

**Evaluation of a phonological therapy  
with treated and untreated groups  
of young children**

by

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**This work is dedicated to the memory of Andrew Bowen 1964-1994**

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## **Abstract**

The speech-language pathology management of children with developmental phonological disorders has been influenced by a paradigm shift. Traditional articulation therapy is being supplanted by linguistically based therapies, which take into account the systematic nature of phonology (Ingram, 1989a). Increasingly, therapy approaches (Fey, 1992) aim to change phonological patterns (Grunwell, 1995), but to date there have been no studies of phonological therapy with treated and untreated groups.

Fourteen randomly selected children were treated with a multifaceted phonological therapy, comprising: family education, metalinguistic tasks, traditional phonetic production procedures, multiple exemplar techniques (minimal contrast and auditory bombardment activities), and homework; administered in alternating blocks and breaks, each of approximately 10 weeks duration. In a longitudinal matched group design their progress was compared with that of 8 untreated control children.

Analysis of Variance of the initial and probe Severity Ratings of the phonological disabilities, 3 to 11 months apart, showed highly significant selective progress in the treated children only ( $F(1,20) = 21.22, p < .01$ ). Non-significant changes in receptive vocabulary ( $F < 1$ ) pointed to the specificity of the therapy. The initial severity of the children's phonological disabilities was the only significant predictor of the duration of therapy they required, with strong (Pearson's) correlations between initial severity and number of treatments ( $r(11) = .75, p < .01$ ). A clinically applicable Severity Index with a high correlation ( $r(79) = .87, p < .01$ ) with the Severity Ratings of experienced speech-language pathologists was developed, and an implementation procedure proposed. Reading tests of the treated children who had started school indicated that, despite successful speech outcomes, 8 out of 11 had early literacy learning difficulties.

Encouraged by the efficacy of the therapy, refinement of the model, through evaluation of the relative contributions of its components, and testing the approach against other phonological therapies might prove edifying avenues of further research.

**KEY WORDS:** developmental phonological disorders, phonological therapy, severity measures

## Declaration

I, Caroline Bowen, certify that this thesis does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any university; and that to the best of my knowledge and belief it does not contain any material previously published or written by another person where due reference is not made in the text.

Signed Caroline Bowen Date 18. 3. 96

# CHAPTER 1

## PHONOLOGICAL THEORY

## AND DEVELOPMENTAL PHONOLOGICAL DISORDERS

In the field of speech-language pathology, the terms *developmental phonological disorder* and *phonological disability* broadly denote a linguistic disorder in children, manifested by the use of abnormal patterns in the spoken medium of language (Grunwell, 1981a). The terms are comparatively new, and reflect the influence of clinical phonology upon the way in which many linguists and language clinicians now conceptualise children's speech sound disorders.

My interest in phonological disability stems from clinical experience, as a speech-language pathologist, treating children with the disorder since the early seventies. In that time, there has been a significant paradigm shift, as linguistic theory has elucidated the distinction between phonetics: the study of speech sounds; and phonology: the study of the rule-governed occurrence of sounds in a language. The effect of the shift has been to alter clinical perspectives and approaches to phonological assessment and therapy. Another shift in the field has related to the role of parents in the therapeutic process (Fey, 1986).

My aims here are to propose, describe, and evaluate a *broad-based* (Kamhi, 1992a) therapy methodology for developmental phonological disorders. Kamhi argued the need for such a model that had some explanatory value, stating: "*Such models are consistent with assessment procedures that are comprehensive in nature and treatment procedures that focus on linguistic, as well as motoric, aspects of speech*" (p. 261).

The intervention *approaches, procedures* and *activities*, as defined by Fey (1992b) of the proposed therapy regime are largely familiar to speech-language pathologists, comprising traditional and phonological techniques. It is necessary, therefore, to view the model against a background of what it adopts from previous and current practice, what knowledge it incorporates from normal language development, and where it departs from what has gone before and is innovative.

## **1.0 Background, Terminology and Nomenclature**

To introduce the therapy model, and to demonstrate how it fits congruently with the theoretical background, this section contains definitions and discussion of the development and application of key terms and concepts.

### **1.0.1 Articulation**

Articulation is a general term used in phonetics to denote the physiological movements involved in modifying the airflow, in the vocal tract above the larynx, to produce the various speech sounds. Sounds are classified according to their place and manner of articulation in the vocal mechanism (Crystal, 1991).

### **1.0.2 Phonology**

Phonology is the branch of linguistics concerned with the study of the sound systems of languages (Crystal, 1991). The aims of phonology are to demonstrate the patterns of distinctive sound contrasts in a language, and to explain the ways speech sounds are organised and represented in the mind. "Phonology" is used clinically as a referent to an individual's speech sound system (e.g., "her phonology" might refer to "her phonological system", or "her phonological development").

### 1.0.3 Developmental Phonological Disorder(s)

Developmental phonological disorders occur when a child's acquisition of his or her phonology is interrupted, and the active learning process slows, or perhaps even ceases. A suitable definition of developmental phonological disorders might be as follows:

*Developmental phonological disorders are a group of developmental language learning disorders of unknown aetiology, occurring at a phonological level, and manifested in the use of abnormal speech patterns, by children impairing their general intelligibility.*

Phonological disability is a synonymous term, found in the earlier work of Ingram (1976), and Grunwell (1981a, b). The disorder is also referred to in the literature as: phonomotor disability (Folkins & Bleile, 1990), syntactic phonological syndrome (Howell & Dean, 1991), phonological disorder (Dean, Howell, Hill & Waters, 1990; Fey, 1992a; Kamhi, 1992a; Stackhouse, 1993), and expressive phonological impairment (Bird, Bishop & Freeman, 1995). Dodd (1995) distinguished three distinct types of phonological disorder (excluding articulation disorders): delayed phonological acquisition, inconsistent deviant disorder, and consistent deviant disorder. Grunwell and Russell (1990) also posited at least three types, related to (1) form: the inventory and contrastive system, (2) function: the variability in the realisation of adult contrasts, and (3) phonotactics (the latter type discussed in detail in Grunwell & Yavas, 1988). There are references in the recent literature to phonological disability as other adjective-adjective-noun labels, including permutations of the following, with or without the word "learning", for instance, "developmental phonological learning disorder" (Gibbon & Grunwell, 1990):

functional	articulation	disorder(s)
non-organic	phonologic(al)	disability(ies)
developmental	intelligibility	impairment(s)
child(hood)	phonetic	delay(s)
paediatric	speech	deviation(s)

#### **1.0.4 The Characteristics of Disordered Phonology**

Stoel-Gammon and Dunn (1985) reviewed the literature on the relationship between normal and disordered phonology, including the work of Compton (1976), Edwards and Bernhardt (1973), Grunwell (1981a), Ingram (1976), Leonard (1973) and Oller (1973). They found that there was a general view that, as well as being many similarities between normal phonology and disordered phonology, there were also substantial differences between the two.

Ingram (1976), Grunwell (1981a, 1985a) and Stoel-Gammon and Dunn (1985) listed the most frequently described characteristics of developmental phonological disorders. Stoel-Gammon and Dunn's (1985) list (paraphrased slightly) included:

- 1. Static speech sound systems that plateau at an early level of development failing to progress towards mastery.*
- 2. Extreme variability in production, without gradual improvement.*
- 3. Persistence of phonological processes [see 1.0.5] beyond the expected ages of occurrence in normal children.*
- 4. Co-occurrence of processes that are observed early in normal acquisition (e.g., reduplication, final consonant deletion), with correct production of sounds that are normally acquired late in the sequence of normal acquisition (e.g., liquids, fricatives, clusters), [also referred to as Chronological Mismatch (Grunwell, 1981a)].*
- 5. Co-occurrence of idiosyncratic rules or processes which rarely occur in normal phonology, such processes significantly reducing intelligibility.*
- 6. Restricted use of sound contrasts. (p. 122)*

### **1.0.5 Phonological Processes and Natural Phonology**

Stampe's (1969) natural phonology theory, described more fully in 1.3.4, introduced the concept of phonological processes. A phonological process was a *descriptive rule or statement* that accounted for structural or segmental speech errors of substitution, omission or addition. Natural phonology stressed the importance of natural phonological processes as a set of universal, obligatory rules governing a particular phonology.

The natural phonological processes were innate, and representative of the constraints a child has to learn in mastering spoken language. The constraints, according to Stampe, disallowed the production of all but the simplest pronunciation patterns in the early stages of phonological development. Later in development they underwent modification or suppression as the child learned more advanced forms. "Advanced forms" really implied the correct "adult" realisation of the sound.

### **1.1 Historical Perspectives**

Speech-language pathology was a young profession when developmental phonological disorders were known as dyslalia or functional articulation disorders. The College of Speech Therapists (1959) '*Terminology for Speech Pathology*' defined dyslalia as: "*Defects of articulation or slow development of articulatory patterns, including substitutions, distortions, omissions and transpositions of the sounds of speech.*" In America, in the same year, Powers (1959) defined the disorder too, but called it "functional articulation disorder". Powers wrote:

*The term functional articulation disorder encompasses a wide variety of deviate speech patterns. These can be described in terms of four possible types of acoustic deviations in the individual speech sounds: omissions, substitutions, distortions, and additions. An individual may show one or any combination of these deviations. (p. 711)*



How interesting it is to find that as early as 1959 speech-language pathologists in Britain and the United States had an agreed definition and terminology (Shriberg, 1993), and were thinking about, and including in their definitions, the notion of *speech patterns* when they described speech development and disorders. Nevertheless, it must be remembered that they did so without taking into account speech sounds' organisation and representation, cognitively. Such constructs were the domain of clinical linguistics, and it would not be for twenty years or more after the formulation of the British and American definitions that a practical, clinical connection would be forged between phonological theory and speech-language pathology practice.

In Britain and Australia, the term dyslalia remained in vogue until the mid-1960's, when the American terminology, functional articulation disorder, gained general usage. Subsequently, this gave way to the widely applied (in the UK, North America and Australia) term of "developmental articulation disorder". The prevailing preoccupation, in the sixties through to the mid seventies, with individual sounds in the so-called "three positions", initial, medial and final, constituted a strictly phonetic approach to the problem and somehow isolated the linguistic function of speech from the mechanics of speech (see Grunwell [1975] for a contemporary critique and a discussion of the desirability of a more linguistically principled approach to assessment and remediation).

Developmental schedules (Poole, 1934; Prather, Hendrick & Kern, 1975; Sander, 1972; Templin, 1957; Wellman, Case, Mengert & Bradbury 1931) for articulatory maturation, based on mean age of "acquisition" of individual phonemes, were, and still are, clinically important (for an Australian example, see Kilminster & Laird [1978]). Before certain ages, particular sound changes were regarded as developmentally appropriate. After these ages, the sound changes, or omissions, substitutions, additions and distortions, were viewed as errors or deviate patterns.

Functional articulation disorders were graded in severity as mild, moderate or severe. In the moderate and severe categories were the “multiple misarticulators” whose speech was generally unintelligible to people outside their immediate family. Discussing therapy, it was readily acknowledged that children with severe functional articulation disorders could usually imitate, or quickly be taught how to produce, most speech sounds (Morley, 1972). Often the “articulation” disorder appeared to reside in their difficulty employing speech sounds for word production, which they could nevertheless produce in isolation.

Intervention concentrated on the mechanical aspects of establishing the production of individual phonemes, one at a time, context by context. The three-position format became the basis for articulation description and assessment, and for articulation therapy. By defining the problem in articulatory terms, and focussing on speech, and accuracy of production, the pioneer speech-language pathologists did not appear to take into account something that they already knew; namely, that speech serves as the spoken medium of language, in a system of contrasts and combinations, that signal meaning-differences. That is, when children are in the process of learning the agreed pronunciation patterns of a language, as well as learning the correspondences between *articulatory movements* and sounds, they are discovering the relationships between *meanings* and sounds.

The linguistic links which prompted speech-language pathologists to consider speech disorders in terms of sound systems or patterns were provided by distinctive features theory (Blache, 1978a), Chomskyan (generative) linguistics (Chomsky and Halle, 1968), and Ingram's (1974, 1976) work on natural phonology. What had been interpreted as multiple individual errors came to be seen as sound class problems, with involvement of multiple members of those classes. From these beginnings stemmed a history of the development of clinical applications of phonology to speech-language pathology practice, which acquired both an international and a cross disciplinary flavour.

When speech-language pathologists eventually turned to linguistics for elucidation of the nature of speech and language disorders, there was a corresponding interest on the part of some linguistic researchers in investigating abnormal speech and language development. Perhaps this interest was usually in the expectation that such research could enhance theory development, or for Linguistics to have a more recognisable *raison d'être* clinically.

## **1.2 Clinical Phonology**

For two phonologists, Pamela Grunwell and David Ingram, there was a clearly stated mission to help the profession of speech-language pathology in the practical application of phonological principles to the treatment of children with phonological disability: and many speech-language pathologists in paediatric settings devoured every word they wrote! Clinical phonology was the clinical application of linguistics at the phonological level (Grunwell, 1987).

Research describing the development of normal and disordered sound systems came to the attention of many speech-language pathologists through the publication of Canadian linguist David Ingram's "*Phonological Disability in Children*" in 1976. The aim of the book, written specifically for language clinicians, was to bridge the gap between linguistic theory and clinical applications. His success in achieving this aim provided a rationale, and a framework, for practical applications. Ingram (1989a) considered that phonology embraced the study of:

1. The nature of the underlying representations of speech sounds,  
(how they are stored in the mind);
2. the nature of the phonetic representations,  
(how the sounds are articulated); and,
3. phonological rules or processes,  
the rules which map between the two above.

The interest stimulated by the accessibility and clinical relevance of Ingram's work led many clinicians inevitably to the contemporary work of Clinical Phonologist Pamela Grunwell (1975) in the north of England. The insights provided by Grunwell's work, especially her continual clinical collaboration with speech and language therapists, encouraged clinicians to apply phonological therapy principles to intervention. Grunwell and Russell (1990) noted that:

*Clinical linguistics focuses on two domains: (1) the theoretical/linguistic domain of the investigation of the nature of disordered child language development; (2) the applied/clinical domain of developing proven investigative and treatment procedures based on sound rationales in order to enhance therapeutic theory and practice. (p 29)*

The publication of Stoel-Gammon and Dunn's (1985) *"Normal and Abnormal Phonology in Children"* provided further theoretically principled guidance. The most radical aspect of the new principles was their focus upon changing phonological patterns by stimulating the children's underlying systems for phoneme use. There was a slightly apprehensive feeling abroad that because of the theoretical paradigm shift, therapeutic approaches, intervention goals, and therapy procedures and activities, should be different, or at least revamped. Fey (1985), answered these concerns and uncertainties in a landmark article, in which he wrote:

*...adopting a phonological approach to dealing with speech sound disorders does not necessitate the rejection of the well-established principles underlying traditional approaches to articulation disorders. To the contrary, articulation must be recognized as a critical aspect of speech sound development under any theory. Consequently phonological principles should be viewed as adding new dimensions and new perspectives to an old problem, not simply as refuting established principles. These new principles have resulted in the development of several procedures that differ in many respects from old procedures, yet are highly similar in others. (p. 225)*

### **1.2.1 Phonological Processes in Phonological Assessment**

Phonological process analysis, which estimates the extent to which processes, or phonological deviations from the adult target system, are present in the child's output phonology, is only one aspect of the clinical phonological assessment.

At the time when the phonological processes construct was introduced into clinical practice many speech-language pathologists, especially those steeped in the traditional articulation assessment methodology, generally had an error-based view of phonological disability, thinking of the children saying and organising "adult" sounds the "wrong" way. Superimposing the error-based view on the phonological processes construct, the sound deviations (from the adult target system) in the child's phonology were also considered to be "errors".

For many clinicians encountering phonological processes for the first time, the sole object of phonological assessment was identification of "error processes" in terms of their percentage of occurrence. Accordingly, many therapists simply abandoned the old three position articulation tests, only to substitute a pre-packaged, phonological process analysis, that located "phonological errors" (e.g., Hodson, 1980; Khan & Lewis, 1986; Lowe, 1986a; Monahan 1984b). The procedures were relied upon not only to provide sufficient data to assess a phonological disability fully, but also to form an adequate foundation for intervention planning.

To be meaningful, however, in addition to a phonological process analysis, phonological assessment must also include a phonetic inventory, syllable and word shape inventories, and an account of the developmental characteristics of the child's pronunciation patterns. Fortunately, in the clinical assessment of developmental phonological disorders, there now seems to be a swing away from using phonological process analysis alone, in favour of more comprehensive assessment approaches such as the *Phonological Assessment of Child Speech: PACS* (Grunwell, 1985a).

### **1.2.2 Phonological Processes in Phonological Therapy**

Assessment procedures which go beyond phonological processes, and upon which management strategies can be based, are integral to the phonological therapy process. In the early 80's, the practising clinicians who turned to the literature for information on how to use the results of their phonological assessment data in constructing theoretically coherent therapies, might have discovered the work of Shriberg and Kwiatowski (1980, 1982) and Edwards and Schriberg (1983). These authors had built on the discussion surrounding the difference between articulation and phonology. In so doing they explicated the distinction between articulation disorders as a motoric difficulty with speech production, and phonological disorders as difficulty learning and manipulating sound classes and contrasts. What evolved from Shriberg and Kwiatowski's (1980) exposition on children's production problems, however, was an analysis and description of natural processes as surface forms, comprising phoneme deletions and substitutions (replacements), which were, in essence, simplifications of underlying forms.

By contrast, Grunwell (1981b) held the view that phonological process analysis implied more than just a comparison between the child's developing system and the adult system. Indeed, the simplifying processes represented *"a manifestation of innate, universal phonological capacity which results in children consistently simplifying in similar ways their pronunciations of words in the adult language, no matter what that language"* (p. 173).

The phonological processes construct was taken very literally in many clinical settings. The commonly held perception of phonological processes as reflexive errors getting in the way of intelligible speech led logically to a specious basic treatment goal of *suppressing* the "error processes" (i.e., suppressing the reflexes). Given the medical orientation of most speech-language pathologists, thinking of processes as reflexes may even have suggested a sort of *neurophysiological* reality for them, as well as the frequently mentioned "psychological reality". Therapy aimed at suppressing processes reflected both an assumption that phonological processes were more than simply descriptive categories, and a perpetuation of traditional theories of error-based, articulation therapy. Intervention approaches often revolved exclusively

around the idea of therapy *eliminating* or *suppressing* developmental phonological processes, to permit an unfolding of a more adult-like phonology, via an unexplained process.

