{21} two tailed, tie corrected)

Total raw scores may conceal information about the relative productivity of the subjects answers. Consequently the total of each type of score (0-3) obtained by each subject group for each answer was extracted from Tables K and L and converted into a percentage score. The percentage scores for each question for both groups can be found in Fig. 9.1.

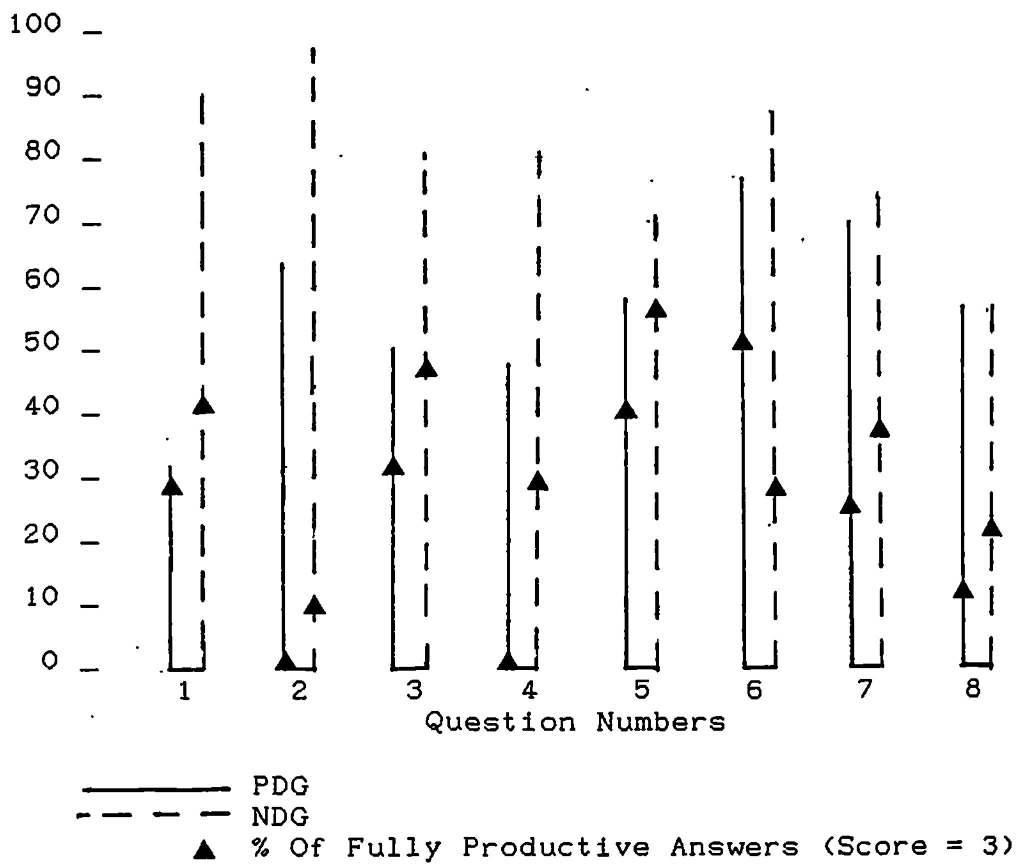

Figure 9.1 Percentage of Productive Answers for each Group for Each Question, Experiment 5

Figure 9.1 shows that the phonologically disordered group provided a lower proportion of productive answers to all the questions with the exception of question 8 where no difference between the two groups was recorded. A greater percentage of fully productive answers (score, 3) was provided by the normally developing group for all questions except question 6.

An examination of individual scores in Tables K & L shows that the majority of children in both groups were able to provide productive answers to most of the questions but the normally developing subjects appeared to be slightly more consistent in their responses.

The three children in the phonologically disordered group who failed to score and the normally developing subject who scored only one failed to give verbal responses to several of the questions but they appeared to listen to the tapes with great interest and smiled or shrugged in response to the questions they did not answer verbally.

b. Association between experimental scores and phonological ability

Kendall rank-order correlation coefficients were calculated to determine whether there was any association between the E.A.T. scores and the scores for this experiment. The result was $T = 0.25$ $p<0.025$, N=37, (two tailed, tie corrected). A low but significant association therefore exists between phonological ability and performance on this task.

This result should be treated with reservation however because complete data was only available for sixteen of the twenty one phonologically disordered children and in retrospect there were felt to be several shortcomings with the experimental design particularly the scoring procedure (see 9.4). These factors also determined that no further statistical tests would be carried out on the data.

c. <u>The Content of the Answers</u>

The transcripts of the answers to individual questions were examined to determine the nature of the children's knowledge about language. Each question will be examined separately and some examples of the answers that were given will be provided to illustrate the nature of their content.

QUESTION 1 Why do you think the man can't say his words properly ?

In order to answer this question the child must be able to listen to the tape recording and recognise that there are errors in the heard speech and mentally review the possible cause of the errors.

Figure 9.1 shows that the normal children were more willing to provide productive responses to this question although seven of these answers were circumlocutory (score, 1), for instance "Cos he's a silly man" or "Cos he's wrong". That is their answers indicated that a problem existed but they appeared unable to reflect further, or lacked the knowledge or experience to do so.

The fully productive answers contained a variety of reasons for difficulty with talking. Two of the four fully productive answers (Score, 3) from the phonologically disordered group suggested problems with teeth, whilst one said that "He couldn't remember things" (A7) and the other "He must have hiccups"

(A12). Two of the eight fully productive answers from the normal children attributed the problem to age, for example "Some men can't because they're old men and because he's an old man" (B17). Two of them said that the man wasn't listening properly, one that he hadn't had practise and one because the words were too difficult. One of the children suggested that the man must have a cold whilst the final answer that scored 3 from this group suggested that the man had problems with his teeth.

QUESTION 2 Do you think we could help him?

To answer this question the child requires to be aware of the possibility of providing assistance to another person and translate it into a simple Yes or No response.

Ten (62%) of the answers from the phonologically disordered and 19 (95%) from the normal children were productive responses, all except two children replied in the affirmative. The two children who replied "No", were both normal children who qualified their responses. "No, because he's not here" (B10) and "No, because there are too many words" (B8). Both answers were judged to be appropriate to the situation and scored three.

QUESTION 3 How do you think we could help him?

This question provided an opportunity for the children to reflect about the sort of assistance that might be possible.

Eight (50%) of the answers from the phonologically disordered and 16 (84%) from the normally developing children were fully productive answers to this question. Most of the answers from the phonologically disordered group suggested that practice or imitation would be helpful. For example the answers "Show him the pictures and get him to say it after us" (A8) and "By 'piting (repeating) a lot of times" (A15). Other answers from this group were logical extensions of their answers to question 1; "Hiccup him, that's what mans do" (A12) and "Fix his teeth" (A20). Subject A2 evidently drawing on his own experience said "The man needs speech therapy. Send him to the speech therapist".

Practice was also the predominant suggestion from the normally developing group. For example subject B20 said "Think we should say cat, mat, one a day until they are all finished". There was again logical extension to question 1 "Take something out of his mouth" (B19) and "Give him cough medicine" (B1).

QUESTION 4 Do you know anyone who can't say their words properly

Seven children from each group, said they didn't know anyone (scoring 2). No disordered child replied in the affirmative, but nine of the normal children said that they did know someone and without exception spontaneously provided additional information. For example "I know somebody but I don't know her name. An old person says [dea] for chair, [t] for teeth, [ka] for kangaroo and [fət] for cat" (B17) and "My friend Ross canna talk properly and old mens canna talk properly" (B6). Babies and ill people were also cited and three of the children mentioned "The man on the tape".

QUESTION 5 Are you a good talker?. Are there any words you can't say properly?

This question differed from the earlier ones in that it asked the children about themselves rather than someone else. It required them to be aware of and make a judgement about their own ability as speakers. The second element of the question was intended as an additional clue to what was required and as a possible opportunity to qualify their answer. A Yes/No answer scored 2 and a score of 3 was given if the children enlarged on their answer.

Nine (55%) of the answers from the phonologically disordered children and 14 (70%) from the normal children were productive, six (40%) and 11 (55%) respectively were elaborated (scoring 3). With the exception of one phonologically disordered child they all considered themselves to be good talkers. The exception was subject A20 who replied "I'd say not. Cos I can't say [tusbʌs] (toothbrush)and [tuspest]".

Two other normally developing children said that once there had been words they couldn't say but that now they were good talkers. Both groups were generally confident that they were good talkers, the normally developing children being particularly certain of their ability to talk, "Yes, I can say everything" (B16) being a typical response.

QUESTION 6 Who do you think this is?

This was probably the most straightforward question in the experiment, requiring the child to simply recognise and label the voices on the tape. Any child who mentioned a baby or a little or "wee" girl or boy scored three, whilst less specific answers, for example "a boy and a man" scored 2.

The majority of the children were able to respond adequately to this question, 12 of the phonologically disordered children and 17 of the normal children. Half of the phonologically disordered children and a quarter of the normal children mentioning a baby or "wee boy" as part of their answer. However, four of the disordered group identified what they heard on the tape in some way with themselves. For example "Me, sounds like Richard (baby brother) when I was a baby" (A11). Only one of the normal children responded in this way. The normal children were more likely to ask questions about the tape asking "What did he say?" or attempting to give the babbling meaning. For example

"A baby, I think it's wrong she's saying" (B16).

QUESTION 7 How do you think babies learn to talk?

This question requires the child to have some understanding of learning and to find appropriate words to express the concept.

Over half the children in each group were willing to attempt this (scoring 2 or 3 for their answers). But only four (25%) of the answers from the phonologically disordered and seven (35%) from the normal children were judged to be fully productive.

The phonologically disordered children who got a maximum score on this question favoured a maturational explanation. "Babies don't learn to talk when they are born. They learn to talk when they are big. They just start talking" (A8), was perhaps the most explicit. Subject A15 said "I don't know. They have to have teeth, like my teeth or your teeth". The normal children also favoured maturational answers to this question, for example "Cos they grow up. Just learn like how you learnt to talk when a wee baby" (B8). Six of the normally developing children with varying degrees of detail (scoring 2 or 3) suggested that teaching or learning from someone was required. "They say ga-ga first. Then Mummy tells them names and they can learn them" (B20) was perhaps the most specific answer.

QUESTION 8 Does anyone have to help them?

This two part question was intended to give the children an opportunity to expand on their previous answer. It does perhaps require more abstract knowledge and thinking than most of the other questions. Two of the children who had spontaneously and specifically provided this type of information in their response to question two were not asked the question again.

Approximately half of both groups of children provided productive answers but only three of the phonologically disordered and four of the normal children's answers were judged to be fully productive. Opinion was equally divided about whether help was required in learning to talk. These contrasting responses came from the Phonologically disordered group "I think somebody has to help them, (Who?) Mummy, Daddy, Grandad. (How?) By tacking their teeth" (Demonstrates this by clicking his teeth together) (A15). "No he'll learn by himself because I learnt myself" (A20). Similar responses to this question came from the normal group.

The quantative results suggest that as a group the phonologically disordered children were rather less successful than the normally developing group in providing productive answers to the questions and, with the exception of question 6, they provided fewer fully productive answers. However the content of the answers from both groups was comparable and demonstrated the children's knowledge of the world. Most of them showed that they were able to reflect upon their experiences and relate these to the questions in what was judged to be an appropriate manner.

9.3.3 DISCUSSION

This discussion will concentrate on the following points: a comparison of the current results with those from previous investigations, an evaluation of the children's answers as evidence of metalinguistic awareness and a review of possible reasons for differences in the ability to answer questions.

a. Comparison of Current Experiment and Previous Investigations.

It is not possible to draw other than very general comparisons between the current and previous investigations because of the different experimental methods employed and the varying subject matter of the questions.

The current experiment showed that the majority of phonologically disordered and normally developing children were willing and able to provide productive answers to the questions. Their responses fully support the following statement from Blank

> "...children by age four years and particularly by age five years are not only clear in their thinking, but are extraordinarily articulate in conveying their ideas to a listener"
>
> Blank et al (1978, pp. 63)

As far as it is possible to judge, the type of responses obtained in the current experiment appear very similar to those obtained by Blank et al. Their question groups 111 & 1V; 'Reordering perception' and 'Reasoning about perception' are broadly equivalent to those in the current investigation. Blank and her colleagues found that although this type of question was generally beyond the capabilities of three year olds, approximately a third of four year olds were able to provide adequate answers to such questions.

The children in the current experiment appeared to be rather better at providing answers than those investigated by Tizard et al (1982) These investigators found that questions similar to the current ones, those which involved explanation and justification, were usually ignored by the children and only rarely answered adequately. However the children in Tizard's investigation (mean age 3.11) were slightly younger than the current subjects. Perhaps more importantly a different experimental method was used. Their questions and answers were taken from spontaneous mother child interaction. In the current experiment the questions were pre planned, they were the specific focus of attention of the child and adult, and the tape recording provided a concrete basis for discussion. These are all factors which may influence the demands made on the child and in this case probably favoured more productive responses.

The investigation undertaken by Edwards & Curtis (1983) used older subjects but the question forms these investigators used are nearest to those of the current experiment. Their questions were all concerned with the speech act although only one, "How do you think babies learn to talk?" was identical to the current questions.

The type of responses obtained from the current subjects and those from the youngest group in the Edwards & Curtis investigation (mean age 5.07) appear broadly comparable. Their results suggest that approximately 75% of the answers from this age group appear to be productive answers. A comparison of the content of the answers from Edwards & Curtis and the present experiment shows that both groups of subjects were aware of age constraints on language ability limitations and the need to learn language.

It appears therefore that the present subjects appeared to behave in a very similar way to subjects in other investigations in their responses to questions.

b. <u>The Answers as a Measure of Metalinguistic Awareness</u>

This experiment showed that many of the children in the investigation were able to reflect about linguistic behaviour and make appropriate responses. The answers they gave demonstrated an ability to explore cause and effect, and an appreciation, to some extent, of the difficulty of the problems they were presented with. This was particularly evident in the pilot study where long discussions about language often developed. For example L. (aged 4.05) talked for a long time about accents, commenting that "...some people talk the same but sort of different...". She illustrated her comments by referring to the "India" (sic.) lady telling a story on Jackanory and the way her Northern Irish grandparents talked.

The answers however contained little that could be described as reference to specific linguistic features. There were no responses, for instance which referred to the relative difficulty of producing sounds, (as reported in 9.1.1.). However this does not mean that the children were incapable of providing specific linguistic answers. It is possible that the nature of the questions did not require more specific answers than those which were given. Information is required to determine how older children and adults would answer the current questions before this possibility can be ruled out. The work of Edwards and Curtis indicates that the answers of the older children in their study were more complex and detailed than those of younger children and included more reference to listening and wider environmental influences but they were still comparable to the types of responses quoted above. These authors report very few linguistic explanations and make no mention of metalinguistic awareness.