Even some of the more linguistically oriented interventionists will refer to targeting a particular process (i.e., with the goal of suppressing it). For example, Howell and Dean (1991) and Jarvis (1991) set themselves the specific goal of “targeting velar fronting” as opposed to (using the same phonological contrast example) “establishing alveolar [t, d, n] velar [k, g, n] contrasts”.

When clinicians refer to “targeting processes” the inference remains that errors are being corrected rather than new patterns being facilitated. It is more explanatory to refer to targeting contrasts, for example, Hodson and Paden (1983) included a sample an IEP which, read in part, “Goal: To increase intelligibility by facilitating the emergence of the following phonological patterns: Final consonants, Velars, etc.” (p. 91). They explained that

*The goal is to eliminate these deficient patterns. If one wishes to think in the positive sense, the target pattern is the appropriate replacement for the deficient; that is, Postvocalic Singleton Obstruent Omission is a DEFICIENT pattern which needs to be reduced, while the DESIRED pattern to be targeted might be termed Inclusion of Postvocalic Singleton Obstruents. From either point of view the intended result is the same. (p. 58)*

### **1.2.3 Nonlinear Phonology**

Nonlinear phonological analysis is concerned with the hierarchical nature of the relationships between phonological units (Bernhardt & Stoel-Gammon, 1994), rather than “linear” or sequentially organised segments or sets of rules of traditional phonological process analysis. These hierarchies, or tiers, include both segmental and prosodic features. In nonlinear analysis the interactions between these two levels are emphasised.

Exploring the clinical application of nonlinear phonology to the management of developmental phonological disorders, Bernhardt and Stoel-Gammon (1994) looked at how child phonologies differed from, or conform to, the adult standard. They considered it inappropriate to

use the term "error", favouring the more neutral "match" when the child and adult forms were the same, and "mismatch" when they were different (cf. Menn, 1983). "Mismatch", meaning phonological deviation, is not to be confused with the term "chronological mismatch" coined by Grunwell (1981a) to denote the co-occurrence of persisting early simplifying processes, and pronunciation patterns characteristic of the later stages of phonological acquisition.

#### **1.2.4 Terminology within the Present Work**

Within the present work, the terms developmental phonological disorder(s) and phonological disability are used synonymously. The terms "phonological deviation", "mismatch" and not "error", are preferred, to indicate that the children's speech attempts deviate from the adult target. "Phonological processes" and "phonological deviation" are used synonymously to describe (but not explain) children's speech deviations from the adult target system. The term "target", is used in general, to refer to the targeting of new contrasts, except when describing the work of others, in which "targeting phonological processes" is used.

### **1.3 Models of Normal Phonological Development**

It has become axiomatic in the literature to say that, since so little known about normal phonological development, a cohesive and convincing linguistic theory of phonological disorders has yet to be formulated. Ingram (1989a) acknowledged various attempts in the field of linguistics to construct a phonological theory that covers both normal and disordered phonological acquisition. He believed that the most likely sources of elucidation of normal acquisition might be universalist theory (Jacobson, 1968), natural phonology theory (Stampe, 1969) or the Stanford University cognitive theory (Macken & Ferguson, 1983). Of the three, Stampe's is the only one directly tied to a phonological theory.



Plainly, a study of disordered phonological development must include detailed reference to the normal process of development, however limited the knowledge-base. An account of recent theories and findings relating to normal phonological acquisition follows.

### **1.3.1 The Behaviourist Model**

The behaviourist model dominated linguistics from the 1950's to the early 1970's. It applied a psychological theory of learning to explain how children came to distinguish and produce the sound system of the ambient language.

Adherents to the behaviourist model, among them Mowrer (1952, 1960), Murai (1963) and Olmstead (1971), identified the role of contingent reinforcement as gradually "shaping" the child's babbling to meaningful adult forms through classical conditioning. An important aspect of the model was the emphasis placed upon the continuity between babbling and early speech.

The behaviourists believed that the infant came to associate the vocalisations of the mother (usually) with primary reinforcements such as food and nurture, with the adult's vocalisations assuming secondary reinforcement status.

Eventually, the infant's vocalisations would become secondary reinforcers (providing self-reinforcement) due to their similarity to the adult model. From this point, the caregiver could refine the sound repertoire of the infant through selective reinforcement. The behaviourist framework, then, did not presuppose, or indeed show any interest in, an innate order of speech sound acquisition. The sounds acquired depended on the reinforcement obtained from the linguistic environment.

### **1.3.2 The Structuralist Model**

The structuralist model (Jakobson, 1941/1968), which stemmed from structuralist linguistic theory proposed discontinuity between babbling and speech. In addition, the structuralists postulated an innate, universal order of acquisition, with distinctive features

emerging hierarchically and predictably. Jakobson regarded babbling as a random activity virtually unrelated to the development of the sound system. Research evidence of regularities in prelinguistic vocal patterns (Ferguson & Macken, 1983; Oller, Wieman, Doyle & Moss, 1976) has weakened this position, however.

Research in the mid-1970's has also refuted Jakobson's hypothesis of a sequence of phonemic oppositions as the basis for the very earliest stages of phonological development. Kiparsky and Menn (1977) demonstrated that the child's word-count is too small to provide objective evidence of the distinctive features "unfolding" in the way proposed by Jakobson. Indeed, the developmental order of phonemic oppositions has proved very difficult to ascertain, since analysis has to take into account the adult targets attempted as well as the child's phonetic repertoire. To complicate matters, children seem to selectively avoid saying words containing certain consonants that are difficult for them to produce (Ferguson & Farwell, 1975; Schwartz & Leonard, 1982). Studies of evidence of lexical avoidance lent weight to the theory that early on, in the first-50-words stage, children target whole words (see Ingram, 1989a, pp. 17-22 for a discussion). The phonetic variability readily observed in children in the 9 to 18 months age range may also provide evidence against a universal order of phoneme acquisition. Irrespective of such shortcomings, Jakobson's views exerted a tremendous and lasting influence upon linguist thought. Ingram (1989a) for one, counted the structuralist model as one of the "*most likely candidates*" (p.162) for a theory of normal phonological acquisition.

### **1.3.3 The Biological Model**

Like Jakobson, Locke (1983b) stressed universality in his proposal of a biological model of phonological development. However, Locke emphasised biological constraints rather than linguistic ones. Rejecting Jacobson's idea of discontinuity between babbling and speech, Locke postulated relatively rigid maturational control over the capabilities of the speech production mechanism. For Locke, phonology began before 12 months of age with the pragmatic stage when certain babbled utterances gained communicative intent. At the same time the phonetic

repertoire was essentially "universal", constrained by the anatomical characteristics of the vocal tract. During the "cognitive stage" that followed, the biological constraints persisted while the child learned to store and retrieve relatively stable forms of phonemes learned from adult language models. At 18 months, in the "systemic stage", biologically determined babbling production patterns gave way to more adult-like speech. These speech attempts reflected phonologically the target language. Learning accounted for the acquisition of patterns found only in adult speech and loss of patterns not contained in it.

### **1.3.4 The Natural Phonology Model**

Meanwhile, Stampe (1969) had proposed his natural phonology model of phonological acquisition. Stampe (1969, 1973, 1979), expounding Natural Phonology, posited that children come innately equipped with a universal repertoire of phonological processes. These processes were "mental operations" that change or delete phonological units, reflecting the natural limitations and capacities of speech production and perception. In Stampe's view, natural processes amounted to articulatory restrictions, which came into play like reflexes. The effect of these "reflexes" was one of preventing accurate production of sound differences. This occurred despite the sounds' being perceived correctly auditorily, and stored as "correct" adult phonemic contrasts in the linguistic mechanism in the brain. The processes operated to constrain and restrict the speech mechanism per se.

Stampe thought that these universal, innate simplifications of speech output involved children's cognitive, perceptual and production domains. In essence, he believed that the processes simplified speaking in three possible ways:

1. given a potential phonological contrast, a process favoured the member of the opposition that was the least complex to produce.
2. it might favour the member of the opposition that was least complex to perceive.

3. it might favour the member of the opposition that was the least complex to produce and perceive. For instance, given the choice of saying /d/ or /ð/, the assumption was that /d/ was easier, because, in normal development, it was acquired earlier. Hence we find [dɪs] for /ðɪs/ (this).

Stampe postulated that, for normal speech acquisition, children had to suppress these natural phonological processes to achieve full productive control of the phonemes of the ambient language. He also believed that from the time they began using speech meaningfully, children possessed a fully developed, adult-like, phonological perceptual system. Thus, while they exhibited natural processes, they already had an underlying representation (mental image or internal knowledge of the lexical items) of the appropriate adult target form.

In his theoretical model of phonological development, Stampe relied heavily upon a deterministic explanation of phonological change. He maintained that children used processes for the phonological act of simplifying pronunciation. The progression to adult-like productions (for instance, the use of consonant clusters), represented mastery of increased constraints (upon output phonology). This development occurred through the suppression of natural processes and consequent revision of the universal system.

Phonological change occurred through a somewhat passive mechanism of suppression as part of maturation. Stampe did not consider the application of cognitive constraints related to the pragmatics of communication, or of the active learning of a language-specific phonology through problem-solving (cf. Cognitive Model). The natural phonology model inspired a wealth of research into phonological acquisition, analysis and description, whilst stimulating debate.

Possibly the most contentious aspect of Stampe's model was his claim that the processes were psychologically real. Smith (1973, 1979) challenged this position, and concluded from his research that there was no psychological reality to the child's system since there was no evidence for the reflex mechanism proposed by Stampe (1969, 1973) in applying phonological processes.

### **1.3.5 The Prosodic Model**

The prosodic model of Waterson (1971, 1981) introduced a novel theoretical construct. It involved a perceptual schema in which "a child perceives only certain of the features of the adult utterance and reproduces only those he is able to cope with" (Waterson, 1971, p.181) in the early stages of word production. Waterson (1971), Braine (1974, 1976), Macken (1980) and Maxwell (1984) asserted that both perception and production are incomplete at first. Both developed and changed before they could become adult-like. Unlike the more generally applied phonological process-based (segmental) description, Waterson's schema provided a gestalt of child production rather than a segment by segment comparison with the adult target. Waterson's approach is particularly useful in describing the word productions of very young children, and may explain those which do not readily appear to be reductions of adult forms.

### **1.3.6 The Cognitive/ Stanford Model**

The Stanford or cognitive model of phonological development (Ferguson, 1968; Kiparsky & Menn, 1977; Macken & Ferguson, 1983), and also Menn's (1976) work on the interactionist discovery model, has been influential in the construction of the therapy tested here, and construed the child as "Little Linguist". In problem-solving mode, he or she met a series of challenges and mastered them, thereby gradually acquiring the adult sound system. Because the child was considered to be involved actively and "cognitively" in the construction of his or her phonology, the term cognitive model was used. Phonological development was an individual, gradual and creative process (Ferguson, 1978; also Leonard 1985).

Most of the proponents of the cognitive model have been involved in the Stanford Child Phonology Project, and in fact the approach is often referred to as the Stanford model (Ferguson, 1978; Macken & Ferguson, 1983). The Stanford team proposed that the strategies engaged in the active construction of phonology were individual for each child, and influenced by internal (characteristics and predispositions of the child) and external (characteristics of the environment) factors. The external factors might include the child's ordinal position in the family,

family size, child rearing practices and interactional style of the primary caregivers. Longitudinal studies revealed evidence of strategies such as children's active hypothesis testing and problem solving as a vehicle for phonological acquisition (Menn, 1981; Macken & Ferguson, 1983).

### **1.3.6.1 Phonological Strategies**

Evidence of problem solving through hypothesis testing was found in several phonological strategies: namely, selectivity in early word choices (lexical avoidance) determined by production constraints (Ferguson & Farwell, 1975; Vihman, 1976); unique reduction devices to produce long words, using "exploratory forms" (Priestly, 1977); and regression (Leopold, 1947). The phonological strategies that children use during acquisition of the phonological system, described in the following sections, appear to have both a cognitive-linguistic component and a motor speech component.

Whilst evidence of the strategies is reported in the literature, particularly in the findings of the Stanford school (Macken & Ferguson, 1983), they have not been easy to define or identify. It is difficult, therefore, to ascertain their frequency of occurrence in children's speech. Most of the evidence for the existence of phonological strategies has come from detailed diary studies of phonologists' own children (e.g., Leopold, 1947; Priestly, 1977). They include lexical selection, idiosyncratic rules, homonymy (which has doubtful status as a phonological strategy), and regression.

#### **1.3.6.1.1 Lexical Selection (Lexical Avoidance)**

Probably the most readily observable strategy is lexical selection (also referred to as lexical avoidance). This selectivity in early word choices in children under two years of age has been cited as evidence that the child's first vocabulary is based partly on the phonological characteristics of adult words (Ferguson & Farwell, 1975; Schwartz & Leonard, 1982).

Longitudinal studies have shown that children will not only avoid sounds or sound patterns that are difficult for them, but also target words of *preferred* shape. A particular child may, for instance, avoid (not include) words with velar consonants, while another may choose (“prefer”) words with bilabial consonants. Ferguson, Peizer and Weeks (1973), for example, studied the speech of a child whose productive vocabulary began with only disyllabic words with open syllables beginning with stops or nasals (bye-bye, doggy, Mommy, patty (cake)).

Research by Stoel-Gammon (1988) has indicated that children differ in the word shapes and segments they prefer or avoid, according to their capabilities, and therefore target different early words. The phenomenon tends to disappear normally once a child’s vocabulary exceeds 60 words. In some children with developmental phonological disorders, restrictions on word shape and sound class persist, even with the development of quite large vocabularies (Stoel-Gammon, 1988). Stoel-Gammon and Dunn (1985) contended that lexical selection “*allows children to reduce the size and complexity of their early lexicon by limiting the phonological form of the adult words they try to produce*” (p. 51).

#### **1.3.6.1.2 Idiosyncratic Rules (Unique Reduction Devices)**

A second phonological strategy referred to as idiosyncratic rules (Connor & Stork, 1972; Grunwell, 1981a; Stoel-Gammon & Dunn, 1985; Grunwell, 1987) or unique reduction devices (Vihman, 1988), was described by Priestly (1977) and Smith (1973). Both Priestly and Smith conducted diary studies of their respective sons’ speech, and found that they had rule-governed ways of dealing with certain types of adult word forms, especially multisyllabic ones. Christopher Priestly, between the ages of 1;10 and 2;2, devised a single output pattern for many of his polysyllabic words, CVjVC, resulting in realisations like:

peanut [pijat]	farmer [fæjæm]	tiger [tæjæt]	seven [sɛjan]
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Whilst Christopher’s “exploratory forms” did not match adult forms segmentally, they did accurately, though idiosyncratically, achieve the appropriate syllable count.

In the author's clinical experience, Gail, a phonologically disordered child aged 5;2 ended all polysyllabic words with /'jV/, for example:

present	[paɪ'ji]	strawberries	[stɔ'ji]
tractor	[dʒæ'ji]	glasses	[ga'ji]
tricycle	[twa'ji]	tomatoes	[ma'ji]
ladder	[la'ja]	elephant	[ɛf'ja]

Such rule use is rarely documented, but provides a clear example of the basic tendency children have to simplify phonologically their word productions, perhaps thereby reducing the complexity of phonological acquisition.

#### **1.3.6.1.3 Homonymy**

In the age range 0;11 to 1;5, Daniel, a child studied by Stoel-Gammon and Cooper (1981), evidenced homonymy in his phonology. For instance, the words block, clock, frog, milk, quack, rock, sock and yuck were all pronounced as [gak]. Homonymy is a phonological strategy which allows children to produce a variety of target word-types using relatively few articulatory patterns (Stoel-Gammon & Cooper, 1981; Vihman, 1988). Homonymy may not be viewed as a strategy in itself, but rather as an outcome of simplification strategies, or as Grunwell (1985a) suggests, *"the lack of adequate phonological contrasts"* (p. 3).

#### **1.3.6.1.4 Regression**

Hildegard Leopold, studied by her father (Leopold, 1947) between the ages of 0;10 and 1;10 provides quite a celebrated example of advance forms or "phonological idioms" and the strategy or phenomenon of regression. Hildegard pronounced "pretty" as [pɹeti] at 10 months, but by 1;10 was realising it as [bɹidi], so that her production conformed to the rest of the forms in her productive vocabulary.



This apparent regression suggested that words are initially acquired outside of the child's system, a view which fits with Waterson's (1971, 1981) prosodic model, and learned as "idioms". Later they enter the system in a form which may need to be modified to become consistent with the system. The "regression" then represents an advance in systematisation. Stoel-Gammon and Dunn (1985) referred to phonological strategies as one of the "fuzzier" aspects of phonological development. It is true that they are difficult to isolate and have only been attested in diary studies of normally developing children. Future investigations of disordered phonological development may reveal a greater prevalence of them in the clinical population. Speculatively, it is possible that the phonological strategies, which apply briefly and elusively in normal phonological development, and which are subject to rapid change, may plateau, stabilise, and persist for longer in "arrested" disordered phonologies.

#### **1.4 Levels of Phonological Organisation**

Phonological systems are thought to involve rules, linking underlying representations with surface forms (see McGregor & Schwartz, 1992, for a review). The underlying or internal representations of words that children have stored mentally are unobservable directly, though they may be inferred, from the children's performance of speech perception and production tasks (e.g., McLeod & Isaac, 1995). Many linguists disagreed with Stampe's assumption that the perceived form is identical to the underlying representation in the child's mind. Several other proposals of the relationships between the perceived and the stored forms of words are available. Waterson (1971) favoured the view that the child perceives the adult word correctly but stores it in a simplified form with features or segments changed or deleted. Ingram (1976) tended towards this theoretical construct at one time. More recently though, he reviewed experimental studies and production data from children in the 18 to 48 months age range (Ingram, 1989b), concluding that:

*The evidence to date suggests that children at this time have reasonably good perception of the words they know, but not necessarily complete knowledge. There may be particular distinctions which are inherently more difficult and which may thus take longer to acquire.*  
(p.360)

Similarly, Macken (1980) posited accurate perception and accurate storage part of the time, coupled with misperception and storage in the misperceived form for some words or sets of words. Straight (1980), on the other hand, suggested two underlying representations: one for perception, which is adult-like, and one for production, which reflects the way the child says the word.

Both Stampe and Smith recognised only two levels of representation. Stampe saw phonological processes as mapping from the underlying representation to the surface phonetic representation, while Smith (1973) saw realisation rules assuming this function. Smith suggested accurate perception and accurate storage. Like Stampe, Smith insisted that the child's phonological rules or processes were innate, or learned very early. Ingram (1974) coined the term "organisational level" to connote a third, intervening component, related to, but distinct from, the perceptual representation of the adult word. A similar three level arrangement, implicit in Jakobson's distinctive features theory, was embraced by the cognitive or Stanford theory.

Smith rejected the hypothesis that each child has a unique system (Ferguson, 1968; Velten, 1943), and assumed full, accurate perception and storage of adult speech targets. He proposed a set of ordered and universal phonological tendencies and realisation rules. Realisation rules were physical expressions of abstract linguistic units. Any underlying form had a corresponding realisation in substance (Crystal, 1991; Lyons, 1968). In this instance, phonemes were "realised" or manifested in phonic substance as phones (whereby meanings were transmitted). Smith's view was that the processes acted as a filter between the correctly stored adult word and the set of sounds produced by the child. Again, the problem arose of the child being perceived as passively allowing the realisation rules to apply in reflecting the adult word.

To summarise, universal phonological tendencies are conceded by most contemporary thinkers in the area. The conventions of using the term “process” and the implementation of the realisation rules format are familiar, and widely accepted, aspects of systems of phonological description: take for example, Edwards & Shriberg (1983), Grunwell (1981a), Ingram (1976), and Stoel-Gammon & Dunn (1985).

## **1.5 Relationship between Phonological and Phonetic Development**

Phonological acquisition involves learning both phonetic and phonological features. The bulk of recent research into children's speech development has dealt with phonology: exploring and attempting to explain the process of the elaboration of speech output into a system of contrastive sound units. In recent years, there has also been a considerable body of research into the acquisition of motor speech control, bringing with it a renewed interest in the nexus between phonological development and phonetic development. Phonological development and phonetic mastery do not synchronise precisely. A common example of this asynchrony, referred to by Smith (1973) as the puzzle phenomenon, is provided by children who realise /s/ and /z/ as [θ] and [ð], while producing “th-words” with [f] in place of /θ/, and [d] or [v] in place of /ð/. The following classic example of phonetic ability preceding phonological execution came from the author's client Andrew, aged 4;6:

some	[θʌm]	thumb	[fʌm]	yellow	[ˈɛlɒs]	zoo	[ðu]
then	[dɛn]	those	[dɒθð]	glove	[gwʌb]	breathe	[bwiv]
brother	[ˈbwʌzə]	globe	[blɒsb]	rabbit	[bræbrɪt]		

Evidence from studies of lexical selection provides support for the view that children are “aware” of their phonetic limitations very early (i.e., during the first 50 words stage) (Ferguson & Farwell, 1975; Schwartz & Leonard, 1982). How conscious the awareness is, of course is uncertain, but children do seem to reflect limitations of motor speech control in their early word choices.

Does this mean that the speech motor mechanism of young children is in fact immature? Studies of duration, co-articulation (Kent, 1982; Hawkins, 1984) and variability (Smith, Sugarman & Long, 1983) in children's speech have demonstrated that this is likely to be the case. Hawkins (1984) reviewed a series of comparative studies of child and adult segment and phrase durations, concluding that children tend to have longer durations, and hence slower speech rate. Hawkins also found that children show greater intrasubject variability of speech segment and phrase durations than adults. Smith, Sugarman and Long (1983) demonstrated that such variability was due in large part to immaturity of the neuromotor mechanism for the control of speech movements.

Co-articulatory ability, or the normal capacity to produce an overlap between speech sounds, caused by an overlapping in the sequence of gestures which produce them, has been thought by Kent (1983) and others, to increase with age. Later studies of co-articulatory ability (Repp, 1986, Sereno and Liebermann, 1987), suggest that speech rate and variability are more relevant predictors than the age of the child. They showed that the development of co-articulatory ability varied widely from child to child, and that the length of time a sound had been in a child's repertoire may be more significant than chronological age in predicting co-articulatory ability. Sereno and Liebermann (1987), in a study of children aged 2;8 to 7;1, found no correlation between age and co-articulatory ability.

Further evidence that phonetic development is implicated in the development of phonological contrasts comes from the frequent observation that phonological contrasts are realised in the child's speech, albeit inaccurately, as they gradually perfect their phonemic realisations of target forms.

Children's progress towards the adult targets of /s/ and /r/, commonly via interdental and labialised versions, respectively, are examples of the "perfecting" process that takes place. Menn (1983) summed up the complex (and fascinating) interplay between the levels of development and learning of phonological and phonetic processing:

*The mismatches between adult model and child word are the result of the child's trial and error attempts; they are shaped by the child's articulatory and auditory endowments (and this to that extent are 'natural') and by the child's previous success in sound production. All rules of child phonology are learned in the sense that the child must discover for herself each correspondence between the sounds she hears and what she does with her vocal tract in an attempt to produce these sounds. (p. 44)*

## **1.6 The Process of Early Speech Development**

Ferguson (1978), in a study of early speech development, concluded that phonological development involved both input and output systems. Phonological development showed individual variation among children, with the gradual extension and regularisation of the child's pronunciation system. Ferguson found the starting point of phonological development per se difficult to isolate.

The difficulty of discerning when babbling stops and phonological organisation begins was exemplified in a study of infant babbling by Oller, Wieman, Doyle and Ross (1976), showing that babbling involved vocalisations with syllabic structure. Oller et al. (1976) believed that these characteristics provided evidence that babbling is governed by the same restrictions on human phonological capacity that govern children's first words. Babbling, and early words, appeared to show the natural phonetic preferences of the speech production mechanism before phonological development begins (i.e., before the constraints of the language being learned came into play). Thus, there was an observable "mechanical" relationship between prelinguistic meaningless vocalisations and meaningful words. It has also been observed that babbling and word-use overlap and co-exist in a child for a period (Kaplan & Kaplan, 1971; McCarthy, 1954). According to Oller et al, a babbled utterance was one which was apparently meaningless, but contained a consonantal element (i.e., syllable margin), at a time when the child was neither laughing nor crying. The characteristics of babbling observed by Oller et al. (1976) included:

<b>Structure</b>	<ul style="list-style-type: none"> <li>• A predominance of simple CVCVCV... strings, with few, if any consonant clusters, and a predominance of open syllables.</li> </ul>
<b>Articulatory Features</b>	<ul style="list-style-type: none"> <li>• Stops more frequent than fricatives, especially syllable-initially.</li> <li>• Fricatives more frequent than stops syllable-finally.</li> <li>• Glides /w, j/ more frequent than liquids /l, r/ .</li> </ul>
<b>“Phonological” Features</b>	<ul style="list-style-type: none"> <li>• A tendency for final obstruents to be voiceless.</li> <li>• A slight preference for apical consonants as against “back” consonants.</li> </ul>

Various researchers have proposed a developmental stage between babbling and word use, which is characterised by the appearance of transitional forms (Dore, Franklin, Miller & Ramer, 1976; Ferguson, 1978; Menyuk & Menn, 1979). Menyuk and Menn (1979) described transitional forms as proto-words, or prototypes of children's early “real” words. Proto-words are relatively consistent in phonetic structure, are related or associated, apparently deliberately, to situations, needs and affective states, and function linguistically to signal meaning. They do not however resemble adult words phonetically. Soon after their emergence, real words appear.

In the period between 9 and 18 months the organisation of productive speech appears to be word-based (Ferguson & Farwell, 1975). The words used at this time not only have considerable phonetic variability, but also wide semantic reference. Between 18 and 24 months, the child will have acquired an active vocabulary of about 50 words. At this point, two-word combinations begin to appear, and the active creation of the phonological system begins.

### **1.6.1 Hewlett's Two-Lexicon Model of Speech Processing and Production**

Hewlett (1990) proposed a two-lexicon model of speech processing and production. The input lexicon stored perceptually based phonological representations that reflected the phonological contrasts available to the child in decoding speech, and the output lexicon contained corresponding articulatory based phonological representations that reflected the child's pronunciation abilities.

The model provided for a view of developmental phonological disorders as a temporary delay or deviation in an essentially normal speech processing and production mechanism. This temporary failure to realise target forms, and persistence in applying inherent rule simplifications may, Hewlett hypothesised, have resulted from breakdown at various levels, such as difficulties with motor execution, lack of perception of sound feature distinctions, or a difficulty finding a solution to the perceived discrepancy between the target and the child's own form.

In proposing the model, Hewlett suggested a possible explanation for certain phonological processes and strategies. He stated, for example, that in normal development the input lexicon is almost certain to be richer in contrasts than the output lexicon. In support of this assertion, he cited the lexical selection experiments of Schwartz and Leonard (1982), which studied the behaviour of children who, for instance, could judge velar fronting accurately as wrong, but who still produced velars with the fronting process. Hewlett posited that, in such cases, words would have accurate representations in the "in" lexicon, but not in the "out" (as long as the problem is not at a phonetic level).

The input lexicon contained perceptual representations in terms of auditory perceptual features. Through realisation rules, perceptual realisations were mapped onto articulatory representations. Hewlett gave the example of a velar fronting rule in which the auditory-perceptual features associated with /k, g, ŋ/ would be mapped onto place of articulation values similar to those for /t, d, n/ in the output lexicon.

Hewlett hypothesised that once a non-adult lexical representation had become established in the output lexicon, the only way it could be revised would be by accessing it again directly from the input lexicon, and producing it via the motor programmer. The motor programmer would then devise a (partially) new motor plan for it. The revised plan would then be refined and practised until its validity could be acknowledged (in the input-output mapping rules), with resultant change in the output lexical representation.

Hewlett's (1990) explanation for lexical avoidance was that while children have perceptual representations for "out" words, *"these words would have no corresponding representation in articulatory terms (either correct or incorrect); they are simply unpronounceable by the child"* (p.28).

## **1.7 The Pre-requisites for a Model of Normal Phonological Development**

Stoel-Gammon and Dunn (1985) listed four basic interacting components necessary for the formulation of a model of normal phonological development. These components fit coherently with the two-lexicon model proposed by Hewlett, with the cognitive and interactionist-discovery approaches (Macken & Ferguson, 1983; Menn, 1976), and with what is known of the neuropsychological processes involved (Chiat & Jones, 1988; Hewlett 1990; Kent, 1988; Vihman, 1988). The components listed were:

- *Auditory-perceptual component*, encompassing the ability to attend to and perceive linguistic input.
- *Cognitive component*, encompassing the ability to recognise, store, and retrieve input, and to compare input with output.
- *Phonological component*, encompassing the ability to use sounds contrastively and to match the phonological distinctions of the adult language.
- *Neuromotor component*, encompassing the ability to plan and execute the articulatory movements underlying speech.



## **1.8 Towards a Theory of Disordered Phonological Development**

Although some clinical research has involved the study of the characteristics of developmental phonological disorders, it is only recently that testable research questions about the nature of the underlying learning disorder that phonological disability reflects have been formulated in the literature. As Ingram (1989a) made clear, these questions are posed in the absence of a proven theory of: (a) phonology, (b) phonological acquisition, or (c) disordered phonological acquisition.

Discussing the need for a theory of disorders, Gibbon and Grunwell (1990) articulated a cogent (but as they said, tentative) proposition that phonologically disabled children may be handicapped primarily in their speech development by a specific language learning disability. They cited Leonard (1985), who portrayed the normal process of developing phonology as one in which the child was *"an active learner who created knowledge from the environmental input"* (p.4). If that were indeed the case, argued Gibbon and Grunwell, then developmental phonological disorders might reflect a constraint on this active learning process which resides somewhere in the speech processing or production mechanisms, preventing or altering the acquisition of phonological knowledge. Gibbon and Grunwell (1990) suggested five reasons, which may occur singly or in combination, for why phonologically disabled children are not, or have apparently stopped being active learners:

1. *The child may be overwhelmed by the phonetic complexity of the sound patterns he or she is exposed to, and unable to abstract new information from the speech environment;*
2. *The child's maturation may be severely delayed so that for an unduly long period speech production potential is restricted by persisting output constraints;*
3. *the child's phonological organisation may be habituated, so that cognitive flexibility to form new hypotheses is suppressed;*
4. *a lack of intrapersonal feedback and awareness may compound these problems;*
5. *the presence of variability may suggest an inability to initiate systematic change and regularise the organisation of phonological knowledge. (p. 148)*

Such hypothetical explanations of the nature of disordered phonological development remain largely untested. Nonetheless, they offer some guidance for clinical intervention. Gibbon and Grunwell went on to say:

*While a certain amount of articulation training may be necessary to stimulate further phonetic maturation, the main focus in therapy should be on phonological patterning. Procedures should concentrate on facilitating the child's perceptual encoding strategies and the storage of systematic patterns from the target system. To varying degrees, depending on the needs and difficulties of each individual child, the child also needs to become aware of how the target system is organised and functions in order to assist him in the cognitive reorganisation of his own system. (p.148)*

## **1.9 Phonological Development and Literacy**

When a child's gradual mastery of his or her phonology appears to be going awry, or has plateaued for too long, a conclusive diagnosis of phonological disability cannot be made until around 4;0 years of age (Grunwell, 1989). Applying this principle in the Australian school systems, children are usually diagnosed during the year prior to commencing school. On average in New South Wales children enter Infants School (comprising Kindergarten, Year 1 and Year 2) at the age of 4 years 9 months. When they do engage in therapy, many of their parents voice concern about the probable consequences of phonological disability for later literacy skills acquisition; there is ample research evidence to suggest that these concerns are sometimes justified (Hall & Tomblin, 1978; King, Jones & Lasky, 1982; Lewis & Freebairn, 1992).

Stackhouse (1993) discussed the confusion in terminology that can arise when the various terms containing the word "phonological" are employed. She proposed that the term "phonological disorder" should be used to describe a child's speech output difficulties (involving a loss of contrastivity, thus reducing intelligibility), and "phonological processing disorder" should refer to the underlying cognitive deficits that a phonologically disordered child might have. She

used the term “phonological awareness training” in the same sense as Goswami and Bryant (1990), to refer to the ways in which words and syllables can be divided into smaller units.

There is an impressive body of research evidence to indicate that there are reciprocal influences between the skills involved in phonological awareness and normal literacy acquisition (Perfetti, 1991; Torgesen, Wagner & Rashotte, 1994), although phonological disability does not necessarily lead to later literacy problems (Bird, Bishop & Freeman, 1995).

Bird, Bishop and Freeman (1995) compared the literacy acquisition of a group of normal children, with two groups of children with phonological disabilities, either with or without additional language problems. They demonstrated that the severity of the children's phonological disabilities in relation to age was an important predictor of literacy outcomes. While stressing that expressive phonology was but one of many linguistic influences in learning to read, Bird, Bishop and Freeman concluded that children who have severe phonological impairments when they start school are at “particular risk” for reading and spelling problems. From their research, it appeared that the basis for such problems was a deficit in analysing speech input into syllabic units, resulting in problems not only with speech production, but also with learning an alphabet reading strategy.

The intelligence of the children clearly determined whether such a deficit would result in serious educational problems. It appeared from their findings that bright children with good language skills were able to compensate for their phonological deficits, and achieve at least adequately in learning to read and write. On the other hand: *“Phonologically impaired children of average nonverbal ability with poor language skills have insufficient resources to implement alternative nonalphabetic strategies and are at very high risk for serious literacy problems”* (p. 460).

## **1.10 Synthesis**

The principles, or theoretical assumptions, upon which any intervention approach is based, derive first from a theory, or theories, of normal phonological development (i.e., how children normally learn the speech sound system through a combination of maturation and learning).

Arising from the practitioner's beliefs and assumptions about normal development, comes a theory of abnormal phonological development (i.e., a theory of disorders, explaining why some children do not acquire their phonology along typical lines). From the theories of normal and abnormal acquisition, and their formalisms, a theory of intervention has evolved. As Ingram (1989a) stated, in the case of phonological intervention, *"Therapy will be based on the individual child's needs, according to the linguistic analysis of his speech and what is known about the process of acquisition"* (p. 131).

The nature of the theory of intervention depends upon how the individual clinician understands, interprets, incorporates, adapts and modifies knowledge about normal and abnormal acquisition, and what theoretical assumptions are made in the process. A theory of *phonological* therapy (i.e., how best to accelerate phonological development, and hence speech clarity, beyond the progress expected with age in phonologically disabled children) must logically rely upon assessment procedures that are congruent with the interventionist's theories of development, disorders and intervention.

An emphasis on the need for congruence and consistency between phonological theory and the process and form of assessment and intervention does not imply that the clinician cannot be theoretically eclectic. Many clinicians would agree that Grunwell's (1985a) position on eclecticism and phonological assessment is also applicable to intervention:

*This [theoretical eclecticism, drawing from a variety of theoretical schools of phonology] does not necessarily result in an unprincipled approach, provided that the analytical techniques [and one could just as easily insert “intervention techniques”] are motivated by clearly defined clinical aims. Indeed a hybridisation of different theoretical approaches may lead to new insights for the theoretical phonologist as well as applicable management guidelines for the practitioner. (p. 4)*

## **1.11 Thesis Outline**

Having introduced key concepts and described some prominent theories of phonological development in Chapter 1: PHONOLOGICAL THEORY AND DEVELOPMENTAL PHONOLOGICAL DISORDERS, it is intended in Chapter 2: CLASSIFICATION, MEASUREMENT, ASSESSMENT AND THERAPY, to discuss briefly methods of classifying and measuring the severity of developmental phonological disorders. Then will follow an account of the historical course of speech-language pathology practice in assessing and treating phonological disability, including examples of group studies and individual case examples.

Chapter 3: THE THERAPEUTIC MODEL, RESEARCH QUESTIONS AND HYPOTHESES, includes a detailed account of the proposed therapeutic model and its theoretical rationales. Fey's (1992b) framework for analysing the form of phonological therapy is applied in discussion of the components of the model, and how it fits with the theoretical background. Chapter 3 concludes with the current research proposal, and its questions and hypotheses.

Chapter 4: METHOD, and Chapter 5: RESULTS AND DISCUSSION, contain respectively, the research methodology, and the results and a discussion of the study, while Chapter 6: THE THERAPEUTIC MODEL IN PRACTICE, comprises four detailed case studies. Finally, in Chapter 7: GENERAL DISCUSSION AND CONCLUSIONS, the findings and implications of the research for clinical practice and further research applications are reviewed.

## **CHAPTER 2**

# **CLASSIFICATION, MEASUREMENT, ASSESSMENT AND THERAPY**

An examination of the work of Morley (1957) revealed that, at that time, children with speech production problems were classified descriptively, by speech therapists, into two broad categories: those with delayed speech development, and those with defective articulation. Within the second group, of course, were the children with dyslalia or functional articulation disorder, which was, by definition, a childhood speech disorder of no known aetiology. Clinicians in the 1950's and early 60's were not greatly concerned with the nature of disordered speech per se. Rather they were more interested in considering the nature of children with speech disorders, and the quality of the linguistic and emotional environments in which they lived.