It is not possible to say therefore whether the current subjects provided the type of answers to the experimental questions which all age groups would see as appropriate or whether their answers are evidence of limitation in metalinguistic awareness, as a result of age, cognitive development or some other unknown factor.

There is some indication from Karmiloff-Smith, (1979 and 1986 a & b) that the type of answer given in the current experiment may represent the limits of four year olds ability to express metalinguistic knowledge. This author used questions to assess children's explicit knowledge of determiners and reference. Knowledge in metalinguistic terms that can be classified as 'Reflecting on the product of an Utterance'. The following example from her data illustrates her orientation. It comes from a 9 year old boy:

> .You said <u>the</u> (stressed) biscuit if there had been a lot you would have said he took <u>a</u> (stressed) biscuit or <u>one of the</u> biscuits"
> (Karmiloff Smith, 1986a p. 124)

Karmiloff-Smith noted a general developmental trend in the ability of children aged from four to twelve to make metalinguistic responses. She found that specific explicit comment on linguistic marking and system, similar to the example quoted above, increased with age and did not feature in any of the responses from four year olds. The youngest children, unlike the older ones, tended to give answers which drew on real world knowledge, that is external factors rather than knowledge of linguistic structure. In other words they provided responses similar to those from the children in this investigation despite the fact that they resulted from questions more specifically related to aspects of linguistic structure.

The similarity of answers across different studies provides a possible indication of the metalinguistic limitations of this age group. However most of the children did attempt to provide answers which were relevant to the question rather than saying they didn't know or giving no response.

These findings are relevant to the debate about whether there is a continuum of metalinguistic awareness or whether there are different kinds of metalinguistic awareness, some of which may be beyond the capabilities of four year old children. Clark (1978) observes that the skill of reflecting on the product of an utterance emerges rather later than the other metalinguistic skills, and that unlike other metacognitive skills one is required to reflect on structure independent of use. The children in the current study were perhaps not required to do this and Karmiloff Smith's children appeared unable to do so.

Because of the nature of the task and the limited statistical data from the experiment it is not possible to place it within a developmental hierarchy, relative to other tasks used in the investigation. The poorer responses from the phonologically disordered group suggest that at least for them it may be more difficult than the other tasks. Factors which may affect the ability to answer these experimental questions will be considered next.

c. <u>Factors Affecting the Ability to Provide Productive Answers</u>.

It is probable that the nature of this experiment, which requires the children not only to reflect, but to use their linguistic ability to formulate their responses, disadvantages the phonologically disordered children relative to those with normal language development. It is probable that several factors will influence the ability to carry out this particular task. The current discussion will be concerned with the following

1. **Linguistic Ability.**

2. **Knowledge and Experience**

3. **Social Factors.**

Knowledge and the ability to use language to convey that knowledge are arguably the two basic abilities required to answer questions successfully. Variations in either or both these aspects of behaviour may account for variations in the ability to provide productive answers. These factors are closely interrelated and probably cannot be fully disentangled.

Blank et al, (1978) for instance, believe that it is not possible to determine whether the failure to provide adequate answers can be attributed to a lack of knowledge or a lack of linguistic ability to express that knowledge or a combination of both factors. Whilst Karmiloff-Smith (1986) points out that lack of response does not necessarily indicate lack of knowledge but may reflect inability to access knowledge (see also Chapter 7).

Linguistic Proficiency and Answering

Questions

Put at its most basic both comprehension and expressive aspects of language are important for success on this task. More specifically Ervin Tripp (1970) suggests that the following linguistic abilities are required in order to answer questions. The ability to distinguish between questions and other forms of speech, the ability to make a semantic interpretation of the message and the ability to provide an answer that is grammatically appropriate.

All the children who were able to make any kind of productive response in the present task must possess these abilities to a certain extent. But it is possible that there were differences in language ability, in addition to the phonological disorder, which affected the phonologically disordered children's ability to respond to the task.

The traditional view of phonological disorder is of a specific deficit confined to this aspect of language, but as the discussion in Chapter 1 indicated this may be an over simplification of the problem. Other aspects of language development may have affected the responses of these children to this task, some of them may have been at a disadvantage because of poorer language comprehension. This group had lower scores on the RDLS, their mean age score was 4.07 compared to 5.03 for the normally developing group and a significant difference was found between the mean standard scores of the two groups (see 4.5 Table 4.2).

The only measure of expressive language available for the current population was the results of the elicited LARSP which was used as a pre-investigation screening assessment. This assessment provided only a very general estimate of expressive language ability and it is possible that there were expressive language differences between the groups which it did not reveal. The absence of a more specific expressive language assessment is a serious limitation of the investigation, particularly in respect of this experiment. More investigation is required but it is possible that restricted expressive language ability prevented some of the phonologically disordered children formulating answers to some of the questions.

The children's limited phonological ability may also have inhibited their willingness or ability to make verbal responses. Some of them may have been, in some sense, aware of their linguistic limitations and were therefore reluctant to speak. It may be that they were not prepared to talk specifically about language difficulties, but there was no indication that this was in fact the case, and those that responded to question 5 considered themselves to be good talkers.

No attempt was made to control the linguistic complexity of the questions used in this experiment either in terms of the structure of the questions themselves or in relation to the complexity of the answers that were required. Figure 9.1 shows that the phonologically disordered children provided many productive answers to question 6 -"Who do you think this is?", which required a one or two word answer, but they did almost as well on question 7 which asked "How do babies learn to talk". This question requires a more linguistically complex answer. The problem is that it probably is also more cognitively demanding, requires more reflective ability than question 7. Separating out the linguistic and cognitive demands of the questions is obviously a very considerable problem but it is one that will require to be tackled if differences in ability on tasks of this kind are to be explained. It is also likely that the relative cognitive difficulty of a question may interact with poor language ability in preventing the production of a fully productive answer. (The reliability of the scoring procedure must also be taken into account in any discussion of this kind).

Finally children's poor phonological ability may have an adverse effect on linguistic interaction with their mothers, and consequently affect their ability to participate in question and answer interchange. The results of research into the association between mother child interaction and language disorder are conflicting. Conti-Ramsden & Friel-Patti (1984) provide a review of the literature. In her own research on the comparison of mother's interchange with language disordered children and their normal siblings Conti-Ramsden (1987) found that although there were no differences in turn taking and the mother's linguistic structure there were significant functional differences during interaction with the language delayed children compared to their normal siblings. Gardner (1989) carried out a comparative study of interaction between phonologically disordered children and their mothers using age and language matched controls. She found that the linguistic experience of the phonologically disordered children was different from the children of the same age and most closely resembled that of the language matched children.

It is therefore probable that the phonologically disordered child will be particularly disadvantaged in this type of experimental task, either because of inferior language ability, the need to combine linguistic and cognitive skills or the reinforcing effects of the language disorder itself on linguistic interchange.

Knowledge and Experience.

Ervin-Tripp suggests that the possession of an information search method is the fourth ability that is essential for answering questions. But this cognitive ability is of little use if the child does not possess appropriate knowledge.

Differences in external factors must affect the children's ability to answer questions. Particular situations or experiences will provide differences in knowledge. It has already been shown that spontaneous comments about language were often prompted by a particular situation or environment, in particular exposure to more than one language. It may be that some children from both the phonologically disordered and normally developing groups were disadvantaged in this experiment because they lacked knowledge or experience on which to base their thinking. For example some of the children in both groups may not have had close contact with a baby or known anyone who had speech difficulties and were therefore unable to answer questions about them. There are however likely to be more complex reasons than this for success or failure in answering questions. The child's environment will also be a factor in influencing social development which will be considered next.

The Social Aspects of Answering Questions

It is possible that differences both in willingness to participate in this experiment and in the ability to answer questions is influenced by the child's level of social development. The ability to answer questions successfully involves the ability to exchange information. Within a Piagetian framework ability to exchange information requires not only intellectual but also social 'decentring' the ability to move from one perspective to another (Light, 1979).

Some questions in the current investigation make greater social demands of this kind, as well as intellectual demands, than others. For instance when answering questions about the baby and the man the children require the ability to take the perspective of another person. The phonologically disordered children who identified themselves in some way with the baby on the tape in their answers were perhaps giving some indication that they found difficulty in doing this. The questions which involve the notion of helping someone requires a sense of social reciprocity. Some of the answers from both groups of children clearly reflected such sensitivity. There was no way of examining social development in this experiment but it is possible to consider whether a language disorder may affect such development.

Lloyd & Beveridge (1981) quoting the work of Beveridge & Dunn (1980) suggest that there are certain aspects of the mother child relationship which promote reflection. These are concerned with the mother encouraging the child to express his feelings and confusions, being attuned to the child's wishes and developing an equal relationship. It is possible that a language disorder may have an adverse effect on establishing this type of relationship. It is easy to see how difficult it may be for instance for the mother to attune to the child's wishes, or she may ignore what he says, if she has difficulty in understanding him. The mother of one child in the current study commented on how much easier she found it to care for her younger child who had no language problems. She talked specifically about the difficulty of understanding what the problem was when the older child was unwell. Her comments serve as an indication of the possible subtle effects a language disorder may have on social interaction.

This discussion about possible factors which may affect responses to the current experimental tasks has demonstrated the complexity of the task itself and the demands it makes upon the child. Most of the points which have been raised must remain, at least for the present, within the realms of speculation. However some proposals will be made for further investigation in the conclusion which can at least help to improve upon the current experiment and go some way towards more explicit discussion.

9.4 CONCLUSION

The results of this experiment have demonstrated that some four year olds are capable of demonstrating considerable reflective ability. They were able to provide reasoned answers to questions about factors which might affect pronunciation and language acquisition. These answers did not make specific reference to linguistic factors however, but it is not possible to determine whether this could be attributed to the developmental level of the children or to the nature of the questions.

The normally developing children were more willing to participate in this experiment and they were rather better at providing productive answers to the questions than the phonologically disordered children. The reasons for this remain unclear but several possible explanations were suggested. Much more research is required however to determine whether such suggestions are other than tentative speculation.

The results from this experiment have demonstrated that it provides a suitable method of tapping this aspect of metalinguistic awareness, but the experimental design requires further refinement.

The questions that were used reflect the nature of the conversations which took place between the children and the experimenter in the early stages of the pilot study. Presented in isolation the wording and the ordering of the questions may appear arbitary and haphazard. The attempt to reproduce in effect a conversational interchange was perhaps not completely successful. Reference has been made to the fact that the questions represent varying degrees of both cognitive and linguistic difficulty. The current scoring system provided only a very crude measure of the children's reflective abilities and did not distinguish between reflective and lingusitic ability.

In retrospect it is felt that it may have been preferrable to use either specifically designed questions to assess both cognitive and linguistic ability or an open ended conversational task. If the first option was adopted questions could be designed to reflect degrees of both cognitive and linguistic difficulty and the scoring system weighted to take both factors into account. Alternatively a more open ended discussion about aspects of language could have been used with subsequent analysis of the data, using the methods of Tizard et al (see section 9.1.2). or Karmiloff-Smith (1986 a & b). All the children may respond better in a less structured situation, an examination of the pilot data suggests that more extensive responses might have been forthcoming in such a situation.

Although this experiment was not entirely successful, it did reveal something of the children's metalinguistic knowledge and it has shown that with some methodological refinements it can be an appropriate method of discovering more about children's metalinguistic awareness. The next chapter describes the follow up study that was carried out to find out whether the children's metalinguistic awareness developed over time.

CHAPTER 10

THE FOLLOW UP EXPERIMENT

10.1 INTRODUCTION

This chapter describes the reassessment of the children's performance on the E.A.T. and the rhyming and segmentation tasks approximately one year after the first assessment. Rhyming and segmentation were chosen for reassessment because significant differences between the two groups were revealed in the first administration of these tasks in this investigation (Chaps. 5 & 6). This experiment was carried out primarily to determine whether metalinguistic awareness had increased over time and whether the association between scores on rhyming and segmentation and the level of phonological development found in the initial experiments was maintained.

Previous investigations have shown rhyming and segmentation ability to be age related in normally developing children. But these investigations differ with regard to the precise age at which success on these tasks is reached (see 5.2.3 & 6.1.1.). In speech and language disordered subjects Stackhouse provides examples of persisting difficulties in rhyme recognition by 11 & 15 year old speech disordered subjects and by an 8 year old child with a stammer (see 5.1.2). These are reports of single subjects however, and it is not known whether they represent typical behaviour of speech disordered subjects of these ages.

Information about the development of metalinguistic awarenesss of individual children, both language disordered and normally developing, is available from a recent longitudinal investigation carried out by Magnusson & Naucler (1987) These authors found that the performance of both groups of subjects on a series of metalinguistic tasks improved with age.

Magnusson & Naucler used 39 matched pairs of subjects in their investigation. One of each pair had a diagnosis of "Retardatio Loquendi Idiopatica" (specific language impairment which could not be attributed to any causative factors, see also 2.4.1). The other child in each pair was developing normally and was matched to the language disordered child on variables such as sex, chronological age and cognitive ability.

These authors collected data on a variety of measures including reading ability and a series of metalinguistic tasks; including two rhyming, two segmentation, a phoneme recognition and a sentence acceptability task. The subjects were assessed on these tasks three times over two years. First at age

6 (one year before starting school), at age 7 (on starting school), and finally at age 8 (at the end of the first school year).

The mean score of the language disordered subjects was found to be significantly below that of the normal subjects on all tasks. The metalinguistic awareness of both groups improved over time but the gap between the mean scores remained substantially the same throughout the investigation. The scores on the phoneme recognition task provided one exception to this pattern. In this case the language disordered subjects had caught up with the normally developing subjects at the end of the investigation but this could be explained because both groups reaching ceiling on this task. The ranking order of task difficulty was identical for both groups and was maintained throughout the investigation. Segmentation was found to be the most difficult and rhyme recognition the easiest task.

Although Magnusson & Naucler found that success on metalinguistic tasks improved with age they did not believe this to be the only variable responsible for change. They found the greatest amount of change taking place between the ages of 7 & 8, the start and finish of the first school year. The authors attribute this change to the children's introduction to orthography (see sections 5.2.3.& 6.3 for further discussion).

Although these results showed significant group differences between the language disordered and normally developing children Magnusssson & Naucler found considerable variation within each group, with some language disordered children frequently performing better on some tasks than their matched pair. It was also reported that although there was a tendency for poor metalinguistic abilities to be associated with more severe language disorder some children with severe disorders had good metalinguistic awareness.

This investigation also indicated that performance on metalinguistic tasks at age six was predictive of later metalinguistic performance. Children in both groups who had good metalinguistic scores on the first assessment maintained their superiority over the rest of the subjects on subsequent testing. Furthermore it was found that the language disordered chldren who were metalinguistically aware before they started school were likely to become good readers and spellers in spite of their linguistic handicap.