### **2.0 Classification**

There are few accounts in the early speech-language pathology literature of disordered speech, but many descriptions of children's performance on sensory, cognitive motor and perceptual tasks, and of the psychological factors presumed to contribute to poor speech development. This aetiological approach to classification was adopted apparently in the belief that if problems in "underlying" areas could be detected and addressed, speech would improve or be more treatable. There was consensus within the speech-language pathology profession in its acceptance of the classification system, thereby giving the profession an agreed terminology.

In making the paradigm shift from functional articulation disorders to developmental phonological disorders, the profession lost track of its shared classification system. Arguing the case for a common terminology, or descriptive-explanatory framework for child phonology, Shriberg (1993, 1994) proposed a system similar to the Diagnostic and Statistical Manual of Mental Disorders - IV (DSM-IV) (American Psychiatric Association, 1987).

The system Shriberg was developing and promoting was intended for genetics research, and examined speech as a bio-behavioural trait. It comprised five subgroups of children with developmental phonological disorders, and was based on descriptive data (rather than on aetiology) such as: age at onset, course, subtypes, gender distribution, prevalence, familial pattern and differential diagnosis.

## **2.1 Measurement**

Shriberg (1993) discussed various means of quantifying the severity of phonological disability including the Articulation Competence Index (ACI) based on measures of the Percentage of Consonants Correct (PCC) and "clinical distortions" (i.e., labialised or velarised /l/ or /r/, lateralised sibilant fricatives or affricates, derhotacised /r/, /ʒ/, or /æ/, and dentalised sibilant fricatives or affricates) measured by the Relative Distortion Index (RDI). The Articulation Competence Index was calculated with the formula:  $ACI = (PCC + RDI) \div 2$ .

The PCC (Shriberg & Kwiatkowski, 1982) was based on a conversational sample of at least 100 words, as follows:  $PCC = (\text{Sum of Correct Consonants} \div \text{Sum of Consonants}) \times 100$ . The authors provided comprehensive instructions for error definition and identification. They suggested the following divisions for the PCC scores, in quantifying the severity of phonological disorders:

80-100% consonants correct	Mild
65-85% consonants correct	Mild-moderate
50-65% consonants correct	Moderate-severe
<50% consonants correct	Severe

Shriberg (1993) was emphatically opposed to using linguistic constructs such as phonological processes as the basis for the measures described, preferring speech sounds (phones), as the linguistic unit of analysis. His argument for this preference was that by having a system linked to the:

*...classic structuralist perspective that manifest speech sounds occur in five forms relative to their phonemic status in a language (correct, omission, substitution, distortion, addition), severity and error-profile analysis based directly on speech-sound production would seem to allow the most direct (i.e., least abstract or least theoretically laden) approach to speech assessment for the complex of questions involved in phenotype research in developmental speech disorders. (p. 110)*

Approaches to measurement with a more clinical intent have been proposed by several researchers. Hodson and Paden (1983), for example, developed a Composite Phonological Deviancy Score, based on the percentage of occurrence of phonological processes (see 2.2.6), calculated with the  $INCIDENCE = (\text{Sum of Deviations} \div \text{Sum of Opportunities}) \times 100$ , formula, following the administration of *The Assessment of Phonological Processes* (Hodson, 1980).

In the Hodson and Paden (1983) protocol, processes were allocated to two categories: basic deficient patterns, of which there were 10, and critical deficient patterns, of which there were 12. Scores were loaded with "compensatory points" as the children increased in age, and also in terms of the number of critical deficient patterns present in their data. The procedure, which is outlined in careful detail in Hodson and Paden (1983), enabled the calculation of Composite Scores and corresponding Severity Intervals, as follows:

Composite Score	Severity Interval
< 24	Mild
25 - 49	Moderate
50 - 74	Severe
> 75	Profound



In tandem with their Composite Phonological Deviancy Score, Hodson and Paden (1983) applied a measure of “*four general levels of intelligibility*” (p. 36): Level 0 Patterns through Level III Patterns.

Another system was proposed by Edwards (1992). Edwards discussed her proposal for a Process Density Index (PDI), which estimated the number of processes “*packed into*” (p. 236) each word in a test or assessment procedure, or in a conversational speech sample. The formula for the procedure was:  $PDI = \text{Sum of Processes per Word} \div \text{Sum of Words in the Sample}$ . Thus, unlike Shriberg's PCC measure of phonetic matches, Edwards' PDI was a measure of phonological mismatches.

The Hodson and Paden approach (Composite Phonological Deviancy Score) probably served its purpose well as an “in house” measure for their pioneering research. However, it has a number of limitations, especially in terms of its construction and validity, and therefore does not generalise well to other settings. Edwards' PDI has little appeal, and would be impossible to apply meaningfully with unintelligible children.

Of the three measures described, Shriberg's is the most practicable. It is clearly not a very informative measure of phonological change for the interventionist, but has enormous advantages for genetic research and cross-laboratory collaborative scholarship, as discussed, most persuasively, by Shriberg (1994). None of the three measures were considered suitable for the present study.

## **2.2 Assessment**

The assessment protocols for analysing speech sound errors which have evolved over the years have all been regarded by their proponents as being the first step in remediation. All have therefore influenced, to some extent, the form of subsequent intervention. Because of this connection between assessment and therapy, clinical practitioners have perceived them to have some explanatory value (Kamhi, 1992a; Shriberg, 1994).

### **2.2.1 Evaluation of Connected Speech and Phonetic Inventory**

Fairbanks' (1940) *Evaluation of Connected Speech and Phonetic Inventory* was an early means of assessing communicative adequacy, and of viewing sound errors systematically in the context of connected speech. He advised the collection of a speech sample comprising spontaneous monologue and reading or picture naming, as a basis for a systematic description of speech, using the *Evaluation of Connected Speech* protocol.

The protocol involved seven parameters: articulation, pronunciation, time, pitch, intensity, vocal meaning and voice quality. Each parameter was scaled from one to seven as Inferior, Very Poor, Poor, Average, Good, Very Good or Superior, with a final overall rating for Total Effect. The speech sample was then analysed using a phonetic inventory of 17 vowels and 24 consonants, with error types classified as substitutions, omissions, distortions and slighting (not defined).

### **2.2.2 Traditional (Sound-by-Sound) Analysis**

Many speech-language pathologists would consider the type of sound-by-sound analysis advocated by Berry and Eisenson (1956), Van Riper (1934) and Van Riper and Irwin (1959) to be "traditional". Rooted in American structuralism (Schwartz, 1992), typically, such an analysis comprised a spontaneous speech sample and a three-position sound inventory in which the client named single words in response to picture stimuli. Connected speech sample analysis was an essential adjunct to the three position test. Berry and Eisenson (1956) commented, "*In any study of speech production, the best measure is probably a tape recording of the child's spontaneous and continuous speech, from which a record of sound omissions, substitutions and distortions can be made*" (p.118).

The three position tests allowed clinicians to identify error phonemes as separate entities in need of remediation in terms of a motor production (articulation) problem. Sound-by-sound analysis was well-suited to the population for which it was originally intended, and there is

general agreement in the literature that it is still the most suitable and efficient one to use to assess children with just a few sound errors (Bernthal & Bankson, 1981; Elbert & Gierut, 1986; Shriberg, 1982). Particularly in America in the 1940's to the 1970's, speech therapists were greatly concerned with school-aged children whose errors involved only a few target sounds, notably /s/, /r/, /l/ and /θ/. The procedure, which identified sound errors and then checked them against developmental norms to ascertain whether they warranted intervention, was an economic and logical approach that facilitated treatment decisions.

### **2.2.3 Distinctive Feature Analysis**

Distinctive(ness) is a term used in linguistics for any feature of speech or writing which enables a contrast to be made between phonological, grammatical or semantic units. The predominant use of the term has been in phonology, as part of the term "distinctive feature", where it refers to a minimal contrastive unit, which some linguists have recognised as a means of explaining how sound systems are organised (Crystal, 1991). Chomsky and Halle (1968) introduced a method of phonological analysis of phonemic systems which relied upon distinctive features. Distinctive features can be used to group phonemes into classes. For example, the English phonemes /m, n, ŋ/ make a class of nasals because of the common feature of + nasal. The phonemes /p, t, k/ share features of manner and voicing. They are all voiceless stops (plosives) and thus form a class. The publication of Chomsky and Halle's (1968) thirteen-feature approach, with all the features being defined in articulatory terms stimulated further interest and research into clinical applications.

The thirteen paired features did not conform to the familiar place-voice-manner template which had influenced phonemic analysis for many years. A binary approach to feature analysis had been favoured by linguists since Jakobson's study of the opposition of the features of phonemes in 1932. Jakobson, Fant and Halle (1952) attempted to develop a universal system of phonology based on twelve acoustic features. Nine of the twelve features were sufficient to define twenty three consonants and six vowels in English.

There was an essential discrepancy between the purposes of Chomsky and Halle (looking for a universal system) and of speech-language pathologists who were concerned with children's' pronunciation difficulties within one language. The system was not designed for speech-language pathology clinical work. However, a number of serious attempts were made to adapt the model for clinical application. Miller and Nicely (1955) made an early but incomplete attempt at a clinically applicable system. Many years later, Singh (1976) built on the work of Miller and Nicely (1955) and produced a system suitable for the analysis of disordered speech which was also relevant to treatment planning. Stoel-Gammon and Dunn (1985) devised a feature system which was an expansion of the Chomsky-Halle system, describing the consonantal system in primarily articulatory terms, and using the features the authors considered to be most useful in the clinical description of normal or disordered developing phonologies.

The distinctive features construct was not without controversy. Some of the issues debated were: (a) the concept of gradual versus binary features (Foley, 1970), (b) coarticulatory influences defying dichotomisation of phonemes in context (Leonard, 1973), and (c) the importance of variability, rather than presence or absence of features (Walsh, 1974). As a result of such debate Anderson (1974) promoted the concept of multivalued features, Sommerstein (1977) roundly criticised the binary system, and Johnson (1980) devised a matrix of phonetic feature, combining distinctive features and place-manner-voice. Whilst distinctive feature analysis offered a systematic way of detecting patterns of sound errors, it probably had more value for theoretical linguists than for speech clinicians, especially as it made no provision for sound distortions (Walsh, 1974), nor did it take into account co-articulatory influences (Leonard, 1973).

#### **2.2.4 Place-Voice-Manner Analysis (PVM)**

PVM analysis was also developed in the 1970's, contributing to the trend of looking at speech sound errors in a more systematic way and taking the effects of phonetic environment

into account. Proponents of the approach rejected the notion of initial, medial and final positions for consonants as individual phonetic entities which could be "analysed" out of context.

In PVM analysis the relationships among error sounds within the phonological system, using the broad phonetic feature classifications of place, voice and manner of articulation, was central (Compton & Hutton, 1978; Fisher & Logemann, 1971; Turton, 1973; Weber, 1970). The speech sample for PVM comprised whole-word transcriptions, and, if desired, a transcription of connected speech. Once the transcription had been made, the information was organised on a data sheet according to the features of PVM. The "place" categories were arranged from front to back: i.e., labial to glottal. The "manner" classifications were nasals, stops, fricatives, affricates, liquids and glides. "Voice" was coded as voiced or voiceless. Instead of the descriptors initial, medial and final, the designations prevocalic, intervocalic and postvocalic were applied. The convention of using the term intervocalic was especially useful in polysyllabic words where the notion of the medial position was complicated (e.g., elephant, apricot). Provision was also made in the PVM analysis for observation of consonant clusters and the child's phonetic inventory.

The PVM analysis was relatively quick and straightforward to conduct, and allowed a visualisation of error patterns which might facilitate the development of efficient treatment decisions. Like the three-position and distinctive feature analyses, PVM provided a comparison of the child's production with the adult model. PVM analysis did not lead to a radical change in therapeutic intervention. Even though the analysis provided a systematic way of observing sound class errors, therapy still concentrated on phonetic production ("articulation").

### ***2.2.5 Phonological Process Analysis***

In the four analyses described above, the focus was on the phonetic aspects of speech in children, whose speech was described relative to adult target sounds. In the mid-1970's came a change in focus away from comparing children's production with the adult model, towards phonological analysis, which gave a view of the child's own system. Phonetic aspects were not discounted, but new emphasis was given to linguistic considerations.

Phonological processes are evident in the latter stages of pre-linguistic development (Oller et al., 1976) and in the early speech of *all* children, gradually disappearing as the child's speech becomes adult-like. Stoel-Gammon and Dunn (1985) allocated processes to two groups:

**Processes Disappearing by 3;0**

Unstressed syllable deletion  
Final consonant deletion  
Doubling  
Diminutization  
Velar fronting  
Consonant assimilation  
Reduplication

**Processes Persisting after 3;0**

Cluster reduction  
Epenthesis  
Gliding  
Vocalization  
Stopping  
Depalatalization  
Final devoicing

Stoel-Gammon and Dunn noted that some of the processes in the left hand column never appear in the speech of some children. The most widespread processes appeared to be unstressed syllable deletion, final consonant deletion, gliding and cluster reduction, which are present in the speech of almost all children. Some years before, Grunwell (1981b) had classified processes as either structural or systemic simplifications:

**1. Structural Simplifications**

Weak syllable deletion  
Final consonant deletion  
Vocalization  
Reduplication  
Consonant harmony  
Cluster reduction

**2. Systemic Simplifications**

Fronting  
Stopping  
Gliding  
Context sensitive voicing

Discrete stages for the appearance and disappearance of processes at all age-levels have not yet been confirmed. However, Grunwell (1981b) developed a clinically valuable *Chronology of Phonological Processes* (see Appendix A), which gives a sense of what happens in normal development, and which Grunwell (1987, pp. 115 & 231) later incorporated into her *Profile of Phonological Development* (the Developmental Assessment in the PACS). Vihman (Grunwell, 1987, personal correspondence) carried out an empirical investigation that verified the age norms at 3;0 provided on the chronology chart.

### **2.2.6 The Desirability of Eclectic Assessment Approaches**

Acknowledging that the phonological analysis of children's language has been a highly researched area since 1976, Ingram (1989a) was critical of the exclusive concentration of most clinical researchers (e.g., Hodson & Paden 1983; Khan & Lewis 1986; Shriberg & Kwiatkowski, 1980; Weiner, 1979) upon phonological processes to the exclusion of other factors. Specifically, Ingram felt that determining the child's phonetic inventory, substitution patterns and phonological features were often neglected. An example of an incomplete set of procedures is Crystal's (1982) Profile of Phonology (*PROPH*) which makes provision for an ample phonemic assessment, but does not identify process patterns, communicative implications or developmental status. Similarly, Elbert and Gierut's (1986) assessment of productive phonological knowledge, which construed a child's phonology as a unique embryonic adult system, involves gathering a detailed record of the child's pronunciation system without identifying mispronunciations or developmental status.

By contrast, Stoel-Gammon (1988) considered that an analysis of a child's phonology should involve an independent and a relational analysis. The independent analysis comprised a phonetic inventory and distribution analysis, looking first at the adult words a child attempts to produce in continuous speech in terms of restrictions on word shape or sound class which might occur due to lexical avoidance. Second, the independent analysis examined the child's production without reference to the adult model. It included an inventory of syllables and word shapes and a statement of sequential restraints, if any.

The relational analysis compared the child's production with an idealised version of the adult target form. Mismatches were identified by sound class and position within the word, combining elements of traditional analysis and PVM, and patterns were identified and described in terms of phonological processes. Stoel-Gammon (1988) summarised the information available once the two analyses were complete:

1. *what the child attempted to produce (independent analysis of adult forms);*
2. *what the child actually produced (independent analysis of child's corpus);*
3. *what was produced correctly (relational analysis);*
4. *what was produced incorrectly (relational analysis);*
5. *the nature of the incorrect productions*  
*(phonological process analysis and identification of other errors); and*
6. *the extent or percent occurrence of the phonological processes and other errors identified. (p. 19)*

In common with most other process analysis systems (e.g., Hodson, 1980), the percentage occurrence of each process was estimated by dividing the number of actual occurrences by the number of "opportunities" (potential occurrences). A limitation of the procedure was that it did not include a contrastive analysis (cf. Grunwell, 1985a).

Grunwell's (1985a) *Phonological Assessment of Child Speech (PACS)* is comprehensive and clinically practical, despite Ingram's (1987) concern that it was lengthy to perform the analysis. The *PACS* consists of ten procedures: (1) phonetic inventory and phonetic distribution, (2) systems of contrastive phones, (3) contrastive assessment, (4) phonotactic analysis and assessment, (5) phonological process analysis, (6) developmental assessment, (7) assessment of feature contrasts, (8) assessment of communicative adequacy, (9) assessment of variability, and (10) assessment of homophony (see 2.5 for further discussion).

### **2.2.7 Limitations of Analyses that Emphasise Phonological Processes**

There are several potential difficulties with analyses that have as their prime focus the identification of phonological processes. The first is probably immediately obvious to clinicians, and that is they provide no objective information about intelligibility. This disadvantage can be



overcome by including a descriptive statement about intelligibility, under a variety of speech conditions, in the assessment report, and considering it in any discussion. The second problem with process-based analyses was summed up by Locke (1983) when he wrote *"that calling a pattern a phonological rule or process is only a descriptive exercise. The existence of the pattern does not necessarily explain anything; the pattern itself is in need of explanation"* (p.340). Judging from the literature, and from discussions with other clinicians, the issue of the distinction between description and explanation (in a clinical phonology context) does not seem to have been as apparent to clinicians.

In clinical practice, the tendency still seems to be for clinicians to conceptualise developmental phonological disorders as a disorder somehow caused by the presence or persistence of the processes. This may be partly due to a lack of theoretical rigour, and partly to a sort of "clinical shorthand" used in simplifying technical information for clients, and eventually incorporated in an oversimplified form into the therapist's theoretical beliefs. To say, however, that a particular child's developmental phonological disorder is due, for instance, to the processes of fronting and cluster reduction, is comparable to saying that chickenpox is a skin disease due to the processes of rashing and itching! The processes do not explain the phonological disability any more than the rash explains the chickenpox.

Nonetheless, in practice, the speech-language pathologist has to find a way of explaining the aims of assessment to parents and caregivers, and this inevitably leads to a view of the symptom as the disorder and a simplistic view of what is happening with the child's speech. The tangible evidence of the disorder, the processes, are measured prior to, and at the completion of the therapy, and at stages in between, to provide an objective record of progress and a basis for explanation, discussion and therapy planning. It is understandable that parents involved in, and observing this process often form the view that, if you eliminate the processes from the child's output phonology, the disorder is cured. Therefore a third potential problem with an exclusively processes based view of developmental phonological disorders is the notion of "cure".

There is growing evidence to suggest that the phenotype of developmental phonological disorders changes as the child grows older. Phonological disability is manifested as unclear speech in pre-readers, but in some “recovered” speech disabled children it continues as a *literacy* (reading or spelling) disorder. As discussed earlier, Bird, Bishop and Freeman (1995) conducted research into difficulties with reading and spelling acquisition of phonologically impaired children. Their results suggested that both the speech impairment and the literacy problems arose from a failure to analyse syllables into smaller phonological units. Thus, for at least some of the children who are successfully treated, speech normalisation is not the end of the story, since a proportion of them develop difficulties with early acquisition of literacy skills, which appear to be phonologically based.

A fourth and final difficulty is related to the nature of commercially available “pre-packaged” process analyses, some of which provide a scant account of the child's phonology, particularly if the children whose speech is being assessed happen to have unusual processes (e.g., Bernthal & Bankson, 1990; Dean, Howell, Hill & Waters, 1990; Khan & Lewis, 1986; Lowe, 1986a; Monahan, 1984b; Shriberg & Kwiatkowski, 1980). A review of these procedures, with their emphasis on identifying processes that occur normally early on in speech development, leaves an unfortunate image of the test developers participating in a quest for the “Top Ten” processes!

## **2.3 Therapy**

Historically, speech-language pathologists have been demonstrably successful in evaluating the needs of speech disordered children and devising workable, enjoyable and successful remediation approaches. The perceived efficacy of the application of the “traditional” therapy model in remediating dyslalia (Morley, 1972) or functional articulation disorders (Powers, 1959) engendered clinician confidence in the techniques employed, despite their largely atheoretical bases.

Pre-dating traditional therapy, the treatment that stemmed from the evaluation of connected speech and phonetic inventory, and sound-by-sound analysis, continued to utilise the intervention strategies devised by phoneticians and early speech teachers, correctionists, and therapists (Fairbanks, 1940, 1954; Jones, 1956; Ward, 1958). Intervention techniques focussed upon auditory discrimination training (called “ear training” by Jones), the mechanical aspects of articulation, and practice drills.

### **2.3.1 Traditional Therapy**

What constitutes the so-called “traditional” approach? There is no single definition, for indeed a number of beliefs and practices may be involved, and the term clearly means different things to different people, depending on what *they* thought was generally done. Some of the procedures which have characterised speech-language pathology assessment and intervention for articulation disorders, and which may be considered by many speech-language pathologists to embrace “traditional” approaches, are described in this section.

Powers, writing in 1971, maintained that the “stimulus methods” developed and described by Travis (1931), had remained the core of the majority of treatment methodologies used by speech-language pathologists. Powers began her therapy with auditory discrimination training. A sound was identified, named, discriminated from other speech sounds, and then discriminated in contexts of increasing complexity. Permutations of the traditional approach, always putting discrimination of sounds produced by others first, are to be found in Berry and Eisenson (1956), Carrell (1968), Garrett (1973), Sloane and Macaulay (1968) and Van Riper (1978). Van Riper (1978) stated:

*The hallmark of traditional therapy lies in its sequence of activities for (1) identifying the standard sound, (2) discriminating it from its error through scanning and comparing, (3) varying and correcting the various productions until it is produced correctly, and finally (4) strengthening and stabilizing it in all contexts and speaking situations. (p. 179)*

Therapy resources designed for the administration of traditional approaches to speech therapy for developmental phonological disorders continue to be published, some incorporating aspects of other programmes and methodologies, and some with evidence of internal development. Adopting the role of teacher, the therapist guides the child through a series of carefully sequenced and graded steps, usually one phoneme at a time. The procedure starts with ear training, and goes on through increasingly complex production contexts. Finally the phoneme is used in spontaneous conversational speech, and the emphasis moves to self-monitoring.

The child takes a passive learning role, with active exploration and processing of the sound system not specifically encouraged. The approach, rather than being communication centred, is “therapy” centred, with the child learning what the therapist sets out to teach. Following the example of the medical profession, published evidence of the success of traditional approaches has been mainly in the form of case illustrations and clinical descriptions (for example, Powers, 1971; Travis, 1931; Van Riper & Irwin, 1959).

### **2.3.2 The Transition to Phonological (Linguistic) Approaches to Therapy**

Traditional therapy was, and still is, often found wanting in the management of children with multiple “articulation errors”. The following quotation comes from Crary (1982), and is included in full because it seems as relevant to today’s clinical reality as it did in the early 1980’s. In introducing the proceedings of a conference in 1980 billed as “The First Major Conference on Phonological Disorders in Children”, Crary (1982) wrote

*In working with children demonstrating multiple articulation errors, clinicians must develop intervention strategies different from traditional sound-by-sound approaches. I have worked with many clinicians who professed frustration over the lack of progress demonstrated by unintelligible children. Common problems include ‘not knowing where to start’, ‘which technique to use’, or lack of carry over - ‘He can say the sound, but he doesn’t use it in words’.*

*In addressing these issues I have often encouraged clinicians to change their entire approach to intervention in such cases by focussing more on how sound systems are organised than how individual sounds are produced (or mis-produced). Clinicians who follow this advice will find many recent, but scattered, publications promoting a particular assessment or remediation technique along the lines of phonological intervention. After developing a few basic phonological concepts and attempting one or more of these procedures, clinicians often report greater success in these severe cases. (p.iii).*

The clinical phonology literature of the early 1980's is replete with sentiments such as those of Crary, crusading for a "phonological" approach, with vague references to greater success, while reassuring traditionally geared speech-language pathologists that what they had been doing in therapy was not somehow misguided. Meanwhile, Shriberg (1982) identified with the traditionalists and sympathised with their bemusement at the information explosion about language development and intervention in the late 1960's and 1970's. He used the intense interest in grammar and syntax to explain the lack of attention to phonology during the period.

The functions or roles for phonemes in impaired or incompletely developed linguistic systems are often observed through patterns affecting groups of sounds that are similar in place, manner or voicing features. The patterns often involve natural sound classes, for instance, stops substituted for fricatives. When a phonological or linguistic approach to remediation is undertaken, a child's phonological system is usually described using one of two basic formats: distinctive features or phonological processes.

The features framework (which is itself "phonological") identifies absent features, and feature-based therapy sets about to teach them. The phonological process framework isolates substitutions and word-structure changes involving classes of sounds. The aim, of therapy is to facilitate the emergence of new phonological patterns. In phonological therapy, sound units are not viewed as isolated segments, but are considered for the way they are used contrastively, and how they are combined in different word structures. Treatment is directed towards sound

classes (e.g., acquisition of a class of fricatives, not one fricative at a time) or towards word structure (e.g., including consonants in word-final position), and its aim is to change phonological patterns (Grunwell 1995). An essential difference between phonological therapy based on a processes framework as opposed to a features framework is that, besides phonological features, it addresses changes to syllabic structure, and concerns itself with assimilation.

Costello and Bosler (1976), Costello and Onstine (1976) and McReynolds and Bennett (1972) provided important information about generalisation patterns related to feature use. These researchers found that by targeting one phoneme for production, consequent generalisation to other sounds containing the same feature occurred. By targeting, for instance, the frication feature of /f/ (for example, teaching it as a "long" sound in contrast with a "short" sound /p/: a distinction which is, incidentally, questionable in acoustic terms), generalisation might occur, improving production of other phonemes with the feature of frication, such as /s/, /z/ and /ʃ/.

Since distinctive features were trained within the context of segments, many traditional articulation therapy techniques were applied during intervention. Blache and colleagues' approach exemplified the way in which feature-based therapy combined conceptual and motoric activities. Blache (1982) explained that he started teaching distinctive features with the basic question: *"Does the child know the ideas I am working with?"* (p.71). His format was as follows:

1. discussion with the child of the minimal word pairs being presented to ensure that the child understands their meanings (Blache, 1978b; Blache & Parsons, 1980; Blache, Parsons & Humphreys, 1981);
2. receptive testing and training to determine that the child can perceive the phonetic feature separating the two words;
3. production training; that is, teaching the child to produce target sounds not in their repertoire, usually using the stimulus methods described by Travis (1931), which Blache called "clinical tricks" to elicit the correct articulatory gesture;

4. carry-over training using the desired feature in longer and longer utterances containing the target words (in therapy sessions and for homework);
5. carry over into connected speech involving parents in a home programme.

In presenting his approach, Blache (1982) proposed an untested rationale which portrayed phonological disability as a learning deficit partly due to an auditory memory-span limitation (Blache & O'Brien, 1979; Blache, Parsons & De Maio, 1977), and partly due to problems producing coarticulatory combinations (McDonald, 1964). This view led Blache to include tasks to "*strengthen memory and muscular synthesis*" (p, 76) at the carry-over stage of the programme.

## **2.4 Four Representative Phonological Therapy Approaches**

The literature contains a number of reports of phonological therapy approaches that had as their main focus improving intelligibility by nurturing the child's phonological system of contrasts, rather than teaching new sounds. A mix of traditional motoric and distinctive features conceptual techniques are described, as well as some novel approaches such as cycling (Hodson & Paden, 1983), auditory bombardment (Hodson & Paden, 1983; Monahan, 1984a) and rebus techniques (Young, 1987). These techniques will be described in subsequent sections.

A discussion paper by Dean and Howell (1986) addressed what they regarded as a tendency (of speech-language pathologists) to resort to empirical treatment procedures rather than attempting to apply theoretical knowledge when faced with a disorder that has no clearly determined cause. In view of Dean and Howell's strong criticism of previous approaches to phonological intervention, especially in terms of theoretical coherence, the links they proposed between their therapy ("*Metaphon*" [Dean, Howell, Hill & Waters, 1990]), and its theoretical bases, will be discussed in detail in section 2.4.4.

### **2.4.1 Hodson and Paden: "Targeting Intelligible Speech"**

Drawing on such diverse sources as Fairbanks (1954), Blache and Parsons (1980), Blache, Parsons and Humphreys (1981), Compton (1970), Hodson (1978, 1980), Ingram (1976) and Schriberg and Kwiatkowski (1980), Hodson and Paden (1983) developed and described a method which concentrated on *"facilitating phonological pattern emergence, rather than on 'drill', or on 'perfecting phoneme segments'"* (p. 56). Hodson and Paden's phonological remediation programme designed in the mid-1970's was experimental, involving over 100 children from 3;0 to 8;0 years of age, *"with the most severe speech disorders"* (Hodson, 1982, p. 97). The children were referred to the research programme because they were considered to be less than 15% intelligible to adult listeners in connected utterances.

In her account of the development of the programme over a six year period, Hodson (1982) observed that most of the older children had already received from one to five years "phoneme oriented" articulation training, while some of the younger children had been enrolled in language programmes. Discussing their research design, Hodson and Paden (1983) stated that:

*We recognise the value of controlled studies, but we were unwilling to withhold phonological programming for any unintelligible client who requested service, even for the purpose of having matched controls. We felt that time was of the essence for these unintelligible children and that they deserve the best remediation service currently available in our clinic. (p. xii)*

In the early stages of developing the programme, the "state of the art" encouraged Hodson and Paden (1983) to teach distinctive features and phonological rules (cf. Blache, 1982). While they found that this approach led to some improvement, it was not sufficient for the requirements of highly unintelligible children. Turning then to natural processes, they discovered that the children had complex error patterns which could not be explained as simplifications of adult speech. Defining phonological process or "deficient pattern" as a change affecting a whole class of sounds, they developed an analytical system (Hodson, 1980) which allowed them to specify uncommon patterns as well as familiar ones.



Hodson's detailed procedures were the antithesis of the pre-packaged 'Top Ten' variety of process analyses. Hodson and Paden (1983) believed that once they could account for (describe) the child's entire phonological system, they could isolate targets for intervention, by deciding which patterns were "critical" for each child, and then set out to remediate them systematically. Summarising the principles underlying their remediation procedures, Hodson and Paden (1983) stated:

*...we believe that remediation procedures should stress both stimulation for the target sound or sequence and practice in its correct production. While these are the same principles which speech-language pathologists typically follow, our approach has been influenced by five underlying concepts which markedly alter traditional methods. Time is allowed for the gradualness of pattern acquisition; auditory stimulation with increased intensity of the signal is heavily relied on; eliciting correct production from the outset is considered to be essential for establishing kinesthetic monitoring; careful selection of phonetic environment to facilitate correct production is therefore stressed; and we take advantage of children's tendencies to generalize new skills. (pp. 53-54)*

Hodson and Paden suggested that phonological processes occurring in more than 40% of possible contexts should signal the need for a particular phonological pattern to be targeted. This suggestion was based on their clinical observations that deficient patterns evident below a 40% level would be eliminated spontaneously without treatment. Broad based stimulation of the sound system over a short time span using a minimum of two target phonemes for each process was the essence of their facilitative-integrative model. Each phonological pattern was targeted for a minimum of two 90-minute sessions. Stimulating five or six processes took a period of six to twelve weeks. Hodson and Paden called these therapy blocks cycles, because the original processes would be reworked in subsequent training periods until a substantial reduction in frequency of occurrence took place. Hodson and Paden (1983); and, Hodson (1989) defined cycles thus:

(1) *A consecutive time period of about two to three months during which a group of phonological patterns is sequentially targeted, usually for two to four weeks per pattern* (Hodson & Paden, 1983, p. 99); and, (2) *time periods during which all phonological patterns that are in need of remediation are facilitated in succession* (Hodson, 1989, p.154).

Treatments included two periods of auditory bombardment, which took place before and after a series of therapy activities, involving approximately two minutes of “auditory stimulation” using (an unspecified) low level of amplification. The clinician read a list of about 15 words containing the day’s target phoneme or sequence, slowly, while the child listened attentively. The amplification was used to “*increase the child’s focus*” (Hodson & Paden, 1983, p. 66), and “*produce awareness that was not achieved through regular listening, nor by other methods*” (p. 50). Auditory bombardment could also include sentences containing the target words.

The therapy activities were centred around production practice of only two to five words per session, using picture cards and games. The clinician would aim to elicit “naturally” during the activities many correct productions of the target, with modelling and cuing being faded out as soon as possible. Probing for targets for the subsequent session involved determining the easiest target for the child to say within a deficient pattern. If the planned target was stridency in clusters, for example, probe words might be: spoon, star, snake, boats and ropes. If, for example, “spoon” proved the easiest for the child to say, the words selected might be: spoon, spin, wasp, spit and spy.

The approach included daily homework. The child would name the picture cards from the preceding session and listen to a 15 word auditory bombardment list once a day. The average length of the once weekly sessions was 75 minutes, and many of the older children were also seen at school for 20 minutes twice weekly. Most children were dismissed as intelligible after two or three treatment cycles (of six to twelve weeks duration).

If Ingram (1976) was the prime mover in prompting Australian speech-language pathologists’ interest in applying phonological process analysis to clinical populations, it is

probably fair to say that Hodson and Paden (1983) provided a similar spur in influencing the decision of clinicians, and academics teaching undergraduate speech-language pathology courses, to consider phonological processes in remediation planning. For many, Hodson and Paden therapy was *the* phonological therapy.

Although the success claimed in attaining intelligibility in a severely phonologically disabled population proved attractive to clinicians, a number of methodological issues require examination. The relative lack of history information about the children, the details of their progress phonologically, and the lack of experimental control highlight the need for further research into the Hodson and Paden approach.

The therapy procedures are most comprehensively documented, but as Stoel-Gammon and Dunn (1985) pointed out, it is not clear whether success was due to using a phonological processes framework, applying the 40% occurrence cut-off criterion to target selection, the cyclic, intense stimulation of several target sounds, auditory bombardment, or any combination of these factors. Ingram (1986) voiced concern about the lack of theoretical justification for some of the assumptions on which the programme was based. He nevertheless regarded it as an effective approach with an underlying rationale based on knowledge of normal language development. He particularly concurred with the linkage between order of phonological acquisition and lexical frequency, and the basic principle of gradualness in acquisition. Similarly, Stoel-Gammon and Dunn (1985) acknowledged the link with normal language acquisition, noting that the approach was a means of *"providing practice with several phonemes, thus stimulating the child's system to change but allowing it to do so at the child's own rate"* (p.177).

The Hodson and Paden approach was different from previous therapies in terms of the use of cycles and the comparatively frequent change in remediation targets, though, of course neither of these strategies were inherently "phonological". Ingram (1989a) suggested that a theoretical rationale for this approach might have been that it mirrors what happens in normal acquisition: that is, children are exposed to the adult system first and gradually incorporate features of it into their own system. Hodson and Paden noted little change in the children's

phonologies during initial treatment cycles, and steady progress in the second and third phases, as the targets were recycled; a finding consistent with the gradualness with which children incorporate adult phonological features, described by Ferguson (1978) and Ingram (1986).

#### **2.4.2 Monahan: “Remediation of Common Phonological Processes”**

Monahan (1984a) developed a phonological analysis and a therapy resource pack or kit incorporating conceptualisation training using a perceptual sorting task and a lexical production procedure, brief sessions of auditory bombardment using minimal pairs, and a phonemic contrast approach enabling the child to perceive semantic differences in minimal word contrast pairs illustrating the error production and the target response. Monahan's approach is rarely mentioned in the literature (e.g., see Williams, 1993, for a passing reference), but the kit, and adaptations of the method, are widely used in Australia.

From the work of Hodson (1978), Ingram (1976, 1981), Shriberg and Kwiatkowski (1982) and Weiner (1979), Monahan noted several processes common to normally developing phonology and to disordered phonological development. She devised a programme around six of the most common processes: stopping, fronting, final consonant deletion, cluster reduction, prevocalic voicing, and stridency deletion.

Following phonological process analysis (only), using her own (Monahan, 1984b) procedure or that of Hodson (1980) and determining the percentage of occurrence of each of the “common” processes, Monahan set treatment priorities claiming to follow Ingram's (1976) suggestions for which processes to target first: those most affecting intelligibility, those occurring occasionally rather than all the time, and those most characteristic of young children. This was an odd assertion, in that she had already narrowed the intervention options to targeting the six most common processes.

Monahan believed that Hodson and Paden's (1983) cutoff criterion to target selection of 40% was too high and suggested 30%. She also proposed, following Weiner's (1979) guidelines,

that stopping, prevocalic voicing and final consonant deletion be targeted before fronting and cluster reduction. Noting Hodson's (1980) reference to stridency deletion being one of the common contributing factors to unintelligibility, she believed that it should be assigned top priority. Targeting of several processes simultaneously was optional.