These results confirm that the relationship between metalinguistic awareness and language disorder is a complex one and they support the findings of the initial rhyming and segmentation experiments in the current investigation (Chapters 5 and 6).

In the current investigation significant correlations were found between chronological age and both rhyming and segmentation (5.4.6 and 6.3.2). However the correlation between chronological age and segmentation, although significant, was the second lowest of the correlations between this measure and other variables The scores for rhyming and segmentation tasks suggests, in agreement with Magnusson & Naucler, that rhyming is an easier task than segmentation. Mean rhyming scores were higher than mean segmentation scores for both groups of children. Many children in both groups found segmentation a very difficult task, zero scores being frequent.

To summarise, it is suggested that reassessment of the children on rhyming and segmentation tasks will provide valuable additional information for the investigation. The results can provide data on the development of rhyming and segmentation ability and information about any changes in the association between these abilities and chronological age and phonological ability in the current population. These findings can then be compared with those found by Magnusson & Naucler. In addition to this quantitative information the experiment can also yield qualitative data from the segmentation task for comparison with that described in section 6.3.2.

10.2 METHOD

10.2.1 SUBJECTS

Forty subjects took part in this experiment, 19 phonologically disordered and 21 normally developing children. Subject A4 had left the area and could not be traced and it was not felt appropriate to include A1 in the experiment. At the time of reassessment this subject had been attending school for over a year and was reported by his teacher and the referring speech therapist to have well developed literacy skills.

The mean age of the phonologically disordered subjects at the time of this experiment was 5.02 (range 4.08 to 5.10) and that of the normally developing group 5.03 (range 4.09 to 5.11).

Between the administration of the first and the current experiment most of the subjects had started school and some of the phonologically disordered children had been receiving speech therapy, variables which may have influenced metalinguistic awareness.

Fourteen phonologically disordered and 17 normally developing subjects were attending primary school. Because of the variety of educational experience of these children, (different schools, teachers, teaching methods and length of attendance) it was felt to be inappropriate to devise a measure to compare children with school experience with those who were not yet at school. The possible influence of educational experience on metalinguistic awareness for the current subjects therefore remains unknown. It is only possible to state that no child had completed more than one term at school at the time of their participation in this experiment. And discussions with each of their teachers established that none of the children was considered to be a fluent reader at this time.

It was possible to determine more precisely the amount of speech therapy each phonologically disordered subject had received. Such information can provide a measure of the potential influence of speech therapy on the development of metalinguistic awareness. This information was obtained from a questionnaire circulated, on the completion of the investigation, to each speech therapist who had referred the phonologically disordered subjects. A copy of the questionnaire can be found in Appendix 1. The replies indicated that twelve of the nineteen subjects in this experiment had received varying amounts of speech therapy. This ranged from 1½ to 50 hours and was usually provided at weekly intervals over periods of time of between six weeks and twelve months.

10.2.2 PROCEDURE

Each subject was revisited approximately twelve months after the start of the original experiments. The time between testings ranged from 9 to 16 months (mean 12.01) for the phonologically disordered children and from 10 to 15 months (mean 11.08) for the normally developing children. It would have been desirable to standardise the time between the first and second assessments of the tasks, but this was not possible. Time constraints, school holidays, children's illnesses and the desire to see the subjects before they had completed an extensive period of schooling resulted in some variation in time between testings.

All the subjects were reassessed on the E.A.T. and the rhyming and segmentation tasks. The same order of administration was used with all subjects, the E.A.T. was administered first followed by the rhyming and then the segmentation task. The procedure used for administrating each task was identical to that used in the original experiments (see Appendix 5 for details).

One visit to each child, involving a total administration time of between 30 and 40 minutes, was sufficient for the reassessment. The children were seen in a variety of locations, chosen for parental convenience, for example school, nursery or child's own home. In all cases it was possible to assess the child in a reasonably quiet location without distractions.

10.3 RESULTS

This section will cover the following:

1. Rhyming, Segmentation and E.A.T. scores from the currrent experiment.

2 Differences between the rhyming and segmentation scores from the current and first administration of the tasks.

3 The association between rhyming, segmentation and E.A.T. scores.

4. Responses to the segmentation task.

5 Association between rhyming and segmentation scores and amount of speech therapy.

10.3.1 RHYMING, SEGMENTATION AND E.A.T. SCORES.

The raw scores for the two metalinguistic tasks and the standard scores for the E.A.T. for both groups of subjects can be found in Table M, Appendix 6. This table shows that there is now some overlap between the E.A.T. scores of the two groups of subjects. The phonological problems of four of the disordered group have now resolved, and these subjects have standard scores of over 100 on the E.A.T. Six other children from this group have scores above 85, the original cut off point for inclusion in the group. Two of the normally developing group now have E.A.T. scores below

100. Both of these scores can largely be accounted for by the phonetic problem of interdental sigmatism.

The distribution of scores, means and standard deviations for both groups of subjects on the rhyming task can be found in Table 10.1.

Table 10.1 Frequency Distribution, Means and Standard Deviations of Rhyming Scores, All Subjects, Follow up Experiment.

Score /10	Group PDG	NDG
10	6	10
9	1	4
8	1	1
7	1	4
6	1	-
5	3	-
4	2	1
3	2	1
2	2	-
1	-	-
0	-	-
N=	19	21
Mean	6.5	8.5
S.D	3.0	2.0

This table shows that the phonologically disordered group have a mean score of 6.5 on the rhyming task compared with a mean of 8.5 for the normally developing group. The phonologically disordered group have the widest distribution of scores. Six phonologically disordered and ten normally developing children reached ceiling on this task.

Table 10.2 shows the distribution of scores, means and standard deviations of both groups on the segmentation task.

Table 10.2 Frequency Distribution, Means and Standard Deviations of Segmentation Scores, All Subjects, Follow up Experiment

Score /12	Group PDG	NDG
12	6	12
11	-	-
10	1	2
9	-	3
8	1	-
7	-	-
6	1	-
5	1	-
4	3	1
3	-	1
2	2	-
1	2	2
0	2	-
N=	19	21
Mean	6.3	9.5
S.D	4.6	2.7

This table shows that the phonologically disordered group have a lower mean score (6.3) than the normally developing group (9.5) and a wider distribution of scores. Six phonologically disordered and 12 normally developing children reached ceiling on this task. Two phonologically disordered subjects did not segment any of the experimental words.

Mann-Whitney statistical tests carried out on the data showed that significant differences existed between the two groups on all measures, at 0.005 level on the E.A.T and 0.05 level on the rhyming and segmentation tasks (Table 10.3).

Table 10.3 Results of Mann-Whitney Test for E.A.T, Rhyming and Segmentation

Assessment	*U* Value	Significance
E.A.T.	30.5	0.005
Rhyming	127.5	0.05
Segment	126.5	0.05

N= 40

10.3.2 DEVELOPMENT OF RHYMING AND SEGMENTATION ABILITY

A comparison of the mean scores on both tasks in the current experiment (Tables 10.1 & 10.2) with those from the initial experiments (Tables 5.1 & 6.1) shows increased scores on both tasks for both groups. In order to compare the amount of development on both tasks for both groups all total scores were converted into percentage scores (Figure 10.1).

Figure 10.1 shows increases of 33% and 15% respectively for the phonologically disordered and normally developing groups on the rhyming task. On the segmentation task there was a 35% increase in scores for the phonologically disordered group and a 41% increase for the normally developing group.

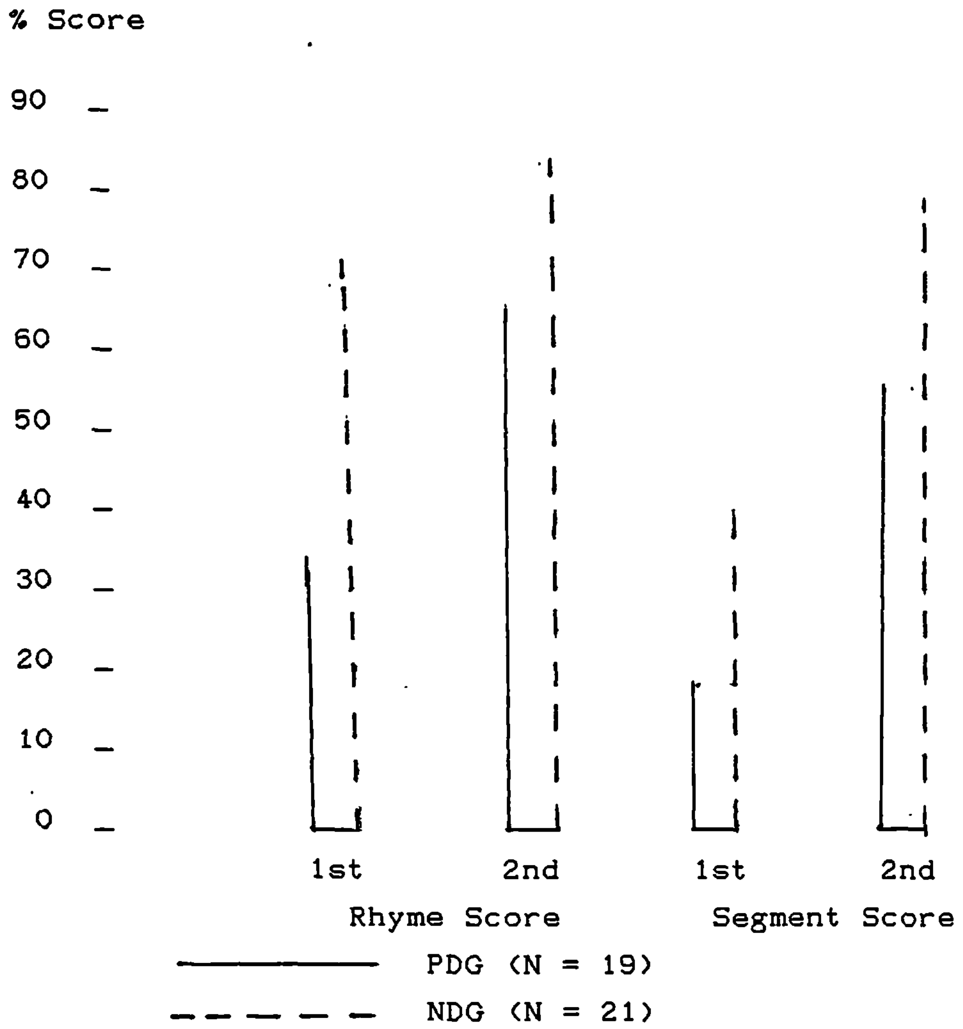

Figure 10.1 Percentage Scores for Rhyming and Segmentation Tasks on First and Follow up Assessments. Both Groups

A comparison of the percentage difference between the two groups on both administrations of the tasks shows that on the first administration of the rhyming task there was a difference of 38% between the two groups which was reduced to 20% in the current experiment. There was less difference between the two groups on the first administration of the segmentation task (20%), this increased slightly to 26% in the current experiment.

Wilcoxon matched pairs statistical tests were carried out to determine if the increases in scores were significant. Table 10.4 shows the resulting *W* values.

Table 10.4 Wilcoxon Matched Pairs Signed Rank Test (*W*). Rhyming and Segmentation Scores on Test and Re-Test for both Groups. Table 10.4 shows the resulting *W* values.

Group	N	W Values Rhyme	W Values Segment
PDG	19	23**	30**
NDG	21	30**	3**

** Significant at 0.01 level

This table shows that increases in scores were highly significant, $p<0.01$, for both the rhyming and segmentation tasks for both groups.

A comparison of Tables C & D with Table M, Appendix 6 shows that 16 phonologically disordered and 15 normally developing children increased their scores on the rhyming task. In some cases the amount of increase was very large, for example from 1 to 9 (A17) and 0 to 8 (A18). One phonologically disordered and two normally developing children had slightly reduced scores on this task.

Thirteen phonologically disordered and 19 normally developing children increased their scores on the segmentation task. Large increases occurred in both groups, for example 1 to 12 (A7 & 14) and 0 to 12 (B19). One phonologically disordered subject had a reduced score. The results show that a large increase in one score is not necessarily accompanied by a similar increase in the other score for either group of subjects.

10.3.3 ASSOCIATION BETWEEN RHYMING, SEGMENTATION, CHRONOLOGICAL AGE AND E.A.T. SCORES.

Kendall rank-order correlation coefficients were calculated to determine the association between the above measures on reassessment. Table 10.5 shows the correlation between all four measures for the total population. Table 10.5 shows that there is a highly significant correlation between the segmentation scores and the three other measures, significant at the 0.01. level. There is also a significant correlation (0.05 level) between rhyming and E.A.T. but the correlation between rhyming and chronological age although positive does not reach significance.

Table 10.5 Kendall Rank-Order Correlation Coefficients C.A, E.A.T, Rhyming and Segmentation Tasks, All Subjects, Follow up Experiment.

	C.A	E.A.T	Rhyme	Segment
C.A	1	0.05	0.21	0.32**
E.A.T	0.05	1	0.26*	0.38**
Rhyme	0.21	0.26*	1	0.40**
Segment	0.32**	0.38**	0.40**	1

N= 40

** Significant at 0.01 level

* Significant at 0.05 level

In order to determine whether the correlations between measures had changed between the administration of the original and the current experiment correlation coefficients were recalculated from the original data to exclude the scores of subjects A1 and A4. These revised correlations can be found in Table 10.6.

A comparison of the two sets of correlations for the total population (Tables 10.5, follow up, & 10.6, revised) shows an increase in association between segmentation and chronological age and segmentation and E.A.T. There is a decrease in the association between rhyming and chronological age, rhyming and E.A.T. and rhyming and segmentation. It is probable that the large number of scores from both groups on both tasks which reached ceiling is responsible for this decrease in association.

Table 10.6 Kendall Rank-Order Correlation Coefficients, C.A, E.A.T, Rhyming and Segmentation. Results from Follow up Subjects on First Assessment.

	C.A	E.A.T	Rhyme	Segment
C.A.	1	0.13	0.32**	0.27*
E.A.T	0.13	1	0.48**	0.25*
Rhyme	0.32**	0.48**	1	0.53**
Segment	0.27*	0.25*	0.53**	1

N= 40
** Significant at 0.01 level
* Significant at 0.05 level

10.3.4 THE NATURE OF THE RESPONSES TO THE SEGMENTATION TASK

The responses from all the subjects were analysed according to the categories used in Chapter 6 (6.3.2). The results are presented in Appendix 6 Tables N & O. These tables show that phonemic and syllabic segmentation appear to be associated. If both types of responses are added together for each subject nine phonologically disordered and 15 normally developing subjects were able to carry out some type of segmentation of all 12 experimental words.