Claiming that a more effective result with intervention based on phonemic rather than phonetic therapy is due to intervention being geared to remediation of "general processes" operating across or affecting many sounds, Monahan constructed her approach to include:

1. conceptualisation training (La Riviere et al., 1974; Winitz, 1975);
2. lexical production (Ferrier & Davis, 1973) with perceptual sorting based on the premise that changes in meaning occur with changes in sound production (Weiner, 1979);
3. auditory bombardment (Hodson, 1980);
4. focus upon contrasts emphasising differentiation of an error production from a target production (Bernthal & Bankson, 1981); and,
5. a drill play format (Shriberg & Kwiatkowski, 1982).

The therapy utilised the kit comprising a manual and six sets of picture cards representing minimal word contrast pairs for the six processes, presented in a six step treatment format:

1. process identification (i.e., explaining the error process to the child [cf. Blache, 1982]);
2. preparation for conceptualisation training (i.e., selecting from the kit a set of five minimal-contrast card-pairs);
3. conceptualisation training involving the child's perception of feature or process contrasts and hence semantic differences between the pairs (cf. Blache, 1982);
4. conceptualisation training involving producing the "target rule" in words, using a play drill format;
5. probing for generalisation; and,

6. auditory bombardment using minimal pairs list and no amplification, for 30 to 60 seconds at the beginning and end of each session, and once daily with the parents at home, drawing the child's attention to specific feature contrasts.

There were four essential differences between Monahan's treatment approach and that of Hodson and Paden, namely:

1. the use of minimal pairs, by Monahan, at all levels of intervention, including auditory bombardment and production practice at word and sentence level;
2. Monahan's more metaphonological emphasis upon increasing the child's awareness of sound properties and phonetic placement by using explanations, concrete demonstrations, imagery and discussion (cf. Blache, 1982; Dean & Howell, 1986);
3. her requirement of a 90% success criterion for process identification and conceptualisation training before training was considered successful; and,
4. her preference for retraining of processes in evidence in more than 30% of obligatory contexts.

Monahan (1986) published four case studies of children aged 5;5 to 5;8, with Composite Phonological Deviancy Scores (Hodson & Paden, 1983) ranging from moderate to severe, with whom the approach was implemented. She reported encouraging success, including an increased percentage of correct sound productions by all four children. The design did not incorporate research control, nor was any attempt made to isolate the crucial variables. Like the Hodson and Paden (1981) remediation study, Monahan's claim to a successful intervention strategy prompted a number of testable research questions, relating to the contributions made by components such as auditory bombardment and conceptualisation training. As well as stimulating research interest, Monahan made a tangible contribution with the development of the therapy kit (Monahan, 1984a), which provides a useful, adaptable resource.

### **2.4.3 Young: “A Language Approach to Treatment”**

Young (1981) also developed commercially available materials with which to implement her approach. Young (1983) described how she utilised the training of children's semantic skills in order to use meaning contrasts as a therapeutic device in her work with minimal word pairs. Young noted that minimal pairs had been used to train distinctive features in terms of *correct production* of a target phoneme and its contrasting sound (Blache & Parsons, 1980; McReynolds & Bennett, 1972; Pollack & Rees, 1972) rather than as a means of changing phonological patterns (Weiner, 1979).

Young's intervention approach was similar to Weiner's in that she used minimal word pairs, trained lexical skills, and focussed upon demonstrating to the child the need to do something different in order to convey meaning (cf. Dean & Howell, 1986). She advocated treating syllable closure first, because: (a) it involves many sounds, (b) it is normally acquired early, (c) failure to use closed syllables has a major effect on intelligibility, and (d) the ability to produce final consonants is necessary for the application of certain morphological markers such as plurals, possessives and some verb inflections (cf. Shriberg & Kwiatkowski, 1980). Young (1987) tested her conceptual-visual approach to eliminating processes in a multiple baseline across behaviours design (Kazdin, 1982) in which two children were “*trained to suppress*” weak syllable deletion and cluster reduction.

Backward chaining procedures with rebuses for visual cuing were employed in treating both processes. Backward chaining is a procedure in which the final part of the word is taught first: for example, the child would be taught the word “low” first, and then blow, glow and slow. A rebus is a pictorial or symbolic representation of a word or phrase suggesting the word elements. “Stool”, for instance, might be represented, for the purpose of visual cuing, with a rebus of a snake (to signify /s/) and a tool (s-tool). In backward chaining, “tool” would be taught first, and the /s/ added (tool - stool).

The two girls aged 4;4 and 4;5, responded well to a four step treatment procedure comprising gradual shaping of production of the rebus words from imitating the individual syllables or segments through to producing the words without a model. An 80% accuracy level was required between steps. When generalisation was at an 80% level on the fourth step (producing the words without a model), "training began on the next process". For both subjects, final consonant deletion was not treated and functioned as the control behaviour.

Follow up data six weeks after treatment indicated that both subjects continued to produce correct responses for both targeted behaviours (80 to 100%). Prior to treatment, all weak syllables had been consistently deleted or reduced, and all initial clusters were produced as singletons. Treatment resulted in improvement in cluster and weak syllable production for trained and untrained words (tested at word-level only). There was no improvement in the untreated process of final consonant deletion, and no improvement across processes. Young suggested that longitudinal studies of generalisation of the skills to newly acquired words should be undertaken in further evaluating the approach.

#### **2.4.4 Dean and Howell: "The Metaphon Resource Pack"**

Dean and Howell (1986) presented a case for developing metalinguistic awareness in phonologically disordered children, in order to increase their knowledge and awareness of the physical or structural properties of the phonological system, as a means of facilitating phonological organisation and change. Their therapeutic model was "*inspired by Ingram (1976) and Grunwell (1985, 1987)*" (p. 2) (Dean, Howell, Waters & Reid, 1995), and several child learning theorists (Beveridge & Griffiths, 1983; Bower 1974, 1979; Cazden, 1983; Donaldson, 1978; Heber, 1981; Perrett-Clermont & Schubauer-Leoni, 1981; Tizzard & Hughes, 1984). The authors' theoretical rationale for their intervention approach was based upon a view of the child learning through cognitive conflict (Bower, 1974, 1979; Donaldson, 1978) and reflection (Beveridge & Griffiths, 1983).



In *Metaphon* therapy, metaphonetic skills were trained to improve the child's "cognitive awareness" of the properties of the sound system, while metalinguistic tasks were implemented to develop (the child's own) communicative effectiveness through more effective use of repair strategies. *Metaphon* therapy was in two overlapping phases. In phase one, the child was taught that language is used to communicate, and language which is normally opaque can be made transparent or tangible (Cazden, 1972). Dean, Howell, Waters and Reid (1995) explained:

*Phase 1 comprises Concept level, Sound level, Phoneme level and Word level. Phase 1 is the most important phase of Metaphon, and the one that is most distinct from other published phonological therapy programmes. The aim is to capture the child's interest in the phonology of the adult target language, to alert the child to the properties of sounds and their contrastive nature, to show that contrasts between sounds convey meaning and to facilitate the child's realization that these features can be manipulated to increase the likelihood of being understood. (p. 5)*

In phase two, metaphonological tasks involving minimal pairs (introduced in Phase 1) and homonymy confrontation were emphasised, and the focus shifted to developing communicative effectiveness by giving the child feedback about success or failure to convey meaning, by means of behavioural responses, prompting him or her to review output. Dean and Howell (1986) postulated that, in the short term, such feedback would improve production by triggering the use of repair strategies based on the new knowledge of sound contrasts learned in phase one, and that in the long term it would effect a change in central phonological processing.

Dean and Howell (1986) asserted that their therapy *model "accords well with current theory about normal phonological acquisition"* (p.234) with reference to the work of Chiat (1983), Kiparsky and Menn (1977), Grunwell (1982a, 1983), Ferguson and Macken (1980), Menn (1983, 1985), and Menyuk (1976). Dean and Howell acknowledged also the influence of the cognitive (Stanford) model, regarding the child as an actively involved problem solving participant in the language learning process. They opined that the cognitive model was consistent with Piagetian

and neo-Piagetian theories because they construed children as actively exploring the environment to assimilate information (Beveridge & Griffiths, 1983; Donaldson, 1978).

Howell and Dean (1987) explained their view of the therapeutic situation both as a social context and a learning situation, emphasising the necessity to provide a social setting which assisted the development of metalinguistic awareness (Cazden 1983). They made a "fundamental plea" to therapists that the child should be an interested and actively engaged participant in the learning process, stressing that the child's curiosity about language should be constantly stimulated by a facilitative therapist. An efficacy study of *Metaphon* therapy was reported (Hill, Howell & Waters, 1988; Hill, Howell, Waters & Dean, 1989), and the *Metaphon Resource Pack* (Dean, Howell, Hill & Waters, 1990) was published the following year. The resource pack comprised assessment and therapy materials. In the administration manual the authors were at pains to point out: *"That Metaphon is a philosophy and not a programme is borne out by the fact that it focuses on underlying theory and not a set of therapeutic activities"* (p.3).

A recent clinical forum comprised an overview of *Metaphon* (Dean, Howell, Waters & Reid, 1995) followed by five commentary and discussion papers (Bleile & Hand, 1995; Grundy, 1995; Klimacka, 1995; Miccio, 1995; and Nettelbladt, 1995), and finally, a response from the *Metaphon* team (Waters, Reid, Dean & Howell, 1995). The forum addressed the theoretical underpinning, components, and application of *The Metaphon Resource Pack*; and also the research design and the *Metaphon* team's interpretation of the results of their efficacy study (Hill, Howell, Waters & Dean, 1989).

Comments in this section will be confined to aspects of *Metaphon* therapy, and the method and results of the *Metaphon* efficacy study will be discussed subsequently, in relation to the results of the current study (see 7.1.2, 7.1.3, and 7.6.9.2). The reader is referred to the forum for a range of interesting views of the theoretical coherence of the therapy approach, and of the assessment component. The aspects of *Metaphon* that appealed to the critics most notably were:

1. its explicit linkage between metalinguistic awareness and a phonological approach; the use of negotiated labels for sounds; and the authors' continuing efforts in keeping abreast with, and incorporating into *Metaphon*, new developments in metalinguistic theory (Bleile & Hand, 1995);
2. its emphasis upon *how* to treat phonological disorders (as opposed to *what* sounds to treat), and the rapidity with which phonological change was effected (Miccio, 1995); and,
3. its focus upon the child's active participation in therapy; the clarity with which the stages and procedures of *Metaphon* therapy were described, providing clinicians with a definite framework within which to work (Klimacka, 1995; Nettelbladt, 1995).

In response to criticism of individual components of *Metaphon*, Waters, Reid, Dean and Howell (1995) stated: "*Metaphon therapy was not designed as a set of unconnected tasks but as an integrated whole.*" (p. 50) Some tasks within *Metaphon* that concerned the critics, and the author most, were: (a) the doubtful validity and potential counter-productiveness of utilising metaphonetic tasks (e.g., distinguishing 'long' from 'short' sounds, to discriminate fricatives from stops; 'Mr Noisy' from 'Mr Quiet' to distinguish voiced and voiceless cognates; 'back' sounds from 'front' sounds to distinguish [k] and [g] from [t] and [d], respectively); and (b) the risks inherent in distorting the acoustic signal, in order to facilitate perceptual saliency, by exaggerating phonemic distinctions (Bleile & Hand, 1995; Grundy, 1995; Klimacka, 1995).

Commenting on the uncertain role of parents (and teachers) in the administration of *Metaphon* therapy, Klimacka noted that:

*Clinical experience has shown that parents may have some difficulty grasping the rationale behind the approach, and regard the perceived indirectness of the early stages of Phase 1 with some impatience. Given the important role which parents play in any young child's therapy programme, this does not seem to have been incorporated to the same extent as in other phonological approaches (Hodson and Paden 1991). (pp. 40-41)*

## **2.5 Grunwell's Approach to Assessment and Treatment**

The main sources for the following summary of Grunwell's approach to assessment and treatment were Grunwell (1985a, 1985b, 1989, 1992b, 1995), Grunwell, March and Russell (1990), Grunwell and Russell (1990), a lecture by Pamela Grunwell at Macquarie University in Sydney in November 1993, and her two-day workshop for the Australian Association of Speech and Hearing (New South Wales Branch), also in November, 1993.

In Grunwell's approach, assessment begins with a screening procedure to determine whether diagnostic assessment, based on the *PACS*, is indicated. Principled treatment decisions are also based on the *PACS*, which provides an ongoing qualitative evaluation of the nature of phonological change. Assessment routinely involves an oral-musculature examination to determine the child's anatomical and physiological potential for speech; an evaluation of phonetic production performance, including stimulability testing; phonological assessment of the patterns in pronunciation; and an account of the developmental characteristics of those patterns. Grunwell stresses that as well as indicating the patterns in, and developmental status of, the child's phonology, a clinical phonological assessment should include information about communicative adequacy, show *how* the child's patterns are inadequate, indicate the types of pronunciation patterns present, define treatment aims, signal directions for treatment regimes, and evaluate change at reassessment.

For Grunwell, the premises of phonological therapy are that: in learning phonology, a child is developing a system of sound contrasts to signal meaning differences, as well as organising a phonological system, based on similarities and differences between contrastive sounds and structures. Therefore, the basic goal of therapy, for a child with a phonological learning disorder, is to facilitate reorganisation of the child's phonological system, and so improve intelligibility, and hence communicative adequacy. Treatment planning is concerned with three parameters of disordered phonology: eradicating variability, expanding the child's phonological system, and extending the range of consonants and syllable structures the child has.

Change is measured in terms of the equivalent positive phonological outcomes of the three parameters of phonological disability: stability, system expansion, and structural extension, using the *PACS* contrastive (phonological and developmental) assessment, and phonological performance indicators (PPI's). Grunwell suggested four main types of phonological change:

- Stabilisation:** the resolution of a variable pronunciation pattern into a stable pattern;
- Destabilisation:** the disruption of a stable pattern, resulting in variability;
- Innovation:** the introduction of a new pattern; and
- Generalisation:** the transfer of a pronunciation pattern across four possible contexts: phonological, lexical, syntactic and socioenvironmental.

With intermediate and specific treatment goals, Grunwell emphasises the need to distinguish between phonetic (e.g., stimulability tasks) and phonological treatment aims. She suggests using well-established structures in introducing new phonological contrasts. Her criteria for selecting treatment targets include working in developmental sequence, where possible, while giving patterns most deviant from normal phonology, and/or those most destructive of communicative adequacy, priority.

Treatment procedures may be system based (metalinguistic) or word based (manipulative). An example of metalinguistic system based activities is minimal pair therapy, which demonstrates to the child that sound differences signal meaning differences. A manipulative word based activity might involve listening to, and eventually saying in context words that share common phonological features. Grunwell (1989) described the therapy of Neil who made the equivalent of 12 months phonological progress in just three months (between the ages of 4;3 and 4;6). Neil's therapy included auditory discrimination, real-word minimal pair games, homophony-homonymy confrontation, phoneme-grapheme correspondences and metaphonological skills training. Grunwell portrayed the intervention process as an elegantly simple undertaking: *"expose the child systematically to the dimensions of the target system absent from his/her speech in a way in which both their form and communicative functions are made evident."* (p. 318-319)

## **2.6 Single Case Studies**

Treatment procedures and activities have also been described and discussed in a number of published single case studies (for instance, Blache, Parsons & Humphreys, 1981; Gibbon, Shockey & Reid, 1992; Grunwell, 1989; Grunwell & Dive, 1988; Grunwell, March & Russell, 1990; Grunwell, Yavas, Russell & LeMaistre, 1988; Jarvis, 1988; Jarvis, 1989; Stone & Stoel-Gammon, 1990; Williams, 1993). These and other studies provide descriptions of, and clinical insights into, a variety of phonological therapy techniques, usually combined with traditional procedures. Because they did not involve groups of children, however, the results could not be generalised and used for direct comparison with group study data. Additionally, the children in the case studies, the therapy procedures used, and case management arrangements, were significantly different from each other, and from the children in the current study, as the following selected examples demonstrate.

The Jarvis (1988) case study of phonological intervention was of a hearing-impaired child (Ben 6;8 to 7;2) with Treacher-Collins Syndrome and considerable emotional and behavioural problems. Ben had no oral communication prior to 4;0. The "speech work" (p. 46) was based on Grunwell (1982a), Ingram (1976), and Ling (1976), incorporating phonetic, phonotactic and phonological goals, and was apparently administered by teachers. The following year, Jarvis (1989) gave an account of "speech work" based on the Metaphon approach (Dean & Howell, 1986) and administered by a teacher of the deaf to Luke (4;9 to 5;7), a child with normal hearing and age-appropriate language skills.

N, the child whose progress in 4 months of phonological therapy (i.e., from the age of 5;0 to 5;4) was studied by Grunwell, Yavas, Russell and Le Maistre (1988), had received previous therapy from the age of 2;6, and had a history of persistent glue ear and associated hearing difficulties. Successful management of his otitis media coincided with the start of therapy. The therapy, which was effective in helping N to make changes in his own pronunciation, was administered in a small group setting, and comprised structured phonological stimulation, incorporating speech sound discrimination, phonetic production exercises, minimal contrast

activities (perception and production), learning self-monitoring and self-correction, and homework.

G (aged 1;7 to 4;0) was the son of the second author, a speech therapist, in a detailed and extremely interesting study by Grunwell, March and Russell (1990). G had learning problems, minimal neurological signs, glue ear of long standing, and did not babble before the age of 1;0. G's language development was age appropriate, but his speech patterns were severely delayed, and his speech unintelligible. Therapy comprised gross motor imitation (refined into imitating facial movements), babble sessions, sound imitation (e.g., cow, sheep and train, noises), tactile activity (e.g., licking chocolate sauce from the top lip), listening to quiet audio-recordings and whispered instructions, auditory discrimination, and sound production discrimination. The conclusions drawn by the authors from G's successful management were:

*...early detection makes for more successful outcomes,...traditional speech therapy techniques can be made to be successful with very young children,...time training a caregiver or an adult in daily contact with the child is well spent,...and close monitoring of speech patterns during indirect intervention ensures flexible and more effective treatment strategies.*  
(p126)

Interesting conclusions were also drawn from the Stone and Stoel-Gammon (1990) study of S (aged 3;9 to 4;7), who exhibited an unusual learning style, in 10 months of therapy, in her preference for learning one new phonological pattern at a time. They concluded:

*...the timing of treatment is an important variable and...children may respond differentially to treatment depending on where they are in the learning process...The results of S's case also lend support to the idea that phonological treatment may be more important for stimulating a developmental process rather than teaching specific behaviours...Research is needed to determine if developmental progressions, once stimulated, are beyond our manipulation, or whether different treatments are more or less powerful in altering a developmental course.*  
(pp. 189-190)

## **2.7 Synthesis**

In the preceding sections, a series of competing, but not necessarily conflicting therapy models have been described. Here were clinicians brave enough to take highly unintelligible children with speech production errors and expose them to therapies that often minimised production training and concentrated not on surface phonetic proficiency, but on attempting to activate and develop the child's underlying system for phoneme use.

From the foregoing theoretical background, and informative descriptive studies of practical clinical applications, a therapeutic model was developed. The key influences in the development of the model were as follows:

1. The work of Weiner (1981a, 1981b) and Blache (1982) concerned with clinical applications of distinctive features, and their consequent contributions to the development of phonological therapy procedures and activities; and Hodson and Paden (1983) particularly for introducing auditory bombardment;
2. the theoretical contributions of Menn (1976, 1981, 1983, 1985), Kiparsky & Menn (1977), Menyuk & Menn (1979), especially in the development of the Interactionist-Discovery Theory;
3. Fey & Gandour (1982) in regard to clinical applications of cognitive and Interactionist-Discovery Theory; and Fey (1985; 1992) for providing a functional framework for analysing the form of phonological therapy.
4. Ferguson (1978); Ingram (1986, 1989a); and Stoel-Gammon and Dunn (1985), for the practical linkage between theories of phonological development, assessment and intervention; and,
5. most significantly, Grunwell (Grunwell, 1980; 1981a; 1981b; 1982a; 1983; 1985a; 1992b; 1995; and Gibbon & Grunwell, 1990) for information, elucidation and clarification of an extraordinary range of clinical phonology theoretical and practical issues.



The model, once devised, was trialed and modified for three years. Clinically, it appeared to be soundly based in theory and in practice, and an efficient and effective means of treating children with developmental phonological disorders. A belief, based on clinical observations and impressions, in the efficacy of a trusted but untested therapeutic model is insufficient justification for continuing its development and application, or for promoting it to other clinicians as a worthwhile approach. Therefore, a rigorous study of its effectiveness was needed. The necessity for such an efficacy study provided the impetus for this research.

## **CHAPTER 3**

# **THE THERAPEUTIC MODEL, RESEARCH QUESTIONS AND HYPOTHESES**

In this chapter, general case management issues will be addressed, and the constituents of the therapy model will be viewed individually, remembering that, in practice, they overlapped. Discussion of which constituent aspects of the therapeutic model are “phonological” and which are not, and of how the model was informed by the theoretical background, will ensue. Then will follow the research questions and hypotheses of the (between groups) therapy efficacy study, and the within group study of the treatment group.

### **3.0 Constituents of the Therapeutic Model**

The multifaceted therapy battery comprised five interacting, dynamic elements. The components of the approach, included in therapeutic management in varying degrees according to individual differences within the phonologically disabled child and his or her family, were: (1) family education; (2) metalinguistic tasks, including aspects of linguistic awareness and phonetic and phonological processing; (3) traditional phonetic production procedures; (4) multiple exemplar techniques, including minimal contrast and auditory bombardment activities; and, (5) homework activities, incorporating (1) to (4), above.

Therapy targets were selected using linguistic criteria, taking into account motivational factors. For example, using linguistic criteria, in targeting fricatives, they might be targeted first for a particular child, in SFWF position, in response to Ferguson's (1978) observation that fricatives often develop first word finally. For another child, using motivational criteria, final fricatives might be targeted first because the child had evidence of development of fricatives SFWF, and by focussing on them the child would experience success in therapy, and hence be encouraged and motivated (see section 6.5 for an illustrative case example).

### **3.1 Case Management**

A frequent criticism, by practising clinicians, of university-based clinical research is that the university setting is not typical or representative of the work settings of most speech-language pathologists. Inherent in this criticism is a common perception that in university research settings, the clinician has more time, help (possibly in the person of a research assistant) and funding to devote to clients than would be reasonably available in a community (public or private) clinical setting. Throughout the study, case management for the research subjects proceeded along typical lines for the particular clinical setting, the author's normal workplace. The research subjects were not given "special" consideration, or attention that other clients attending the clinic might not have enjoyed. Guiding case management was an interest in developing a therapy regime which could be implemented in a normal clinical setting, including those with sole practitioners, with basic, even limited, clinical resources. It was hoped that the outcome of developing and testing the therapy model would be to have an intervention methodology that an individual speech-language pathologist could apply without the need for help from, or consultation with, others. Extra within-clinic time was not allocated to the treatment subjects either. The children were assessed and treated as part of a normal work week for the clinician, and their therapy sessions were scheduled, according to the appointment times available when they did not have to be at preschool.

In common with all other preschoolers attending the clinic, the treatment children's appointments tended to be in the morning or early afternoon (between 8.00 am and 2.00 pm), to avoid fatigue factors which might impede progress. The initial consultation usually took 60 to 75 minutes. Both parents (in intact families), or one parent or primary caregiver in separated or single-parent families, were encouraged to remain present throughout the assessment. Within 7 to 10 days of the initial assessment, the parents were provided with a written assessment report.

It was, of course, important for the phonologically disabled child, and for the parent/s that the focus of the initial consultation should be on them. They needed to *join* with the therapist in establishing a co-operative working relationship. This was potentially very difficult to do with younger (or indeed older) children or babies vying for attention, making a noise, or just exploring the room. Additionally, it would have been extremely difficult, and hence undesirable, to attempt to take an audiotaped phonological sample in excessive ambient noise. As child-minding facilities were not available as part of the clinic's facilities, the author's preference was to explain to the caregiver, at the time of setting up the initial appointment, the importance of being able to focus on the child to be assessed, without distractions, and in reasonably quiet conditions, in the first interview. They were, therefore, requested not to bring other children with them for the first visit. Again, this was not something that was done exclusively for the research children, but rather, general practice policy.

The duration of therapy sessions was 50 minutes. Appointments were scheduled on the hour, allowing 10 minutes between clients, about five minutes of which was taken up with record keeping. Generally speaking, the child would engage one-to-one with the therapist for 30 to 40 minutes, and the parent would join them for 10 to 20 minutes at the end. Sometimes the parent would remain present for the first and last 10 minutes of a therapy session, leaving therapist and child alone together for the intervening half hour.

Attendance at the clinic for therapy (for all phonologically disabled children attending the clinic) occurred in treatment blocks. The children would attend with their parent(s) weekly for 10 weeks, and then have a 10 week break from therapy attendance. The first therapy appointment

after the break included a review assessment, and further therapy appointments were scheduled, as required. If children missed therapy appointments (due to illness, for example), practice policy was for additional appointments to be arranged at the end of the series of 10 weeks, if necessary. There are reports in the literature of children with phonological disorders being treated in therapy blocks and breaks (e.g., Hodson & Paden, 1983; Stone & Stoel-Gammon, 1990) where the breaks were imposed by university or school vacations. The difference in the current model was that the breaks were planned as a necessary component of the therapy.

### **3.2 The Therapist - Family Relationship**

In the author's clinical experience, active, informed involvement, when possible, of primary caregivers and significant others in the phonologically disabled child's immediate communicative environment, in the intervention process, enhances therapeutic management. In the following discussion of the family education aspects of the model, the terms "parent" and "family" are used in preference to the clumsier "parent/s or primary caregiver/s".

#### ***3.2.1 Family Education***

Family education and training occurred through a combination of observing and joining in during assessment and therapy sessions, general and specific written information, direct instruction, role play, discussion, and set projects. The therapist modelled for parents ways of facilitating phonological change, in normal communicative contexts, with an emphasis on learning rather than teaching. The desirability of the child's active participation in the activities presented was constantly emphasised.

### **3.2.2 Rationale for the Family Education Constituent**

Gibbon and Grunwell (1990) hypothesised that the phonologically disabled child might be overwhelmed by the phonetic complexity of the sound patterns to which he or she was exposed: so much so that they were unable to abstract new information from the speech environment (see 2.6). This state of being overwhelmed is mirrored by the bewilderment and anxiety expressed by many parents of phonologically disordered children, when they first present at a speech language pathology clinic seeking assessment and management advice. In particular, the parents of children with moderate to severe developmental phonological disorders (i.e., children whose speech is largely unintelligible), simply don't know where to start correcting, or even whether they should.

The therapeutic model was family centred (Crais, 1991). It stressed family involvement, particularly of parents, in the intervention process, both during *and* between therapy attendances. Where possible, the parents were encouraged to act as the prime agents of intervention, once they had the skills and confidence to do so (cf. Grunwell, March & Russell, 1990). Such a degree of family involvement was encouraged in the belief that if therapy were to be communication centred (Howell & McCartney, 1990; Low, Newman & Ravsten, 1989) it should be integrated with the communicative interactions within the family where the child was generally assumed to spend most time.

### **3.2.3 The Process of Family Education**

Providing the parents with guidance in the form of a structured, supervised therapeutic management plan that was readily understood, and easy to implement, was the essence of the family education constituent of the therapy model. Therapeutic management began with information sharing in the initial consultation, when the parent watched the assessment, and then had the opportunity to ask questions, discuss relevant issues and express their concerns,

feelings and ideas about their child's difficulties, the clinical diagnosis, and the proposed management plan. Supportive, didactic information sharing continued week by week during the therapy sessions, as the therapist explained and modelled for the parents, special techniques and strategies (see 3.2.4), and homework activities (see 3.5.3).

As an adjunct to the verbal discussion and exchange of information and ideas face-to-face during assessment and therapy sessions, the parents were provided with a booklet: "Notes for Families and Teachers" (see Appendix A). The booklet was given to them, to keep, and to photocopy if they wished for limited distribution, in the third or fourth week of therapy. It contained information about language development in general, phonological development in particular, phonological disability, and the therapy approach, and answered many of their questions.

#### **3.2.3.1 Family Involvement in the Initial Assessment Consultation**

The importance of a successful first meeting between child, parent(s) and therapist cannot be emphasised too strongly. Family education and training *began* with the initial consultation appointment, which consisted of a case history interview, followed by the speech and language assessment. Observing the assessment, and having the opportunity to discuss and question the therapist during the first visit, was an important element of the *therapy*. It enabled the parents to gain an understanding of the assessment process, and the treatment planning process. A written report of the initial assessment was provided to the parents within 7 to 10 days, and this generally stimulated further discussion. The report also included a formal request for the child to participate in the research project, and accompanying informed consent documentation (see Appendix B).

#### **3.2.3.2 Family Involvement in the Treatment Sessions**

As far as the treatment consultations were concerned, it was not considered necessary or desirable to have parents "in" the whole time. It was preferable for the therapist to have some time one-to-one with the child. This time alone strengthened the relationship between the

therapist and the child, and created a safe emotional environment in which children would take risks and experiment with their phonology, without feeling threatened. For that to happen, there had to be an emotional, and what might be termed "intellectual", *closeness* between therapist and child, which was not always possible with a third person continually present.

Having been firm about not having other children present at the initial consultation, the "rules" were relaxed for therapy sessions. It was seldom a problem to have one or two siblings playing quietly at a distance in a large enough treatment room, while a parent participated in a treatment, or parent-therapist discussion proceeded.

### **3.2.3.3 Family Involvement in Homework**

Each time a child attended for therapy, some of the activities from the therapy session were included in the homework. Parents were instructed to do the homework in 5 to 7 minute sessions, once, twice or three times daily, 5 or 6 days a week. The practice sessions could be separated by as little as 10 minutes. They were asked to do the homework in "good" listening conditions, and to create at least a 50-50 balance between the "talking tasks" and "listening and thinking tasks" contained in the homework, but to err on the side of reducing the talking tasks and increasing the listening and thinking tasks (see also 3.4.2). This point often had to be emphasised, as, quite understandably, the parents frequently saw speech production practice as the most important and beneficial aim and aspect of the homework programme.

The families were asked not to practice in the morning prior to a therapy session, but as far as possible, always to practice later the same day as a therapy session. The request to do homework later, on the same day as a therapy session, was explained in terms of enhanced reinforcement due to a recency effect. Suggesting no homework earlier in the day of a therapy session was motivated simply in terms of not wanting to overload parent or child with too much to do on the same day, *and* guarding against their becoming bored with too much homework. The families were encouraged to make the homework as informal, "natural" and enjoyable (for them and for the child) as they could.



Some of the children had regular “homework” at preschool, once, or at most, twice per week, with a pre-school early intervention resource teacher. This practice was encouraged, being regarded as extremely helpful to the child and supportive of the parents. All of the children took their speech books to pre-school fortnightly or weekly, during therapy blocks, to show their teachers, who then gave them general encouragement and reinforcement, related to the current goals, procedures and activities in the books.

#### **3.2.4 Special Skills and Techniques for Parents**

The booklet, “Notes for Families and Teachers” contained explanations of developmental phonological disorder, expressed in lay terms. Prior to the study, successive drafts of the booklet had been read and criticised by the (12) parents of six phonologically disabled children who had been in therapy with the author, five speech language pathologists with varying degrees of experience as clinicians and as parents, and two undergraduate speech-language pathology students, one of whom was also a parent. Many of their suggestions were incorporated into the final version of the booklet, which underwent no further modification once the study began. Sections of the booklet were discussed with the families and teachers, and elaborated when required, as therapy proceeded. Some details of the topics covered, in the booklet, and in discussion, are summarised below. The entire booklet is included in Appendix A.

Phonological disability was defined and described in the context of linguistic development overall, and the concept of developmental readiness explained. The process of assessment and phonological therapy was outlined, and the questions that families often ask about phonological disability answered. The constituents of the therapeutic regime were itemised, with examples.

As previously discussed (1.0.6), the term “error” to denote a phonological deviation was avoided, or used in a qualified way. The parents, students and clinicians who had criticised the booklet deemed the terms “phonological deviation” and “deviant phonology” undesirable. Phonological disability was therefore described in the booklet in terms of “phonological

processes", in preference to the more descriptive, but potentially alarming or offensive (to a lay population) "phonological deviations". In discussion, the terms "phonological deviation", "mismatch" or "phonological mismatch" were generally employed.

Aspects of the therapy, such as minimal contrasts activities, auditory bombardment, and structuring and implementing the homework were covered in general detail in the booklet, often explained again in writing in the speech book (specifically in relation to the child concerned), and discussed as required. An attempt was made to call technical terms by their correct names, without overburdening the booklet with excessive jargon. The lay critics were very helpful in this regard, as they were quick to pinpoint unfamiliar concepts and language.

The parents (and the significant others who became involved in the research project) were given direct instruction in providing to the child appropriate modelling and modelling corrections. They learned how to encourage self-monitoring and self-correction; how to recognise and reinforce the use of phonological revisions and repairs; and how to integrate these techniques into naturalistic contexts. Skills such as providing "labelled praise" as a form of positive feedback were discussed and practised, sometimes using role play.

### ***3.2.5 The Children's Participation in Therapy***

In the preceding discussion, the family education and training aspects of the model, and the special skills that parents were shown how to use, were outlined. The main concerns in the preceding discussion were the relationship and interaction between the therapist and the parents, and what was required of the parents in the overall management of their child's developmental phonological disorders.

The following sections relate more to the relationship and interactions between the therapist and the child; the family (as therapist) and the child; and the expectations of children's participation in therapy.

### **3.3 Metalinguistic Tasks**

With its emphasis on children following the normal developmental route in resolving their production problems, the therapeutic regime required that they must learn self-monitoring abilities. This learning, in turn, relied upon the development of certain metalinguistic knowledge and skills, including the awareness that the purpose of phonological development is effective communication.

#### ***3.3.1 Rationale for a Metalinguistic Tasks Constituent***

The rationale for the inclusion of the metalinguistic tasks constituent was to provide the parents and child with a mutually understood frame of reference and terminology to use in activities related to thinking and talking about the properties of language. They were exposed to a vocabulary of terms such as "sound", "word", and "meaning", and metaphonological tasks such as phoneme segmentation, recognising phoneme-grapheme correspondences, and rhyme matching.

As this discussion concerns three and four and younger five year olds, it may be surprising to find knowledge of "sound" and "word", and phoneme segmentation ability included in the preceding list. Whitworth and Zubrick (1983) determined that a stable concept of "sound" (i.e., phoneme) was not present in normal children until five or six years of age, and that the concept of "word" was not established until almost seven. Further, they found that phonemic segmentation ability was not present consistently until six years, with girls evidencing more advanced acquisition than boys.

Nevertheless, clinical experience has shown that *some* phonologically disabled three and four year olds can manipulate the concepts of sound and word in a limited, but meaningful and useful way in therapy, and they can perform simple phoneme segmentation tasks, when taught how. Those children who are unable to perform such tasks independently appeared to benefit from performing tasks encompassing these skills, with some adult assistance.

In performing phoneme segmentation tasks, pre-readers were able to recognise at least a few phoneme-grapheme correspondences, especially if learning was facilitated by the use of picture-cues (e.g., letter 's' corresponding with /s/ and a picture of a snake).

### **3.3.2 The Process of Metalinguistic Tasks Training**

Where possible, familiar children's books, games and activities were used as vehicles for developing opportunities for metalinguistic discovery, with the aim of encouraging the child to think about, and talk about language, especially at a phonological level. Besides fostering general metacommunicative abilities, the approach incorporated didactic, interactive teaching to develop such specific skills and abilities as:

1. Traditional metaphonetic activities, including knowledge of and ability to recognise sound-effect : picture associations (e.g., a picture of a train to associate with /tʃ/ - representing a "choo-choo" sound-effect; a picture of someone with a finger to their lips to associate with /ʃ/ - representing a "be quiet" sound-effect). This would be extended into tasks such as: "Listen to me say these words.....did you hear a train noise?" (e.g., in vs chin); "...did you hear a 'be quiet' noise?" (e.g., in vs shin); and "...tell me which noise you hear first, a train noise or a 'be quiet' noise?" (e.g., chin, shin).
2. Phoneme segmentation for onset matching (see 4.5.6.2) - that is, sorting words by initial phoneme (e.g., "Find John some friends whose names start with the same sound as his name: /dʒ/" - from a selection such as Ted, Jerry, Jack and Humpty).
3. Awareness of rhymes and sound patterns between words (e.g., minimal contrasts) (see 4.5.6.1), and the ability to sort words according to their phonetic or structural characteristics (e.g., finding rhyming words; finding words containing consonant clusters) (see 4.5.6.3).
4. Rudimentary knowledge of what a sound and a word (or "name") are (see 4.6.6.4).