The predominance of random single phoneme responses by two subjects (A12 and B5) is a possible demonstration of some degree of phonemic awareness but a lack of knowledge of segmentation. Two children (A19 and B13) gave semantic definitions, that is they gave the meaning of the word or an associated word (for example door in response to 'key'). This type of response may indicate that the child has no concept either of phonemes or segmentation.

The 'don't know' responses of one child (A5) cannot be fully explained. The behaviour of this child gave the impression that such responses were not due to lack of interest, he appeared to be concentrating on the task and making an effort to solve the problem. It is of interest that he also did badly on the rhyming task and had the lowest E. A. T. standard score of the total population (53) a score which was identical to that obtained on first testing.

If the current responses are compared with those made on the original administration of this task (Table E & F) it can be seen that the subjects are now much more likely to attempt segmentation and are much less likely to provide semantic responses or say they 'don't know' or make no response to the task. The general move towards phonemic and syllabic segmentation away from other types of response suggests a developmental progression in segmentation.

10.3.5 ASSOCIATION BETWEEN AMOUNT OF SPEECH THERAPY AND RHYMING AND SEGMENTATION.

Information about the amount of speech therapy received by each phonologically disordered subject between the administration of the initial and the current experiment was extracted from the questionnaires returned by the speech therapists (see Appendix 1 for Questionnaire). Twelve of the 19 subjects participating in the current experiment had received varying amounts of speech therapy, ranging from 1½ to 50 hours.

Kendall rank-order correlation coefficients were calculated to determine the association between rhyming and segmentation scores, and the amount of speech therapy provided, using data from 11 subjects. Data from one subject (A21) was excluded because she had received a much greater amount of therapy, (50 hours) than the other subjects, some of it in an intensive form. The results of this test show that there was a positive, though non significant correlation, between amount of speech therapy and segmentation ($T = 0.09$, $p>0.2$, N, 11)and a negative non significant correlation between this measure and rhyming ($T = -0.05$, $p>0.2$, *N11*).

10.4 DISCUSSION

The results of this experiment show that the rhyming and segmentation ability of both groups of children has improved over time. The rate of development of each group on these abilities is broadly comparable. There are changes in some of the correlations between rhyming and segmentation and chronological age and phonological development, but the general patterns of significance found in the original experiments are broadly maintained.

10.4.1 DEVELOPMENT OF RHYMING AND SEGMENTATION ABILITY

The increases in the mean scores of both groups on both tasks and the improvement in the individual scores of the majority of subjects shows that children in both groups became better rhymers and segmenters as they got older. Age is not the only variable affecting task performance however, there is no absolute agreement between age and these metalinguistic abilities It is possible to be a relatively young subject and be a good rhymer and/or segmenter or be relatively old and poor at either or both tasks.

The results of this experiment suggest that development of metalinguistic awareness is simply delayed in the phonologicaly disordered group. Although they are still lagging behind the normally developing group in their performance on both tasks, rhyming ability is developing more rapidly and this group are showing evidence of catching up with the normally developing group on this task. These results are comparable to those of Magnusson & Naucler (1987), who found approximately equal amounts of development between testings in their two groups of subjects.

Although both groups of subjects show significant metalinguistic development there is considerable variation in development within each group. A comparison of the raw scores for both tasks in the original and the current experiment show that although some children have made very large amounts of progress a few scores have remained static. There are shortcomings in this experiment however, which should be avoided in any further experiment. In this investigation the time between first and second assessments varied, unavoidably, between subjects. If the amount of development between two points in time is being measured the time between assessments should be identical for all subjects. Differences in time between reassessments must therefore be taken into account when comparing individual subject development.

Two phonologically disordered children showed no evidence of either phonemic or syllabic segmentation. Both these children were also relatively poor rhymers, but one of them made good phonological progress, whilst the other, who had the lowest score on the E.A.T. obtained the same score on retest.

These two subjects show that, although there is a significant correlation between rhyming and E.A.T. and a significant correlation between segmentation and E.A.T, development of metalinguistic awareness does not necessarily depend upon or result in change in phonological development. A pattern also noted by Magnusson & Naucler (10.1) and one which supports the type of relationships between metalinguistic awareness and phonological ability discussed in Chapters 5 & 6.

10.4.2 ASSOCIATION BETWEEN RHYMING AND SEGMENTATION ABILITY

In both administrations of the tasks the highest correlations were obtained between the rhyming and segmentation scores. A comparison of the mean scores on both tasks for both groups however (Tables 10.1 & 10.2) shows that rhyming continues to be an easier task than segmentation for most subjects. A finding also noted by Magnusson & Naucler. This continuing association between the two tasks lends support to the discussion on the relative requirements of each task and the development of phonemic awareness to be found in Chapters 5 and 6. The tendency for phonemic and syllabic segmentation responses to occur together in the data of some subjects (10.3.4) also supports a developmental progression in phonemic awareness.

10.4.3 POSSIBLE INFLUENCES ON THE DEVELOPMENT OF RHYMING AND SEGMENTATION

Although the results from the current investigation are comparable in almost all respects to those of Magnusson & Naucler, they were obtained from children who were at the time of each testing at least a year younger than their subjects.

It is possible that starting school was a common factor influencing the metalinguistic development of both populations. Magnusson & Naucler attributed rapid development to introduction to orthography in the first year at school. No measure of orthographic knowledge was used in the current experiment and enquiries (10.2.1) suggested that most of the subjects had had little formal reading and writing experience at the time of the current experiment. However it is possible that the increased general exposure to print and/or minimum exposure to letter sound correspondences is sufficient to influence metalinguistic awareness.

Rhyming and segmentation ability was not confined to the school children however. Some language disordered and some normally developing children in both investigations scored well on these tasks before they started school. It is only possible to speculate about what factors might have encouraged these abilities. For example certain home environments may encourage metalinguistic awareness possibly through exposure to print, (see section 2.10).

Magnusson & Naucler's suggestion that orthographic knowledge increases metalinguistic awareness is contrary to Bryant & Bradley's argument (5.2.3) that metalinguistic awareness is a necessary precursor to literacy. But Magnusson & Naucler do not argue that orthograpic knowledge is the only influencing factor, they also found early awareness to be predictive of later advanced reading ability in both their subject groups.

No contribution can be made on this point from the results of the current investigation because no reading tests or any other measures of orthographic knowledge were used. Some anecdotal information is available to suggest that two of the current subjects, (A3 & A11) showed reading and writing ability that was judged to lag considerably behind their other academic abilities after two years at school. Their experimental results however do not provide evidence to support either group of authors. Both children scored above average on the E.A.T at the time of this experiment, A3 had below average rhyming and average segmentation scores and A11, although not at school at the time of retesting, had maximum scores on both metalinguistic tasks.

The experimental results from other investigations and information about individual subjects from the current investigation suggest that the interrelationship between metalinguistic awareness and literacy, is very complex. Neither metalinguistic awareness or literacy being necessarily dependent upon the other. Both abilities may depend upon some common underlying factor, possibly a certain minimum level of cognitive or phonological ability. Once this level has been reached metalinguistic awareness may be accelerated by exposure to certain stimuli such as rhyming play, bi-lingual environment, specific practice (Chapter 6) or introduction to letter sound correspondences. Such a possibility would accord with the discussion about possible different levels of metalinguistic awareness in Chapter 8.

10.4.4. FURTHER INVESTIGATIONS.

The results of the current investigation suggest that the metalinguistic awareness and phonological ability of the majority of the phonologically disordered group will continue to develop. But further assessment will be required to confirm this and to determine if the children who showed little progress on either the metalinguistic tasks or who scored poorly on the E.A.T. will continue to have difficulties. It is possible that these children when they are older will show similar patterns of behaviour to those described by Stackhouse (1985). Further investigation would also determine whether there were was any association between phonological delay, metalinguistic awareness and development of literacy in this specific group of subjects.

Further investigation is required to determine the general relationship between metalinguistic awareness and the development of literacy or, more specifically, orthographic knowledge. In this investigation it was felt that no measure of school experience was possible. Even if such a measure can be constructed, for example by using only subjects who had been with the same teacher for the same amount of time this would provide a very crude measure of exposure to orthography. More precise measures, that is, specific tests of orthographic knowledge are required.

Longitudinal investigations with repeated assessments of metalinguistic awareness, and development of phonological and literacy development would provide the most satisfactory way of determining the relationship between these abilities. Such investigations would complement the investigations which were suggested in Chapter 5, to discover the nature of the association between very early phonological acquisition and play with language.

If certain environmental factors, such as those suggested above, influence metalinguistic development it might be expected that speech therapy intervention would also be influential in such development. The current experiment showed a low positive but non significant relationship between metalinguistic awareness and amount of speech therapy. This is again possibly too crude a measure of intervention. The children were seen by several different therapists who may have employed different therapeutic methods, some of which may have had more influence on metalinguistic development than others. Once again more precise measures are required to test out this possibility. However preliminary results of the research investigation assessing the efficacy of a therapeutic process which aims to bring about phonological change through utilising metalinguistic awareness (Hill et al, see 7.3.3. and Chapter 11). appears to support a mutually influencing situation between these two factors. This investigation shows that phonological development is accompanied by increasing metaphonological awareness. Other aspects of language such as vocabulary development and other metalinguistic abilities, for example syntactical awareness, stayed relatively constant and do not appear to have been influenced by the intervention programme.

The next chapter concludes the investigation. It brings together the results of all the experiments, and the preceeding discussions and suggests implications for therapeutic intervention for phonological disorder.

CHAPTER 11 CONCLUSION

This investigation has confirmed that metalinguistic awareness is not a well defined circumscribed phenomenon. Therefore the feasibility of the problem posed at the outset of the investigation - whether phonologically disordered children have less well developed metalinguistic awareness than normal children- is itself open to debate. Despite this it can be argued that metalinguistic awareness as assessed by the five experiments used in the study is in some respects less advanced in phonologically disordered children. On the basis of the results from four of the tasks a proposition about the relationship between metalinguistic awareness and phonological disorder will be made for further testing and suggestions will be made for therapeutic intervention which are in accord with this proposition. It is considered that the fifth task, Talking about Talking, made rather different demands on the children and this will be considered separately. Before discussing the metalinguistic tasks other characteristics of the two groups of children will be briefly considered.

11.1 PHONOLOGICAL AND OTHER CHARACTERISTICS

The simplifying phonological processes used by the current subjects were described in 4.6.3. Briefly it was found that that the phonological development of the normally developing children was not yet completed and they shared some simplifying processes with the phonologically disordered group. This supports the results of previous investigations, in that the majority of children who are described as phonologically disordered have essentially delayed rather than deviant phonological development. This picture of delay was confirmed by the E.A.T. results from the follow up study where it was found that the scores from the two groups now overlapped.

The two groups were comparable in all other respects with the exception of a significant difference on the comprehension section of the Reynell Developmental Language Scales. This result suggests that the problems of the phonologically disordered group are not necessarily confined to the phonological aspects of language and this finding is therefore in accord with the results of previous investigations (see 1.2.3). This suggestion must be treated with caution however because the R.D.L.S also showed significant correlations with all the other pre investigation measures. This study failed to provide a precise measure of the expressive language ability of the subjects and this further limits any conclusions which can be made about the specificity, or otherwise of the disorder.

11.2 EXPERIMENT 5 TALKING ABOUT TALKING

Although no statistical tests were used to determine whether the differences between the two groups were significant the results of this experiment show that the phonologically disordered children were less willing than the normally developing children to take part in this experiment and those that did so provided less productive answers.

This experiment is considered separately because of the more complex the nature of the task. Differences between the groups could be attributed either to differences in linguistic proficiency or linguistic knowledge or to possible social and cognitive differences arising from the phonological disorder (section 9.3.3). The relative contribution of these limitations to differences in performance cannot be determined from the present experiment because of methodological limitations. Changes in experimental method were suggested in 9.4 which may help to resolve this problem.

11.3 EXPERIMENTS ONE TO FOUR

There was a significant difference between the two groups of subjects on the rhyming (Experiment 1) and the segmentation tasks (Experiment 2) and a significant correlation between the scores for these two experiments. There was no significant difference between the two groups on the acceptability and the constraints experiments (Experiments 3 & 4).

The performance on the subsidiary parts of the experiments are also of relevance. The phonologically disordered children were as good as the normally developing children at modifying their own production to imitate and correct mispronounced real words in the acceptability task. They differed only in achieving the adult target (section 7.3.2). The phonologically disordered children were poorer at imitating the P.E. nonsense words in the constraints experiment than the normal children. But both groups showed similar ability when imitating I.E. words and they were all inferior to the adult subjects in this activity.

To summarise, when compared with the normally developing group the phonologically disordered group have:

1. Less advanced phonological development.
2. Inferior rhyming and segmentation ability.
3. Inferior ability to imitate novel P.E. forms.

The next section of the chapter will discuss the association between these factors further in relation to the first four metalinguistic tasks.

11.4 A PROPOSED RELATIONSHIP BETWEEN PHONOLOGICAL DISORDER AND METALINGUISTIC AWARENESS

It is suggested that these four experimental tasks all require the ability to carry out mental operations using the acoustic features of the experimental words. Differences between group performance on the rhyming and segmentation tasks and lack of difference on the acceptability and constraints tasks may be accounted for by the relative amount of detailed analysis of acoustic features of the words that is required. It is possible to consider these tasks within a developmental framework. Most children were successful in the acceptability experiment, rhyming was generally a more difficult task, particularly for the phonologically disordered group, but easier than segmentation. All the children did less well than the adults in the constraints task, suggesting that it was possibly beyond the current ability of most of the child subjects.

The notion of a developmental relationship between tasks is supported by the following: First the variation in performance across tasks by individual children; Second the increase in rhyming and segmentation scores of most of the children between the initial and follow up experiments. third the age related performance on different types of segmentation tasks noted in previous investigations (see section 6.1); Fourth the developmental progression from semantic to rhyming ability noted in Chapter 5.

Differences between the two groups are currently appparent at the rhyming and segmentation stage. It is proposed that delay in rhyming and segmentation ability may be accounted for by delay in acquiring phonological memory codes and this in turn may result from delayed phonemic sensitivity. These two factors may also contribute to delayed phonological development.

This proposition is based on two theoretical explanations discussed in earlier chapters. In chapter 5 rhyming ability as a reflection of establishing phonological memory codes was considered and in Chapter 6 the possibility that segmentation ability was associated with developing phonemic sensitivity was discussed. It will be argued in this chapter that these two theoretical explanations are complementary to each other.

The evidence that will be used to support this proposition comes from the results of the present and previous investigations, theoretical explanations of metalinguistic awareness and theories of phonological aquisition. The establishment of phonological memory codes will be considered first.

11.4.1 PHONOLOGICAL MEMORY

The theory that differences in rhyming and segmentation ability, reflect differences in the establishment of phonological memory traces was first discussed in section 5.3.3 and will be enlarged upon here.

Rack and Snowling (Rack, 1985 and Snowling 1987) suggest that difficulty in establishing an auditory memory trace for phonological information underlies both rhyming ability and dyslexia. Snowling suggests that dyslexic children do not make use of phonological coding to process incoming information and consequently this information may not be transferred to long term memory. She says that a "level of processing" theory of memory (Craik & Lockhart, 1972) provides the most satisfactory way of accounting for this possibility. Within this theory it is suggested that the more elaborate the memory trace the better it will be remembered over time.

Craik & Tulving, (1980) have extended this model of memory and suggest that the elaborateness of the memory trace, the number of different ways that information about stimuli is remembered, is of prime importance and that this can be regarded as a by-product of perceptual processing. It is possible, Craik says, to carry out a series of different analyses on incoming auditory stimuli, for example semantic and structural analyses and it is the kind of analyses that are carried out which determines the nature of what is retained in memory.

If this model is applied to rhyming and segmentation tasks it can be seen that differences in analysing the structural, phonemic, aspects of presented words may lead to differences in establishing this kind of memory trace and making use of this kind of information with consequent differences in task performance.

This theory can also account for the differences between performance on the acceptability task compared with the rhyming and segmentation tasks. The acceptability task requires a semantic memory trace with some reference to the structural aspects of the word, whereas in the rhyming and segmentation tasks only the structural, phonemic, memory traces are of use. (See also sections 5.1.2. and 5.2 in relation to rhyme fragility).

The results of the subsidiary aspect of the acceptability experiment also support the proposition that differences in establishing phonological memory traces may underlie both metalinguistic and phonological development. The ability of the phonologically disordered children to modify mispronunciations of real words but their frequent failure to achieve adult targets may suggest that they were drawing on identical semantic information, to the normal children but a different less elaborate structural representation.

The results of the current constraints experiment (see 8.5.3. and 8.1.1) support the view that there is gradual development of phonological representations. This experiment found significant differences between child and adult word choices. In such experiments word choice relies entirely on the phonemic aspects of the words and reference to semantic knowledge will be of little value. The significantly poorer imitation of P.E nonsense words by the phonologically disordered group may be a reflection of necessary reliance on poorer structural representation when no semantic representation is available. The poorer imitation of I.E. forms by all the children suggests less detailed phonological representations compared with the adult subjects.

Waterson's model of phonological representation cited in 8.1.2 accounts very well for the development of phonological representation becoming increasingly complex. An alternative theoretical model to account for poorer ability to process nonsense words which can be related to the development of phonology comes from

Snowling (1987). She proposes a two route model of single word processing. In this model familiar words are processed via a lexicon linked with semantic memory. The second indirect route does not involve semantic access but uses (implicit) phoneme segmentation to process new and novel words. It is this route which, she says, dyslexic children have difficulty in using. This route is also said to be used when children are acquiring new vocabulary. If children have difficulty in using this route it can be seen that phonological acquisition will also be delayed.

Experimental evidence of progressively more detailed memory for word forms is also provided from comparisons of child and adult malapropisms (Aitchison, 1987and Vihman, 1981). Children appear to consider words as wholes (8.3.4). There are also differences between children and adults in what appear to be the most prominent features of words, for children rhythm and stressed vowels are particularly important. This finding can provide support to link the memory trace theory and the limitations in acoustic sensitivity theory to be discussed shortly.

Snowling emphasises the developmental aspects of establishing phonological memory codes. Establishing these codes, she says, is not impossible for dyslexic children but they are delayed in this development compared to normal readers. In this respect this theory is in agreement with the developmental framework suggested at the start of this section. Snowling does not suggest why dyslexic children are delayed in establishing phonological memory codes. She rejects "input processing limitations" but it will be suggested below that such limitations merit further investigation and that delay in establishing phonological memory codes may result from poor acoustic sensitivity.

11.4.2 ACOUSTIC SENSITIVITY

Differences in the development of acoustic sensitivity as an explanation for differences in metalinguistic awareness was first discussed in 6.1.2. According to this theoretical standpoint, proposed by Liberman et al (1974) and Treiman (1985) task performance is the result of a developing ability to progressively extract increasingly more specific acoustic information from the experimental words. These authors suggest that development of segmentation reflects a progression from responding to 'natural' divisions, and recognition of the acoustic energy peak within a syllable, through to the ability to segment the specific abstract features of phonemes.

These authors provide different explanations for experimental task success and failure. Liberman et al suggest that the analytical ability required for segmentation is either the result of intellectual maturity or a learnt ability that is helped by instruction. Treiman (quoting Treiman & Brown, 1981 and Treiman & Breaux, 1982) imply perceptual development, by stating that "young children perceive syllables primarily as wholes", (Treiman, 1985, p. 163).

These explanations are not necessarily mutually exclusive. Strange & Broen discussing the theoretical and experimental problems involved in understanding phonemic perception and phonological development suggest (quoting Gibson 1969) that we should

> "...consider the development of phonemic perception as consisting of the "education of selective attention"....Through experience with stimulation children become more efficient in their ability to abstract information and filter irrelevent stimulation".
>
> (Strange & Broen, 1980. p. 150-151)

The results of the current investigation showed that virtually all the children improved in rhyming and segmentation ability over time (see also 10.1), but whether this was the result of intellectual or perceptual development or a combination of both is not known. It is moreover unrealistic to expect these experiments to determine explanations of this kind. The issue of both what is involved in perceptual development and the nature of the correspondence between the acoustic patterns of words and syllables and phonemic perception is complex and unresolved.

The complex nature of the acoustic signal itself provides support for the possibility that there may be a developmental dimension to phonemic feature recognition. It is known that there are a very large number of acoustic parameters which may be used to identify phonemes and that the interaction between them is highly complex. It is therefore entirely feasible that children and adults may attend to different features, age related changes in perception of synthetic speech have been found in children aged between three and seven years (see 11.4.2).

Theories of phonological development which suggest perceptual limitations in young children, particularly those which emphasise the need to pay attention to syntagmatic as well as the paradigmatic aspects of speech also provide persuasive support for a perceptual limitations influence on task success (see section 6.4.3.).

A possible explanation for the association between metalinguistic awareness and phonological disorder can therefore be provided within these theoretical frameworks, but before suggesting ways in which this explanation can be tested by further research some reservations must be considered.

11.4.3 RESERVATIONS TO THE PROPOSITION

There are reservations to the association suggested above in relation to what is known about other aspects of development, some of the results from this investigation and methodological difficulties.

a. Other Aspects of Development

The suggestion that young children may have perceptual limitations has to be considered against the extensive research which has shown that very young children are capable of making very fine phonetic discriminations (discussed in 5.3.3). But, at the most general level it can be argued that this represents an innate biological capability, something which may be rather different from the ability to pay specific attention to speech. The wider context of the relationship between innate capacity and experience must also be taken into consideration. A variety of possible interactional patterns can be postulated between innate ability and experience. For example early language specific experience may be required either to facilitate or maintain innate abilities. (See Aslin & Pisoni, 1980, for a detailed review of possible interactions and Lieberman & Blumstein (198 for specific examples).

The evidence of early rhyming play discussed in section 5.1.1 is a potential problem when looking for support for the associations suggested above. However the difference between what is required to carry out a spontaneous activity compared with a conscious experimental task must be considered. This reservation can also be countered by considering the developmental relationships between phonological ability and phonemic awareness suggested in section 5.3.3. Both abilities are still in the process of development and the possibility of a mutually reinforcing situation between phonemic sensitivity and phonological expertise remains possible within the proposition suggested above.

b. <u>Reservations from Experimental Results</u>

The results of the rhyming and segmentation experiments showed that there was no necessary association between metalinguistic awareness and phonological ability. It is not therefore possible to suggest a common underlying perceptual or memory factor in all cases. Although an association exists for some subjects this association is not guaranteed. There was some overlap between the metalinguistic awareness of the two groups of children. It is possible that poor perception or memory may acount for the disorder in some children and not others. Alternatively it may be only one in a multiplicity of other affecting factors. Although a developmental relationship is suggested, metalinguistic awareness and phonological ability may be developing at different rates and one may be ahead of the other at any point in time.

With regard to the normally developing children who had good phonological ability but poor metalinguistic awareness there may be a variety of reasons for the poor metalinguistic scores. Some may have failed be cause of the experimental nature of the situation or task or because they lacked previous experience of such tasks or related activities. There was evidence from the current investigation which indicated that some children learnt to segment during the experiment. These children may have had phonemic awareness but may have never thought to use it in segmentation activities (section 6.4.5. and 6.4.6).

Very little is known about possible influencing variables, such as family background and cognitive ability on metalinguistic awareness. An attempt was made in the current investigation to consider the possible influence of such variables, but others were ignored. The association between rhyming and segmentation and phonological ability appeared to be fairly indpendent of the influence of other variables, but much more investigation is required. Family background in particular requires more investigation and the association between sex and metalinguistic awareness has been ignored in this and previous investigations.

c. <u>Methodological and Theoretical Reservations</u>

Although it is possible to apply the Craik theory of memory to both metalinguistic awareness and phonological development. There is a problem in relating the results of the current investigation to this model. Rack and Snowling used only auditory stimuli, in their investigations. In the present investigation picture cues accompanied the acceptability, rhyming and segmentation experiments. The theoretical model does not deal with combinations of auditory and pictorial stimuli and it is not known how they may interact. At the most general it can be argued that because the children had access to a permanent picture cue this may in some way have facilitated access to stored forms and have made the task somewhat easier. It is an aspect of the investigation which requires further consideration.

Finally there are overriding problems with any investigation which is concerned with perception and memory, particularly when these are in the course of development. The concepts are not always well defined and specified, for instance perception and discrimination are not always clearly distinguished. The division between sensory and cognitive aspects of responding to speech stimuli is difficult to determine in the type of experiments used in this investigation. Ultimately any discussion of memory limitations and differences relies on theoretical models and these are at risk of being misinterpreted or not being appropriately applied.

To summarise, despite these reservations, it is considered that delay in metalinguistic awareness and phonological development may be associated with differences in phonemic awareness or in establishing detailed phonological memory traces. This proposition is in agreement with some theories of phonological acquisition and it can also be related to what is known about the differences in perceptual ability and inferences which have been made about differences in the mental representations of children and adults. In other words information from both linguistic and psychological disciplines can be combined to support the proposition, but ultimately this support is dependent upon making inferences from selected theoretical models. Further research is required to test the proposition and the next section of the chapter suggests some possible directions for such research.

11.5 SUGGESTIONS FOR FURTHER RESEARCH

Suggestions for further research have been made in earlier chapters in relation to individual experiments and the main themes and directions will be brought together here. These will be divided into two main areas, those which consolidate and refine the experiments used in this investigation and suggestions for new research.

11.5.1 CONSOLIDATION AND REFINEMENT

The following summarise what are believed to be the most important revisions to the research methodolgy:

1. More attention should be paid to the measures used to assess auditory discrimination and memory in relation to the proposition suggested in section 11.4 and the discussion in Chapter 5.

2. A more precise measure of expressive language ability and its relationship to metalinguistic awareness is required to determine to what extent expressive language limitations may have affected the children's responses to the experimental tasks, particularly in Experiment 5. Without this information it is not possible to determine whether limitations in language use or language awareness were responsible for differences between children. As an

adjunct to this, Experiment 5 should be redesigned to take account of both the cognitive and linguistic requirements of the experimental questions. (See section 9.4.3).

3. More information is required about environmental influences on metalinguistic awareness. The current investigation used a measure of family background to assist in subject selection but the possible interrelationships between metalinguistic awareness and environmental influences were not examined. Further research is required to investigate this relationship, in particular to determine what aspects of home background might encourage reflective behaviour (see 2.9.1 and 9.3.3).

The influence of speech therapy intervention can also provide information about the possible effects of external influences. Although an attempt was made to measure this in the current investigation it was not possible to take account of the wide variety of possible influencing variables such as amount and frequency of therapy.

4. More sophisticated statistical analysis may be enlightening to determine relationships between variables. The current investigation was essentially exploratory and for the most part looked only at the association between pairs of variables.

11.5.2. NEW DIRECTIONS FOR INVESTIGATION

Two main directions for new research are suggested, first to discover more about the longitudinal relationship between phonological development and metalinguistic awareness and second to determine whether there are any differences in perceptual ability between phonologically disordered and normal children.

1. Some suggestions for research to determine longitudinal relationships were made in Chapters 5 and 6. An investigation, of the predictive relationship between early and later phonological development, combined with observations of the nature and extent of spontaneous language play during development, is required. It is recognised that the logistics of carrying out such research are overwhelming, but a first stage may well be to find out more about the association between spontaneous language play and phonological development in children slightly younger than the current population.

2. Direct examination of differences in phonological memory traces cannot be carried out to determine whether phonologically disordered and normal children differ in this respect, but some suggestions to improve the methodology to examine this through metalinguistic tasks were made in 5.4 and 8.4. Phonemic perception

is more directly accessible. It should be possible to devise an experiment to determine whether there are differences between phonologically disordered and normal children in their ability to extract information from the speech signal. There have been many investigations of children's ability to discriminate between phonemes and minimal pair words using a variety of experimental methods. (section 1.4.2). However there appear to be no investigations of the ability to extract acoustic cues from words, except indirectly from the metalinguistic tasks of the type used in this investigation.

In these tasks subjects are responding to natural speech and it is not possible to determine which of a multiplicity of acoustic cues are being employed to carry out the task. A more specific assessment of phonemic awareness can be carried out using synthetic speech. Using such a technique it is possible to vary just one acoustic parameter at a time by a known amount and any differential responses can be seen to rest on that parameter. The use of synthetic speech to assess acoustic perception has been used with child subjects it is therefore a feasible experimental method for making comparisons between the phonemic awareness of phonologically disordered and normally developing children. Nittrouer & Studdert Kennedy (1987) used synthetically generated fricative sounds to investigate the development of acoustic sensitivity in three to seven year old children. Age related changes in perceptual sensitivity were demonstrated in this experiment, lending support to the notion of perceptual development suggested earlier in this chapter. There appears to be no published research which has investigated the perception of phonologically disordered children using synthetic speech. But this method has been used with dysphasic children (see for example Tallal et al 1981), and deaf children (Hazan et al, 1986).

Finally the implications for remediation arising out of this investigation will be considered.

11.6 IMPLICATIONS FOR REMEDIATION

If, as has been suggested above, phonologically disordered children have delayed phonemic awareness or are delayed in developing phonological memory traces a profitable remediation strategy should be to direct effort towards increasing such awareness. The therapeutic approach devised by Dean & Howell (1986) referred to in earlier chapters suggests one way in which this might be done.

The first stage of this approach concentrates on phonemes as specific entities. The children are encouraged to pay attention to the specific features of phonemes using activities specifically designed to encourage them to discover the common features of classes of sounds and to explore ways in which sounds differ. Properties of sounds are given terms that are meaningful to the child such as "long" and "short", to represent frication and stopping, and "back" and "front" for alveolar and velar place of articulation. Therapeutic activities and games are devised which involve the children in carrying out activities related to the properties of the phonemes being focussed upon.

In the next stage of intervention the children are given the opportunity to listen for the same features and contrasts of features when the sounds are used in minimal pair word games before they are encouraged to attempt the words themselves. It is suggested that this type of intervention, by isolating and abstracting phonemes from words and directing attention to their common properties, serves to heighten awareness of the existence of phonemes for the children and encourages them to actively concentrate on listening for their salient features.

Such activities require the ability to discriminate between different phonemes. Phoneme discrimination tasks are a frequent part of much phonological remediation and this type of activity may increase awareness indirectly. It is suggested that the activities described above go beyond discrimination practice however, in that they use classes rather than pairs of sounds and they require the children not only to discriminate but also to classify and categorise sounds according to their common properties.

Measuring therapeutic effectiveness is notoriously difficult, particularly in relation to developmental disorders, but the results of an evaluative study of this approach (Hill et al, In Press) show that phonological development is accelerated when compared to vocabulary development over the same period of time. This study also found that rhyming and segmentation ability developed more quickly than other aspects of metalinguistic awareness, such as syntactical awareness, during the period of the evaluation study.. The spontaneous comments collected from the children also suggested that they were becoming more aware of phonemic aspects of language (see Howell & Dean, 1987 and Howell & McCartney, In Press for some examples).

Although this therapeutic approach appears to accelerate phonological development it is not certain whether change can be attributed solely to heightening phonemic awareness. This is only one aspect of the approach, attention is also given to developing the children's awareness of their own communicative competence. They are encouraged to be aware that they may not always be understood and that they are able to make repairs to their speech. The discussion in 7.1.3 indicated that this may be a factor in encouraging review and modification of pronunciation. In addition a basic premise of this therapeutic approach is the close attention that is given to the learning situation, the children, are encouraged to be active participators in the remediation process. It is not possible therefore to say whether any aspect of this approach is more influential than any other in effecting change. More research is required into therapeutic procedures but it can be argued that the apparent effectiveness of the approach described above is, in itself, support for the proposition of the association between metalinguistic awareness and phonological development put forward at the start of this chapter.

This investigation has taken some exploratory steps in a relatively new research direction. In doing so it has made some contribution to solving the mystery of what remains a perplexing disorder. Much more research is required to test the usefulness of the conclusions suggested above and, if speech therapists are to provide the optimum remediation for these children, the current findings must be considered alongside other existing and future knowledge about phonological disorder.

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Queen Margaret College

EDINBURGH Clerwood Terrace · Edinburgh · EH12 8TS
Telephone : 031-339 8111

Principal : Miss Claudine L. Morgan, M.Ed.

DEPARTMENT OF SPEECH THERAPY

Head of Department : Miss M.A. McGovern, M.A., L.C.S.T.

JH/IHR

Dear

I am asking for your help with a research project that I am undertaking into the linguistic awareness of phonologically disordered children. You will find more details on the attached sheet. Mrs Dunlop knows about the project and is agreeable to me contacting you.

I would be very grateful if you could allow me to carry out assessments on any children referred to you who you think fit the attached criteria. In return I will provide you with the results of my assessments.

If you would like any further information, or are not clear about the sort of children I am interested in, please contact me at any time and I will discuss the project further with you.

I do hope you will be able to help. I enclose some referral forms and an S.A.E. in anticipation.

Yours sincerely,

JANET HOWELL BA LCST
Research Assistant
Department of Speech Therapy

The linguistic awareness of children with phonological disorders

The project is being carried out with the Sub-department of Speech, School of Education, University of Newcastle-Upon-Tyne, as a PhD dissertation.

Summary of the proposal

Recent studies in child language acquisition frequently refer to the child's developing awareness of language, including phonology. Current therapeutic techniques for children with disordered phonology do not clearly exploit this awareness and its existence in phonologically disordered children has not been investigated. The proposed study comprises a series of investigations into this knowledge in disordered and normal children. The purpose is to see if this knowledge is less well established in phonologically disordered children. If it is found to be so this finding has implications for the role of linguistic awareness in the process of development, the nature of phonological disorder and current therapeutic techniques.

The Subjects

A total of 20 children diagnosed as phonologically disordered according to Grunwell criteria - "an abnormal, or inadequate, or disorganised system of sound patterns". They should have no obvious anatomical, or intellectual deficit and be new referrals within the age range 3 yr 9 mths to 5 +.

The Investigation

1. The administration of the E.A.T., the comprehension section of the R.D.L.S., an elicited L.A.R.S.P., the performance section of the W.P.P.S.I. and an auditory perception assessment to determine suitability for the project, together with a phonological analysis.
2. One or two visits to the children selected for the study to administer a series of linguistic awareness tasks currently being devised, for example a discrimination and sound matching task and a sound segmentation task.
3. The possibility of readministering the linguistic awareness tasks in another six months or so to see if there has been any change in the children's ability over time.

Timing and Administrative Arrangements

Children can be visited at any time that is suitable within or outside their normal treatment time, to administer the assessments and the linguistic awareness tasks.

I will be happy to have children referred to me any time but preferably as soon as possible.

The results of the initial tests will be immediately made available to the therapist.

The only information required about the child for the purposes of the project is age, sex and name. The children will not be identified by their real names in the project, and parental consent forms will be provided by the researcher.

JANET HOWELL
October 1983

L O T H I A N   H E A L T H   B O A R D

SPEECH THERAPY SERVICE

I agree to the speech therapy assessment of my child , being carried out by a qualified speech therapist from the School of Speech Therapy, Queen Margaret College, as part of a research project.

I understand that my child's full name will not be used in the records.

Parent's signature:

Speech Therapist:

Queen Margaret College

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DEPARTMENT OF SPEECH THERAPY

Head of Department : Miss M.A. McGovern, M.A., L.C.S.T.

Dear

I am carrying out a study into what young normal children know about talking before they start Primary school. This involves the children, who have been chosen for the project, taking part in some speech games and assessments. Each child in the project will be seen approximately four times for a period of fifteen minutes during their normal nursery attendance.

Mrs Grimshaw, the Headteacher, is kindly allowing me to work with the children in Drumbrae Nursery School, and if you agree, I would like..................... to be part of the study. The only information required from you would be the completion of a short questionnaire about..................... hearing, together with a note of your current occupation/s and school leaving age/s. This latter information is to ensure that a cross section of the children in the community is included in the project. All information will be treated in the strictest confidence and there will be no individual identification of the children.

I hope you will consent to me seeing your child. By finding out more about normal children like .... it will be possible to help those children whose speech is slow to develop. If you agree to help in this way, can you please complete the attached consent form and return it to the nursery.

I am most grateful for your help.

Yours sincerely,

JANET HOWELL, BA, LCST

LANGUAGE AWARENESS STUDY

I agree to my child ______________________________ taking part in this study. I understand that all information will be given in strictest confidence and that there will be no way of identifying any individual child.

Signed ______________________________ Parent/guardian

Parental Occupation

(If you are currently unemployed, or are occupied full time looking after home and children, please put your last occupation.)

Mother: Occupation ______________________________ School leaving age: _______

Father: Occupation ______________________________ School leaving age: _______

QUEEN MARGARET COLLEGE

DEPARTMENT OF SPEECH THERAPY

Thank you very much for lending me your patients. I have now completed the experimental tasks but as one last favour I would be grateful if you could complete a questionnaire on their therapeutic attendance.

Please circle the appropriate answer or fill in the space where appropriate.

PATIENT NAME	
1. Has the patient received regular speech therapy? (If you have answered 'No', no further information is required)	Yes No
2. Please give appropriate dates.	From To ....
3. How often did/does patient receive therapy?	....
4. Please estimate from your answers to 2 and 3 the approximate amount of therapy received.	.......hrs
5. If patient is no longer having therapy is s/he discharged on review other (please state)	
6. Which of the following best describes therapeutic approach? Direct work on phonology Direct work on other aspect of language General language stimulation Other (please state)	 ....
7. Using a scale of 1(Excellent) to 5(Very Poor) please assess the following areas:-	
Attendance for therapy	1 2 3 4 5
Parental co-operation	1 2 3 4 5
Response to therapy	1 2 3 4 5
8. Have you any other comments?	

Please return the questionnaire in the S.A.E. as soon as possible.

Thank you very much for your help.

JANET HOWELL

March 1985

APPENDIX 2

PHONEME DISCRIMINATION TASK

Materials

Two hand puppets
Twenty pairs of minimal pair words.
(Each pair presented twice using ABX format)

Procedure

The child sits facing the tester, who has a puppet on each hand. The tester says the words using habitual pitch and volume. Each puppet is moved to shield the tester's mouth, at a distance of about twelve inches, before producing each of the words in the pair. When the x word is produced the puppets are stationary and the testers mouth is visible. The word that the child selects is ringed on the assessment sheet. The trials demonstrated that it is advantageous to present the test in two halves, separated by another activity.

Instructions

"I've got two puppets here who are going to say some words for us. I would like you to listen to them very carefully. They will say one word each and when they have said their words I shall ask you to point to the one which said one of the words. Shall we have a practice?. Listen very carefully.

'dough', 'wing' which one said dough?.

That was very good, let's try another one...

The four trial items followed by the experimental items are presented in this way.

LINGUISTIC AWARENESS INVESTIGATION

PHONEME DISCRIMINATION

GROUP/NO.................... NAME....................... DATE OF BIRTH..............

TEST DATE................... AGE........................

Examples: dough wing key zoo

thin pan lake ship

TEST:

1.	wing	ring	21.	ship	sip
2.	tie	pie	22.	ring	wing
3.	din	bin	23.	tie	dye
4.	dip	zip	24.	do	zoo
5.	goat	coat	25.	key	tea
6.	gun	bun	26.	toe	no
7.	pin	bin	27.	dough	go
8.	fin	thin	28.	pan	man
9.	sip	zip	29.	no	toe
10.	tea	key	30.	go	dough
11.	bun	gun	31.	dye	tie
12.	zip	sip	32.	lake	rake
13.	pie	tie	33.	sea	tea
14.	thin	fin	34.	pea	key
15.	pin	bin	35.	man	pan
16.	do	zoo	36.	rake	lake
17.	bin	pin	37.	zip	dip
18.	sip	ship	38.	goat	coat
19.	sea	tea	39.	tea	see
20	zoo	do	40.	bin	din
			TOTAL		

COMMENTS

J.Howell October 1983

QUESTIONS TO PARENTS

We would like to find out what your child can hear and understand outside the speech clinic or nursery school. Your answers will help us to find out why some children's speech seems to be a little slower to develop than others.

All the questions can be answered by ticking the yes or no boxes, but I have left a space underneath each question for you to add any comments, ask us questions or give any examples if you wish.

Child's Name ______________________ Clinic/Nursery ________________

---

1. Does your child turn round if you call his/her name when he/she can't see you? yes ☐ no ☐

   ....

   ....

---

2. Does he/she come to find out what's happening or turn round if he/she hears sounds like cups rattling or sweet or biscuit papers? yes ☐ no ☐

   ....

   ....

---

3. Does he/she let you know if the telephone or door bell rings? yes ☐ no ☐

   ....

   ....

---

4. Can he/she find objects when asked to? yes ☐ no ☐
   For example: Where's John?
   Find your socks.

   ....

   ....

---

5. Does he/she respond differently to different sounds? For example does he/she cry at lound noises or look happy if someone laughs or sings? yes ☐ no ☐

   ....

   ....

---

6. Does he/she copy any sounds? For example will he/she make animal or car noises? yes ☐ no ☐

   ....

   ....

---

7. Does he/she copy other people talking? yes ☐ no ☐

....

....

---

8. Will he/she fetch things for you when you ask, even if you don't look at or point to what you want? yes ☐ no ☐

....

....

---

9. Does he/she like being read to? yes ☐ no ☐

....

....

---

10. Can he/she point to pictures in a book if you ask him/her? yes ☐ no ☐

....

....

---

11. Does he/she like listening to songs or nursery rhymes? yes ☐ no ☐

....

....

---

12. Can he/she say or sing any songs or nursery rhymes? yes ☐ no ☐

....

....

---

13. Does he/she let you know when the ice cream van come or he/she hears other noises in the street? yes ☐ no ☐

....

....

---

14. Does he/she have any favourite television commercials? yes ☐ no ☐

....

....

---

15. Does he/she copy any television commercials? yes ☐ no ☐

....

....

---

16. Can he/she find you when you call from another room? yes ☐ no ☐

....

....

7. Does he/she copy other people talking? yes ☐ no ☐

....

....

---

8. Will he/she fetch things for you when you ask, even if you don't look at or point to what you want? yes ☐ no ☐

....

....

---

9. Does he/she like being read to? yes ☐ no ☐

....

....

---

10. Can he/she point to pictures in a book if you ask him/her? yes ☐ no ☐

....

....

---

11. Does he/she like listening to songs or nursery rhymes? yes ☐ no ☐

....

....

---

12. Can he/she say or sing any songs or nursery rhymes? yes ☐ no ☐

....

....

---

13. Does he/she let you know when the ice cream van come or he/she hears other noises in the street? yes ☐ no ☐

....

....

---

14. Does he/she have any favourite television commercials? yes ☐ no ☐

....

....

---

15. Does he/she copy any television commercials? yes ☐ no ☐

....

....

---

16. Can he/she find you when you call from another room? yes ☐ no ☐

....

....

SIMPLIFYING DEVELOPMENTAL PHONOLOGICAL PROCESSES
(Based on Grunwell, 1987; Ingram, 1976; Steel-Gammon & Dunn (1985)

Approximate age of suppression	Process	Structural/ Systemic	Example
2.00 to 2.06	Reduplication	Structural	pudding [pʊpʊ] *
2.06 to 3.00	Consonant Harmony	Structural	fish [sɪs] bottle [dɒtɷ]
	Context Sensitive Voicing (CSV)	Systemic	pencil [beɪnsɷ]
	Stopping / f + s /	Systemic	finger [pɪŋgɤr]
	Stopping / v + z /	Systemic	glove [gʌb]
3.00 to 3.06	Final Consonant Deletion (FCD)	Structural	ball [bɔ]
	Fronting / k,g,+ŋ/ (Fr)	Systemic	garage [darɪdz]
3.06 to 4.00	Weak Syllable Deletion (WSD)	Structural	matches [ma]
	Cluster Reduction (CR)	Structural	brush [bʌṡ] smoke [môk]
4.00 to 4.06	Fronting /ʃ, tʃ, dʒ/	Systemic	fish [fɪs]
	Stopping / tʃ, + dʒ/		bridge [brɪd]
4.06 -	Stopping / θ + ð/	Systemic	thumb [dʌm]
	Substition /θ + ð/ - [f + s]	Systemic	thumb [fʌm]
	Gliding /r/ - [w]	Systemic	red [wɛd]
*	Vocalisation	Structural	pencil [pɛnsɷ]

* Chronology not documented

APPENDIX 4 PHONOLOGICAL CHARACTERISTICS
TABLE B

Table B Developmental Phonological Processes used by Phonologically Disordered Children.

Processes grouped chronologically	Subjects 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	Number of Subjects using each process OP	OB	TOTAL
2.00 to 2.06 Reduplication																						0	0	0
2.06 to 3.00 Consonant harmony				op		op	op		op		op				op	op					op	8	0	8
Context Sensitive Voicing		op	op		op		op	op	op	op	op	op	op	op		op		op	op	op	op	16	0	16
Stopping /f + v/		op			op	op	op	op	op		op	op	op			op					op	11	0	11
Stopping /s + z/		op	op		op	op	op		op	op			op	op	op	**	**				op	11	2	13
3.00 to 3.06 Final Consonant Deletion					op				op	op		op		op	op		op		op		op	9	0	9
Fronting /k,g + ŋ/	op	op	op	op	**	op	op	op	op	op	op		op	op	**	op	**		op	op	op	16	3	19
3.06 to 4.00 Weak Syllable Deletion																					op	1	0	1
Cluster Reduction	op	op	op	op	op	op	op	op	op	op	op	op	op	op	cp	op	op	op	op	op	op	21	0	21
4.00 to 4.06 Fronting /ʃ, tʃ, dʒ/	op	op	op	op	op	op	op	op	op	op	op	op			op	op	op	op	**	op		17	1	18
Stopping /tʃ + dʒ/	op	op		op					op	op	op	op	op	op	op	op	op	op		op	op	15	0	15
4.06 – Stopping /θ + ð/		op	op				op	op			op		op		op	op			op		op	10	0	10
Substitution /θ + ð/ → [f or s]	op	op	op	op	op	op	op	op	op	op	op	op	op	op	op	op	op	op	op	**	op	20	1	21
Gliding /r/ → [w]	op		op	op		op	op	op	op	op	op	op	op				op	op	op	op		15	0	15
Vocalisation*	op		op		op	op	op	op	op	op	op	op	op	op	cp	op	op	op	op	op	op	19	0	19
Total processes used by each child	7	9	9	7	9	9	11	9	12	10	11	9	10	8	10	11	9	7	9	8	12			

*Chronology not documented

KEY: op = optional
** = obligatory

Table C. Atypical Phonological Processes used by Phonologically Disordered Children

Atypical Processes	Subjects 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	Number of Subjects using each process
Glottal replacement/insertion	op	op		op	op	op		op	op	op	op	op			op	op	op	op	op	op	op	17
Free Variation of Approximants	op						op						op	op		op					op	6
Backing Stops						op				op	op								op			4
Initial Consonant Deletion		op									op							op				3
Affricating /ʃ/ + stops			op														op				op	3
Stopping /w, l + r/		op																		op		2
Gliding nasals/fricatives																		op	op			2
Labialisation of alveolar/velar stops					op											op						2
Vowel Insertion	op																					1
Fronting Nasals				op																		1
Nasalisation of stops							op															1
Number of processes used by each child	3	3	1	2	2	2	2	1	1	2	3	1	1	1	1	3	2	3	3	2	3	

KEY: op = optional

<u>Table D.</u> Developmental Phonological Processes used by Normally Developing Subjects.

Processes grouped chronologically	Subjects 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	Number of Subjects using each process: OP	OB	TOTAL
2.00 to 2.06 Reduplication																						0	0	0
2.06 to 3.00 Consonant Harmony												op	op	op								3	0	3
Context Sensitive Voicing														op								1	0	1
Stopping /f + v/					op																op	2	0	2
Stopping /s + z/													op									1	0	1
3.00 to 3.06 Final Consonant Deletion																		op				1	0	1
Fronting /k,g + ŋ/			op										op									2	0	2
3.06 to 4.00 Weak Syllable Deletion																					op	1	0	1
Cluster Reduction	op	op	op	op	op		op			op	op	op	op		cp				op		op	13	0	13
4.00 to 4.06 Fronting /ʃ, tʃ, dʒ/				op	op	op	op	op	op		op	op	op	op	op					op	op	13	0	13
Stopping /tʃ + dʒ/																						0	0	0
4.06 - Stopping /θ + ð/	op				op																op	3	0	3
Substitution /θ + ð/ → [f or s]	op	op	op	op	op	op	op		**		op	op	**	op	op		op	op	op	**	op	16	3	19
Gliding /r/ → [w]			op				op	op				op		op	op							6	0	6
Vocalisation*	op		op	op					op		op	op			cp				op			8	0	8
Total processes used by each child	4	2	5	4	5	2	4	2	3	2	4	6	6	5	5	0	1	2	3	2	6			

*Chronology not documented

KEY: op = optional
** = obligatory

LINGUISTIC AWARENESS INVESTIGATION

EXPERIMENT 1: IDENTIFICATION OF RHYME

GROUP/NO .... NAME .... D OF B ....

AGE .... TEST DATE ....

EXAMPLES

1 Nursery rhyme

2 Rhyming snap

3 dog log bat spoon rain moon

egg peg leg fair shoe wing blue two

TEST

	pear	bear	chair	fan
	hen	ring	pen	ten
*	fox	clocks	rain	box
	bees	pan	man	van
	keys	men	trees	peas
*	cat	mat	hat	chair
	phone	stone	hen	bone
	socks	cake	rake	snake
	ring	swing	king	hat
	rain	pear	plane	train

Total correct: Visual: ____________

Auditory: ___________

NAMING ABILITY:

*MEMORY ABILITY:

COMMENTS:

JANET HOWELL

October 1983

LINGUISTIC AWARENESS INVESTIGATION

EXPERIMENT 2: SEGMENTATION

GROUP/NO .... NAME .... D OF B ....

AGE .... TEST DATE ....

Examples:

1. Child's name ____________
2. K words ____________
3. S words ____________
4. ship ____________
5. ball ____________

TEST

1. watch ____________
2. milk ____________
3. fork ____________
4. shoe ____________
5. van ____________
6. sock ____________

TOTAL ____________

7. bus ____________
8. key ____________
9. doll ____________
10. pig ____________
11. gun ____________
12. tap ____________

TOTAL ____________

13. bread ____________
14. thread ____________
15. spoon ____________
16. tree ____________

17. apple ____________
18. egg ____________
19. ice ____________
20. ink ____________

TOTAL ____________

TOTAL ____________

COMMENTS

J.HOWELL

LINGUISTIC AWARENESS INVESTIGATION

EXPERIMENT 3: NAMING ACCEPTABILITY

GROUP/NO .... NAME....................... DATE OF BIRTH.............

TEST DATE................ AGE.......................

Examples 1. cat tat 2. chocolate

TEST

			Imitation	Correction
1.	fish	pɩʃ		
2.	flag			
3.	water	wɔwɔ		
4.	shoe	tu		
5.	kite			
6.	socks	tɒks		
7.	paper			
8.	tent	dɛnt		
9.	yellow	lɛlo		
10.	shells	sɛlz		
11.	bubbles			
12.	glove	glʌp		
13.	cup	tʌp		
14.	teeth			
15.	thumb	bʌm		
16.	rope			
17.	flower	faɷwə		
18.	scissors	tɩdəz		
19.	red	wɛd		
20.	banana	nanə		
21.	comb			
22.	egg	ɛd		
23.	pegs	pɛ		
24.	spoon	pun		
25.	chair	tɛə		
Total Correct				

COMMENTS

LINGUISTIC AWARENESS INVESTIGATION

EXPERIMENT 4: PHONOTACTIC CONSTRAINTS

GROUP/NO .... NAME..................... DATE OF BIRTH...........

TEST DATE .... AGE.....................

Examples: 1. skib srob
2. klek dluk

TEST

CHOICE			REPETITION	
			Choice	Non-choice
1.	ŋɛp	<u>nup</u>		
2.	<u>brɩn</u>	bwen		
3.	pwep	<u>plun</u>		
4.	θlip	<u>θrop</u>		
5.	<u>flɛb</u>	fmob		
6.	<u>trɛm</u>	tlɔm		
7.	dlip	<u>drap</u>		
8.	<u>frəm</u>	fwum		
9.	<u>blep</u>	bnɛp		
10.	pweb	<u>prɒb</u>		
11.	<u>nupli</u>	ŋopwɔ		
12.	mrul	<u>frɒl</u>		
13.	dlɛf	<u>drɔf</u>		
14.	<u>trɒm</u>	tlim		
15.	<u>dwal</u>	nwɒl		
16.	unbwɛn	<u>ɔnbrɒn</u>		
17.	bɛfmab	<u>bɒflɛb</u>		
18.	mufwɩn	<u>mɛfrum</u>		
19.	pɒbnɛp	<u>pɩblɛp</u>		
20.	<u>wəmp</u>	wɛvp		

TOTALS P.E.__________ I.E. __________ Repetition to P.E. __________

Experiment 5: Questions

To be asked after playing acceptability tape

1. Why do you think the man can't say his words properly?

2. Do you think we could help him?

3. How do you think we could help him?

4. Do you know anyone who can't say their words properly?

5. Are you a good talker?. Are there any words you cant say properly?

To be asked after playing baby tape

6. Who do you think this is?

7. How do you think babies learn to talk?

8. Does anyone have to help them?. How can they help?.

Experiment 5: Scoring Procedure

Each answer is given a numerical score ranging from 0 to 3 following the schedule detailed below.

1. Non-Productive Answers. Score 0

These are answers which provide no evidence of an ability or willingness to continue with discussion.

Such responses include:

a. "don't know"

b. failure to make any verbal response

c. a response apparently unrelated to the question.

2. Productive Answers. Score 1-3

These are answers which are capable of allowing discussion to continue.

a. A score of 1 is given for responses which according to Blank do not obviously focus on the central issue of the question. The subject appears to understand the question but provides little evidence of active reflection.

These would include circumlocutory answers for example in response to set A, question 1 "Cos he's funny, cos he says jokes"

b. A score of 2 is given for appropriate yes/no answers and answers that lack precision.

For example in response to Set B question 1 a response of "boy" rather than "little boy" or "baby"

c. A score of 3 is given for answers which are considered to be fully productive responses. A specific explanation or qualification of a yes/no answer.

For example in response to set A q. 1 "Must have something in his mouth ... maybe he's got wrong teeth in"

(_N.B. Blank et al and Tizard et al use the terms adequate and inadequate. But productive and non-productive are considered to be more appropriate descriptions for this investigation).

Table A Pre-Investigation Variables, Phonologically Disordered Group (PDG) (N=21)

Subj	Sex	FB	CA	EAT (StSc)	RDLS (StSc)	WPPSI (IQ)	Aud. Mem.	Aud. Dis. /40
1	M	C	5.5	82	1.1	99	*	38
2	M	B	4.3	69	0.9	124	39	32
3	M	A	3.10	84	1.4	126	47	27
4	M	C	3.11	84	0.1	119	28	21
5	M	C	3.10	53	0.8	111	48	23
6	M	A	4.1	74	0	112	35	22
7	M	A	4.1	85	1.6	123	40	33
8	M	C	4.9	85	0.5	114	56	35
9	M	D	4.0	65	-0.5	114	43	20
10	M	C	3.10	73	0.4	104	43	24
11	M	A	3.8	73	1.5	127	55	35
12	M	B	3.9	84	0.2	110	37	*
13	M	B	4.2	80	0.1	108	41	18
14	M	B	4.2	74	0.6	108	38	30
15	M	B	3.10	73	1.3	111	62	29
16	F	D	4.5	61	-1.0	88	38	29
17	F	D	3.11	73	-0.4	104	30	25
18	F	C	4.4	70	0.6	112	43	28
19	F	C	4.0	73	-1.4	105	32	19
20	F	C	3.11	84	0	101	47	25
21	F	C	4.11	54	0	105	30	27
Mean			4.2	74	0.3	111	42	27
S.D.			5	9	0.5	9	9	6

* Would not cooperate in this task.

Table B Pre-Investigation Variables for Normally Developing Group (NDG) (N=21)

Subj	Sex	FB	CA	EAT (StSc)	RDLS (StSc)	WPPSI (IQ)	Aud. Mem.	Aud. Dis. /40
1	M	C	4.3	121	0.9	133	52	29
2	M	B	4.4	117	1.5	115	41	31
3	M	A	4.4	109	0.2	110	44	21
4	M	B	4.7	114	1.3	116	44	28
5	M	C	4.6	105	-0.8	95	32	25
6	M	C	4.7	141	0.2	101	38	32
7	M	B	3.10	125	0.7	107	44	29
8	M	B	4.1	107	1.3	123	37	28
9	M	C	4.0	113	1.3	126	36	31
10	M	B	4.6	114	1.0	127	38	35
11	M	C	4.9	101	0.3	107	42	26
12	M	B	4.0	107	0.5	123	40	33
13	M	D	3.11	111	0.1	97	32	27
14	M	C	4.2	121	1.1	112	41	27
15	M	C	4.2	113	0.9	114	49	30
16	F	A	4.4	145	1.5	108	45	28
17	F	A	4.4	145	0.9	107	44	31
18	F	B	4.0	149	1.3	123	34	23
19	F	D	4.1	149	1.3	118	49	23
20	F	B	4.1	123	1.6	123	50	29
21	F	C	4.0	113	0.4	122	32	28
Mean			4.3	121	0.8	115	41	28
S.D.			3	15	0.6	10	6	5

Table C Raw Scores for Experimental Tasks, Phonologically Disordered Group (PDG) (N=21)

Subj.	Rhyme /10	Segment /12	Accept. /18	Constraint /15
1	8	3	18	12
2	9	8	8	9
3	6	4	13	7
4	4	1	10	7
5	0	0	14	5
6	3	0	14	5
7	3	1	17	8
8	9	8	17	8
9	2	2	7	6
10	2	5	7	6
11	3	2	2	6
12	3	0	16	*
13	2	0	18	7
14	2	1	15	10
15	5	0	17	9
16	2	0	17	5
17	1	1	7	5
18	6	4	18	8
19	1	0	2	8
20	0	0	16	9
21	1	2	13	9
Mean	3.4	2.0	12.6	7.4
S.D	2.7	2.6	5.1	1.9

Table D Raw Scores for Experimental Tasks, Normally Developing Group (NDG) (N=21)

Subj.	Rhyme /10	Segment /12	Accept /18	Constraint /15
1	6	4	15	9
2	10	12	16	8
3	4	2	17	6
4	9	6	14	10
5	5	0	8	5
6	5	1	10	7
7	3	0	11	7
8	8	4	15	7
9	8	5	17	7
10	10	12	13	8
11	8	3	14	7
12	4	1	14	7
13	5	0	14	7
14	8	1	10	8
15	8	2	12	6
16	8	9	17	9
17	10	11	15	10
18	7	8	15	7
19	7	0	16	9
20	10	5	16	4
21	4	9	4	9
Mean	7	4.5	13.4	7.4
SD	2.2	4.1	3.2	1.5

<u>Table E</u> Types of Responses to Segmentation Task, Phonologically Disordered Group (PDG)

	A	B	C	D	E	F	G	
1	3	9						12
2	8		1		3			12
3	4		4		1	3		12
4	1	1			10			12
5				12				12
6				2	8	2		12
7	1		11					12
8	8	2			1	1		12
9	2		6	2	1	1		12
10	5	3	1		2	1		12
11	2		5			5		12
12			1	8		3		12
13				1	11			12
14	1	1			7	3		12
15						5	7	12
16					11	1		12
17	1		4	1	2		4	12
18						11	1	12
19			1	8	2	1		12
20	4		6		2			12
21	2				4	6		12
Total	42	16	40	34	65	43	12	252

<u>Key</u>
A. = Phonemic segmentation
B. = Segmentation of the initial phoneme and the following vowel, that is cv segmentation. For example [va] in response to "van"
C. = Incorrect single phoneme.
D. = Semantic definitions
E. = Naming the presented picture.
F. = No response / Don't know
G. = Other.

Table F Types of Responses to Segmentation Task, Normally Developing Group (NDG)

	A	B	C	D	E	F	G	
1	4	1			1	4	2	12
2	12							12
3	2	4	6					12
4	6	4			1	1		12
5				6	1	2	3	12
6	1	1	6		2		2	12
7					1	8	3	12
8	4		1		1	6		12
9	5	7						12
10	12							12
11	3	1			3	5		12
12	1			4	6	1		12
13						1	11	12
14	1	2			8	1		12
15	2	10						12
16	9	3						12
17	11						1	12
18	8		1		1		2	12
19				1	5	6		12
20	5				7			12
21	9				3			12
Total	95	33	14	11	40	35	24	252

Key
A. = Phonemic segmentation
B. = Segmentation of the initial phoneme and the following vowel, that is cv segmentation. For example [va] in response to "van"
C. = Incorrect single phoneme.
D. = Semantic definitions
E. = Naming the presented picture.
F. = No response / Don't know
G. = Other.

APPENDIX 6 TABLES

Table G Numbers of Possible English (PE), Impossible English (IE) Word Choices and No Responses (NR) for 15 Monosyllabic Word Pairs, All Child and Adult Subjects

				Group					
		PDG			NDG			Adult	
Sub.	PE	IE	NR	PE	IE	NR	PE	IE	NR
1	12	2	1	9	6	–	10	5	–
2	9	5	1	8	7	–	10	5	–
3	7	8	–	6	9	–	6	9	–
4	7	7	1	10	5	–	15	–	–
5	5	10	–	5	6	4	6	9	–
6	5	8	2	7	8	–	12	3	–
7	8	7	–	7	8	–	8	7	–
8	8	7	–	7	8	–	15	–	–
9	6	9	–	7	8	–	15	–	–
10	6	8	1	8	7	–	11	4	–
11	6	9	–	7	5	3	11	4	–
12	*			7	8	–	9	6	–
13	7	8	–	7	8	–	5	10	–
14	10	5	–	8	7	–	14	1	–
15	9	6	–	6	9	–	13	2	–
16	5	10	–	9	6	–	12	3	–
17	5	7	3	10	5	–	13	2	–
18	8	5	2	7	8	–	8	7	–
19	8	7	–	9	6	–	11	4	–
20	9	6	–	4	11	–	14	1	–
21	9	6	–	9	6	–	12	3	–
Total	149	140	11	157	151	7	235	80	–
Mean	7.4			7.4			11.1		
SD	1.9			1.5			3.0		

* Could not be induced to choose

APPENDIX 6 TABLES

Table H Number of Possible English (PE) and Impossible English (IE) Word Choices and No Responses (NR) for 5 Bisyllabic Word Pairs. All Child and Adult Subjects

	Group								
	PDG			NDG			Adult		
Sub	PE	IE	NR	PE	IE	NR	PE	IE	NR
1	3	2	-	3	2	-	3	2	-
2	1	4	-	4	1	-	-	4	1
3	2	3	-	2	3	-	3	2	-
4	2	3	-	2	3	-	2	3	-
5	3	2	-	5	-	-	3	2	-
6	3	2	-	3	2	-	3	2	-
7	4	-	1	3	1	1	4	1	-
8	4	1	-	2	3	-	4	1	-
9	1	4	-	4	1	-	2	3	-
10	1	4	-	3	2	-	-	5	-
11	5	-	-	1	2	2	3	2	-
12	*			4	1	-	2	3	-
13	4	1	-	5	-	-	5	-	-
14	2	3	-	4	1	-	2	3	-
15	1	4	-	3	2	-	1	4	-
16	1	4	-	2	3	-	4	1	-
17	4	-	1	5	-	-	2	3	-
18	3	2	-	5	-	-	3	2	-
19	4	1	-	2	3	-	5	-	-
20	4	-	1	3	2	-	2	3	-
21	4	1	-	4	1	-	4	1	-
Total	56	41	3	69	33	3	57	47	1
Mean	2.8			3.2			2.9		
S.D	1.2			1.1			1.3		

* Could not be induced to choose

APPENDIX 6 TABLES

TABLE I. Number of Accurate Imitations of 15 Monosyllabic and 5 Bisyllabic Possible English (PE) Words. All Child and Adult Subjects

	/15 Monosyll			/5 Bisyll		
Sub.	PDG	NDG	Adult	PDG	NDG	Adult
1	11	14	15	4	4	5
2	4	13	15	2	5	5
3	8	11	15	5	5	5
4	13	15	15	3	4	5
5	1	8	15	2	3	5
6	3	12	15	2	5	5
7	11	10	15	5	2	5
8	14	7	15	4	3	5
9	2	14	15	1	5	5
10	4	14	15	3	4	5
11	1	13	15	–	5	5
12	4	13	15	1	4	5
13	6	12	14	–	2	5
14	11	11	15	4	5	5
15	3	14	15	1	5	5
16	6	13	13	2	4	5
17	3	13	15	1	5	5
18	6	13	15	5	3	5
19	6	15	15	4	4	5
20	3	14	15	4	5	5
21	9	9	15	5	1	5
Total	129	258	312	58	83	105
Mean	6.1	12.2	14.8	2.7	3.9	5
SD	3.8	2.1	0.4	1.6	1.3	0

Table J Number of Accurate Imitations of 15 Monosyllabic and 5 Bisyllabic Impossible English (IE) Words. All Child and Adult Subjects

	/15 Monosyll			/5 Bisyll		
Sub.	PDG	NDG	Adult	PDG	NDG	Adult
1	-	1	14	1	4	5
2	-	2	10	3	2	4
3	4	2	11	2	4	5
4	-	3	6	-	3	5
5	-	-	11	-	3	5
6	-	3	12	1	1	5
7	2	2	6	3	1	4
8	6	5	10	4	3	5
9	-	1	10	1	5	5
10	1	2	8	2	3	5
11	-	3	11	1	3	5
12	1	1	12	1	2	4
13	3	1	9	2	3	5
14	1	-	11	3	3	5
15	-	2	8	3	2	5
16	-	3	11	1	4	5
17	-	1	10	-	4	5
18	2	1	12	1	3	5
19	1	4	11	3	4	5
20	1	1	12	3	3	5
21	1	-	12	4	1	5
Total	23	38	217	39	61	102
Mean	1.0	1.8	10.3	1.8	2.9	4.8
S.D	1.5	1.7	1.9	1.2	1.0	0

Table K Raw Scores for Answers to Experiment 5 Questions, Phonologically Disordered Group

	Question Numbers								
Sub.	1	2	3	4	5	6	7	8	Total
1	§								
2	0	2	3	-	-	3	0	0	8
3	§								
4	§								
5	0	0	0	0	0	3	2	2	7
6	0	0	0	0	0	0	0	0	0
7	3	2	3	2	3	3	2	2	20
8	0	2	3	2	3	3	3	0	16
9	0	0	0	0	0	0	0	0	0
10	3	0	0	0	3	1	2	2	11
11	*								
12	3	2	2	2	1	3	3	2	18
13	0	2	0	0	2	1	0	2	7
14	0	2	0	0	0	3	2	0	7
15	-	2	3	2	2	0	3	3	15
16	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	2	2	0	4
18	3	2	2	2	3	2	3	2	19
19	*								
20	1	2	3	2	3	3	2	3	19
21	-	2	2	2	3	3	1	1	14

§ Did not take part in this experiment
* Only Questions 6 - 8 asked.

Table L Raw Scores for Answers to Experiment 5 Questions, Normally Developing Group

	Question Numbers								
Sub.	1	2	3	4	5	6	7	8	Total
1	3	2	2	0	0	2	0	0	9
2	1	2	2	2	3	2	0	0	12
3	2	2	3	2	3	2	0	0	14
4	3	2	0	2	3	3	3	0	16
5	1	0	0	0	0	0	0	0	1
6	3	2	3	3	3	2	0	2	18
7	§								
8	3	3	–	3	3	1	3	2	18
9	3	2	2	3	3	0	3	–	16
10	3	3	3	2	2	0	3	3	19
11	1	2	3	2	3	3	2	3	19
12	1	1	2	3	3	2	3	3	18
13	2	2	2	3	2	2	1	1	15
14	1	2	3	2	2	2	0	3	15
15	1	2	2	–	–	1	1	1	8
16	2	2	3	2	3	3	1	2	18
17	3	2	2	3	3	2	2	1	18
18	1	2	3	3	3	2	3	–	17
19	3	2	3	0	0	2	2	0	12
20	0	2	3	3	0	3	3	2	16
21	0	2	0	3	0	3	2	0	10

§ Did not participate in this experiment

Table M Chronological Ages, EAT and Rhyming and Segmentation Scores for Follow Up Study. All subjects

	PDG (N = 19)				NDG (N = 21)			
Sub.	CA	EAT	Rhym	Seg	CA	EAT	Rhym	Seg
1	§				5.3	114	7	12
2	5.4	87	10	12	5.6	130	10	12
3	4.10	122	3	6	5.5	114	8	12
4	§				5.9	122	10	12
5	5.2	53	2	0	5.7	90	3	1
6	5.4	82	3	10	5.11	122	9	10
7	5.4	94	10	12	5.0	118	4	9
8	5.7	110	10	8	5.1	91	10	12
9	5.1	58	5	2	4.11	110	9	9
10	4.11	85	5	2	5.5	130	10	12
11	4.8	114	10	12	5.8	110	10	9
12	4.10	101	4	4	4.10	110	9	3
13	5.2	86	2	4	4.9	101	7	1
14	5.1	70	5	12	5.0	118	10	4
15	4.9	74	7	1	5.1	106	10	12
16	5.9	58	10	5	5.6	130	10	12
17	4.11	68	9	1	5.6	130	9	12
18	5.0	88	8	4	5.0	133	10	12
19	4.8	90	4	0	5.2	133	7	12
20	5.4	86	10	12	5.1	133	10	10
21	5.10	74	6	12	5.1	133	7	12
Mean	5.2	84	6.5	6.3	5.3	118	8.5	9.5
SD		18.4	3.0	4.6		13.2	2.0	2.7

§ Did not participate in follow up study.

Table N Types of Responses to Segmentation Task in Follow up Study. Phonologically Disordered Subjects (N =19)

	A	B	C	D	E	F	G	
1	§							
2	12							12
3	6	1	4			1		12
4	§							
5						12		12
6	10		2					12
7	12							12
8	8	4						12
9	2	1	3			2	4	12
10	2		1		4		5	12
11	12							12
12	4		8					12
13	4	8						12
14	12							12
15	1	3	4		2		2	12
16	5	7						12
17	1		6	4			1	12
18	4	7	1					12
19				12				12
20	10	2						12
21	12							12
Total	117	33	29	16	6	15	12	228

§ Did not participate in the follow up study

<u>Key</u>

A. = Phonemic segmentation
B. = Segmentation of the initial phoneme and the following vowel, that is cv segmentation. For example [va] in response to "van"
C. = Incorrect single phoneme.
D. = Semantic definitions
E. = Naming the presented picture.
F. = No response / Don't know
G = Other.

Table Q Types of Responses to Segmentation Task in Follow up Study Normally Developing Group (N = 21)

	A	B	C	D	E	F	G	
1	12							12
2	12							12
3	12							12
4	12							12
5	1		11					12
6	10	2						12
7	9	1			1		1	12
8	12							12
9	9	1	1			1		12
10	12							12
11	9	1	1			1		12
12	3	7			2			12
13	1			11				12
14	4	5			2	1		12
15	12							12
16	12							12
17	12							12
18	12							12
19	12							12
20	10	2						12
21	12							12
Total	200	21	12	11	5	2	1	252

Key
A. = Phonemic segmentation
B. = Segmentation of the initial phoneme and the following vowel, that is cv segmentation. For example [va] in response to "van"
C. = Incorrect single phoneme.
D. = Semantic definitions
E. = Naming the presented picture.
F. = No response / Don't know
G. = Other.

NOTES ON STATISTICAL TREATMENT OF DATA

1. Non Parametric Statistics.

Non-parametirc tests were chosen to analyse the data because no assumptions could be made about the distribution of the task scores.

2. Kendall Rank-Order Correlation Coefficient (T)

This test was used in preference to the Spearman Rank-Order Correlation Coefficient because it provides for the possibility of calculating partial-rank orders. It was therefore possible to assess, at least to some extent, the influence of other variables, on any associations between phonological ability and metalinguistic measures. Siegal & Castellan (1988) say that these two meaures of association make similar use of the information in the data.

3. Computing of Results.

The Amstat 2, Statistical Package (Coleman & Coleman) was used to calculate the results of the experiments. This package implements the tests found in Siegel (1956)

4. Missing Data Points.

There were three missing points in the data (marked thus *). Amstat 2 does not provide a facility for dealing with missing data. The mean of the subject group was therefore substituted in these cases. Sample manual calculations were made omitting and including the pertinent subjects, these indicated that adopting the procedure of using the group mean to substitute for missing data had minimal effects on the results.

References

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