5. Understanding that words have meanings - and that they can "make sense" or not (metalinguistic processing).
6. Understanding that you have to say the "right" word to make sense (knowledge of communicative adequacy or communicative effectiveness).
7. Understanding that you have to say the word the "right" way to make sense.
8. Awareness of and the ability to perform revisions and repairs ("self corrections"), and metalinguistic knowledge of when or why we make revisions and repairs.
9. Judging when a word sounds "right" and when it sounds "wrong".
10. Lexical and grammatical innovations, utilising morphophonological structures such as: plurals (boy : boys), possessives (boy : boy's or boys') and past tense (mow : mowed) to facilitate the emergence of new phonological contrasts (Shriberg & Kwiatkowski, 1980).
11. Metaphonological knowledge of phoneme-grapheme correspondences or sound symbol relationships (e.g., recognising that the letter "s" corresponds with /s/).

### **3.4 Traditional Phonetic Production Procedures**

In their concern to focus on cognitive awareness and organisation of the sound system, and to a greater or lesser extent, on the metalinguistics of communicative effectiveness, Dean and Howell (1986), Monahan (1984a) and Young (1983) tended to understate the importance of developmental readiness to revise phonemic production as a factor in phonological maturation (Hewlett, 1990). Whilst Hodson and Paden (1983) distanced themselves from what they called "phoneme oriented articulation training", they were nonetheless more disposed to use traditional approaches to establishing standard sounds than Monahan, Young and Dean and Howell, and others experimenting with phonological approaches in the mid-80's.

Grunwell (1985a) listed frequent, but not obligatory, characteristics of phonetic inventories of phonologically disordered children, which could occur singly or in any combination:

- (a) few (often only one) places of articulation used with any frequency;*
- (b) lack of fricatives, often...only one at one place of articulation, and rarely voiced;*
- (c) absence of affricates;*
- (d) restricted use of voiced-voiceless (lenis-fortis) feature;*
- (e) frequent use of the glottal stop and/or glottal fricative. (p. 95)*

### **3.4.1 Rationale for Including a Phonetic Production Constituent**

Hewlett (1990) asserted that before the phonetic production of a sound can be revised, at least the following four conditions must be satisfied:

1. the child must be aware of the inadequacy of the current production;
2. the child must have the desire to change it;
3. the child must have knowledge of the required target or targets; and,
4. the child's vocal apparatus must have sufficient dexterity to implement newly learned sounds at speed, and in a variety of phonetic contexts.

Acceptance of Hewlett's conditions, in particular numbers three and four, was an integral part of the theoretical base for the inclusion of a phonetic production training element in the therapy model, especially for the children who required phonetic inventory expansion. The phonetic production aspect of the therapy approach also sat well with Stoel-Gammon and Dunn's (1985) model of phonological development which contained a neuromotor component, encompassing the ability to plan and execute the articulatory movements underlying speech.

### **3.4.2 The Process of Phonetic Production Training**

Traditional phonemic placement techniques were incorporated, and phonetic production practice was included, but minimised, in the belief that if children with phonological problems were treated with too strong an emphasis on phonetic production, it would impede their progress.

Children with restricted phonetic inventories and phonotactic repertoires were taught, early in therapy, to produce the absent phonemes, or at least phonemes in the same sound class, and to extend their range of phonotactic options. Those who were slow to respond to inventory expansion, or who had difficulty maintaining the ability to produce new sounds, had production practice of short lists of words, containing target phonemes Syllable Initial Word Initial Position (SIWI) occasionally included in therapy and homework. Most children had some direct traditional instruction ("stimulation") in producing target sounds, around half had incidental production practice of single words containing target phonemes as part of metaphonological and metaphonetic tasks, and around half had a very small amount of formal production practice. The *proportion* of production practice, for those who did it, was greater in homework sessions than during therapy sessions.

Parents were encouraged not to emphasise production practice too strongly. They were reminded that language is learned first by listening, and that the "listening" and "conceptual" aspects of the therapy were more important than the "speaking" ones. The "listening" constituents comprised minimal contrasts therapy and auditory bombardment (listening to talking); the "conceptual" constituents were contained in the metalinguistic tasks activities (thinking about talking); and the "speaking" constituents involved metalinguistic tasks and phonetic production training (talking about talking). A balance of at least 50-50 between *listening and conceptual*, and *speaking* tasks was suggested to the parents, while encouraging them to tip the balance somewhat in favour of listening and conceptual activities, and to regard practising saying words as a very minor aspect, only included sometimes, and only for some children.

### **3.5 Multiple Exemplar Techniques**

In practice, minimal contrast activities and auditory bombardment, frequently overlapped and were referred to collectively as multiple exemplar training. Both related logically to the other parts of the therapeutic model, and to familiar and enjoyable child-parent communicative

interactions such as story reading, nursery rhymes, rhyming humour, cloze (sentence completion) tasks, and games.

### **3.5.1 Rationale for a Multiple Exemplar Techniques Constituent**

Hodson and Paden (1983) proposed that auditory bombardment helped develop "auditory images", allowing the child to learn to monitor incorrect productions, while production practice produced kinaesthetic images, which also assisted in error monitoring. Commenting on Hodson and Paden's proposal, Ingram (1989a) posited that a theoretical explanation for the apparent usefulness of auditory bombardment might lie in preliminary data from cross-linguistic studies of phonological acquisition. Ingram cited the findings of Pye, Ingram and List (1987), which suggested that the acquisition of first sounds is influenced more by their linguistic prominence than by their assumed articulatory difficulty. For instance, monolingual French speaking children learn /v/ early, while it is acquired late by monolingual English speaking children. The incidence of /v/ in French is much higher than it is in English. Ingram (1989a) suggested that auditory bombardment might facilitate phonological change due to the frequency of presentation of multiple exemplars, because it increases the frequency of some targets.

The author's clinical experience with Hodson and Paden's (1983) style of auditory bombardment, using amplification and lists of words with the same initial target phoneme, and more particularly, with the style utilising minimal word contrasts (Monahan, 1984a) has shown some form of controlled phonological input to be a worthwhile aspect of intervention, at least for some clients. Additionally, anecdotal accounts from experienced clinicians in whose "clinical judgement" auditory bombardment seems beneficial, encourages one to agree with Stoel-Gammon and Dunn (1985), Ingram (1989a), and others, that the approach merits empirical investigation.

There were two potential ways of providing intensified, systematic, and repeated exposure to multiple exemplars of phonological structures and contrasts (Ingram, 1989a): first, through the techniques developed by Weiner (1981a), Blache (1978b, 1982) and others, often



referred to as minimal contrast therapy, and second, auditory bombardment (Hodson & Paden, 1983, Monahan, 1984a). By increasing lexical frequency, minimal contrast activities provided a means of facilitating the child's ability to recognise contrastive phones, and to be confronted by the interconnections between the way a word is pronounced, the transmission of meaning, and communicative effectiveness. Auditory bombardment also increased lexical frequency and controlled phonological input for limited periods, potentially presenting an opportunity for the children to discover underlying phonological patterns for themselves.

### **3.5.2 The Process of Multiple Exemplar Techniques Training**

Multiple exemplar training included minimal contrasts therapy and auditory bombardment. Both were performed within therapy sessions and for homework.

#### **3.5.2.1 Minimal Contrasts Activities**

The minimal contrasts activities were many and varied. Mostly they involved simple card games with minimal meaningful contrasts (MMC's) pictured on playing cards, or on pictures pasted into the children's speech books. Training sets might, for example, consist of pictures, usually accompanied by the written word, of:

Final Consonant Deletion		Cluster Reduction		Velar Fronting		Deaffrication	
light	lie	glow	low	car	tar	chip	ship
boat	bow	black	back	corn	torn	chew	shoe
moon	moo	steam	team	cap	tap	chop	shop
couch	cow	clip	lip	kite	tight	cheep	sheep
bean	bee	ski	key	call	tall	chain	Shane
calf	car	spit	pit	key	tea	choose	shoes
Stopping of Fricatives		Gliding (of liquids)		Stopping of Affricates		Glottal Replacement /s/ → /h/	
fat	pat	lead	weed	chin	tin	sauce	horse
feel	peel	line	wine	chair	tear	seal	heel
fill	pill	lock	wok	chip	tip	soup	hoop
full	pull	lick	wick	chop	top	sew	hoe
fall	Paul	lip	whip	cheese	tease	sum	hum
foal	pole	lake	wake	chick	tick	sip	hip

Context Sensitive Voicing		Palato-alveolar Fronting		Glottal Replacement /t/, /k/ → /h/		Word-Final Devoicing	
bowl	pole	ship	sip	toe	hoe	weed	wheat
buy	pie	sheet	seat	tie	high	wag	whack
big	pig'	shoe	Sue	tip	hip	pig	pick
beep	peep	shell	sell	cot	hot	cub	cup
gum	come	show	sew	cart	heart	Marge	march
Sue	zoo	short	sort	key	he	feed	feet

Training sets of cards, or pictures in the speech books, ranged in number from three pairs to nine pairs. All the activities were modelled for the children first, until they understood what to do, for example, the child might have to sort the cards into two piles, with vs. without final consonants for final consonant deletion.

Some typical examples of minimal contrasts activities, which all included pictures accompanied by spoken words throughout, are listed below. Many of them were modified (and often thereby improved and made more interesting to the children!) by the parents, older siblings, or by the treatment children themselves, as they played the games. For example, many of the children would "personalise" an activity by including one of their toys as an integral part of it, or make an activity more elaborate or interesting in some other way. Some of the basic formats were:

1. "Point to the one I say": in which the child pointed to the pictures of the words, spoken in random order (e.g., glow, black, low, steam, back, team, glow), or rhyming order (e.g., low, glow, back, black, team, steam), by the therapist or the parent.
2. "Put the rhyming words with these words." : in which the therapist or parent set out three to nine cards (e.g., pat, peel, pill, pull) and the child placed rhyming cards beside them (fat, feel, fill, full) ( see 4.5.6.3 for a variation of this game).
3. "Say the word that rhymes with the one I say": in which the therapist or parent said words containing the target phoneme, and the child said the rhyming non-target word ( e.g., the adult would say "fill" and the child would say "pill").

4. "Give me the word that rhymes with the one I say": in which the adult said the non-target word, and the child selected the rhyming word containing the target sound (e.g., the adult would say "pill" and the child would select "fill").
5. "Tell me the one to give you": in which the child said the word, and the adult responded to the word actually said. So, for example, if the child attempted to say "fill", but produced it as "pill", the adult would give him or her "pill", causing them to experience a communication failure. This game was based on the homophony confrontation tasks described by Weiner (1981a). The aim was for the children to realise the failure to communicate their message, and attempt to revise their production. There were many variations on this activity, involving various games, puppet plays, and "magic tricks" in a "magic show". It was the only minimal contrasts activity that was not included in homework, though all the parents observed it during therapy sessions. It required a "light" touch, and humour that the *child* found funny and did not go on for too long. The games involving homophony confrontation were not played when siblings were present, because of the possibility of their giving rise to teasing.
6. "You be the teacher, and tell me if I say these words the right way or the wrong way": in which the adult said the words in rhyming or random order, and the child judged whether the words had been produced correctly or not.
7. "Silly Sentences": in which the child judged whether a sentence was a "silly one" (e.g., the adult might say "We flew to Melbourne in a pane" and the child would judge the sentence a "silly one").
8. "Silly Dinners": was a variation of "Silly Sentences". The adult said what they wanted for dinner, and the child would judge whether it was a "silly dinner" or not (e.g., "For my dinner I will have 20 hot ships (chips) and two delicious shops (chops)").
9. "Shake-ups and Match-ups" see Section 4.5.6.3.
10. "Find the two-step words": in which the child sorted the words with consonant clusters SIWI from minimally contrasting words with singleton consonants SIWI (e.g., top/stop).

11. "Walk when you hear the two-steps": in which the child "walked" with their fingers when they heard a consonant cluster SIWI as opposed to a singleton consonant SIWI.

The therapist or parent would help the child perform the task, gradually phasing out the help until the child was performing their part of the task independently. The purpose of the tasks was explained to the parents and the children as a good way of listening to, and "thinking about", the way words sound. The parents were instructed to encourage the children to "think the words in your mind" while they performed sorting tasks.

Including graphemes meant that sometimes the children sorted pictures visually as well as, or possibly instead of, auditorily. If they did, it was encouraged, and viewed as an additional way for the child to find systematic patterns and correspondence between linguistic levels. The minimal contrasts activities typically provided a natural lead-in to a brief "input" of auditory bombardment, and the boundaries between where minimal contrast activities finished, and auditory bombardment activities took over, were sometimes blurred. The minimal contrast training sets would sometimes double as auditory bombardment list words.

### **3.5.2.2 Auditory Bombardment Activities**

Auditory bombardment provided the children with concentrated exposure to a particular sound in a specific word context (usually SIWI, e.g., fill, feel, fall, file, foal, fool, fell, foil; or, chair, cheese, chew, chin, chick, child, church, chop), or in minimally contrasted word-pairs (e.g., bow-boat, cow-couch, etc; or pay-play; back-black, etc).

Auditory bombardment was explained to the parents and the children as a good way of listening to sounds in words. During therapy sessions, the auditory bombardment words would be read to the child one to three separate times during the session. The lists would comprise 10 to 15 different words (all familiar, or all unfamiliar, or a combination of the two) with a common phonetic feature (e.g., all starting with /s/; or all ending with a particular consonant class, for example the nasals /m/, /n/ and /ŋ/; or a list of minimal meaningful contrasts (see above). Two

examples of auditory bombardment list for nasals Syllable Final Word Final Position (SFWF), follow:

List 1: fun, sun, bun, moon, soon, coon, ring, wing, sing, ring, sing, wing, moon, soon, coon, fun, sun, bun.

List 2: pin-ping, thin-thing, win-wing, Kim-king, rim-ring, dim-ding, ping-ping-ping, ding-ding-ding, boing-boing-boing-boing-boing.

The rationale for using unfamiliar words was based on the observation that new lexical (and grammatical) learning in normal development appears to promote changes in the child's phonological system (Shriberg & Kwiatkowski, 1980), and is hence a potential trigger for phonological innovation. Funny or made up words (e.g., kerpow), and contrasts (e.g., zowie-kerpowie) and onomatopoeic words (e.g., ding dong) were used for their perceptual saliency for the children, and because the children and parents found them fun.

When auditory bombardment was included in the homework, the parents were asked to present it twice in each homework session. All that was involved was for the adult to read the word list to the child while they listened quietly. The parents were encouraged to say the rhyming words "rhythmically" in pairs, so that they formed couplets (or triplets if there were three words, e.g., Sue/shoe/chew; sip/ship/chip; sore/shore/chore).

No amplification was suggested, and indeed, the auditory bombardment was occasionally whispered to the child. The parents were told not to over-emphasise target sounds (i.e., not to distort them), though they were told that it sometimes helped if they made the bombardment interesting or funny. In this regard, funny, perceptually salient made-up words like "boing", "ker-plop", "ker-plunk" and "shillyshally" often set the children laughing, and asking for "more bombs" ("bombs" was a name one of the therapy children invented for "auditory bombardment", which rapidly gained currency in the clinic). The same child's father *marched* while proclaiming the bombardment list, which his delighted family found very funny! When tape recordings of therapy sessions were taken home, they always included auditory bombardment.

### **3.6 Homework Activities**

The homework was such a central aspect of the therapy approach that it has, of necessity, been referred to several times already in describing and discussing the other constituents of the model, and will be discussed in further detail here.

Hodson and Paden described a few minutes daily "homework", which involved practice at saying target word lists, and auditory bombardment. Similarly, Monahan sent home auditory bombardment lists for parents to read to each child daily. Young, on the other hand, did not report any parent involvement or homework. In reporting the efficacy study of the Dean and Howell *Metaphon* approach, Hill, Waters and Dean (1989) did not allude to homework per se. However, they did state, in relation to their 30 minute therapy sessions, that: *"parental attendance was actively encouraged and although one parent was almost always present, the degree of active participation in the therapy situation was variable"* (p. 18).

#### **3.6.1 Rationale for a Homework Constituent**

There were several reasons why the homework was considered such a crucial aspect of the model:

1. Homework activities provided practice and reinforcement and an opportunity to generalise newly learned skills, for both the child and the family. For the child this practice, reinforcement and generalisation involved aspects of learning more about their own phonology, and for the parents, it involved developing their skills as co-therapists.
2. It was important that the parents and their child engaged in the homework activities away from the therapist's supervision, facilitating independent experimentation with, and development of, the tasks presented. The parents' confidence increased as they became more "at home" (literally) with the procedures, so that they became more critical and innovative in their approach to the homework. Before long, most parents would initiate appropriate steps in therapy, arising from something that occurred during homework.

3. The homework took the therapy away from the often contrived confines of communicative interaction within the clinic, and into more meaningful communication contexts for the child. This socio-environmental generalisation enabled the parents to introduce skills they had acquired in terms of nurturing the child's phonological system, as natural opportunities arose, and when they were "in the mood" and the child was receptive.
4. The homework was conducive to internal development, which allowed each family to "individualise" it somewhat, hence making it more relevant and interesting for them all.
5. Because the homework was dynamic, it influenced the form the therapy sessions took, and allowed the therapist to mould the activities that occurred in the clinic to suit the individual child and his or her family better.
6. When phonological "breakthroughs" occurred at home, they were usually noticed during the homework. This was very encouraging and motivating for the families, who readily saw, and valued, their own contribution to such obvious progress. The parents' perception and recognition of their active involvement in therapeutic management was a powerful reinforcer for them, and for the child.
7. Recognising, and taking responsibility and credit for phonological innovation and change, reduced dependency (of parent and child) on the clinician's guidance, and promoted an atmosphere in which the parents could encourage the child to "take over" their own independent *phonological learning*. More traditional therapy approaches lacked this aspect, as the emphasis throughout therapy was on *phonetic or phonemic teaching*.
8. Being involved in homework had the potential to help the parents to understand the approach and have confidence in it (cf. Klimacka, 1995, commenting on *Metaphon*, see 2.4.4).

### **3.6.2 The Homework Process**

The strategy of integrating reinforcement into ordinary communicative interactions at home was particularly important with the three year olds. With older children, it was workable and often quite enjoyable to structure therapy sessions like individually tailored "lessons", with a related home practice schedule or "homework". By contrast, three year olds (and indeed their parents) were usually less responsive to such an approach. For them, a less formal structure was more suitable, and conducive to increased concentration, co-operation, and enjoyment of the therapeutic interaction. Importantly, even if three year olds were able to conform to a lesson format in therapy, a comparable situation was generally impossible for parents to replicate at home, once the initial novelty had dwindled.

The homework activities usually took the form of what was portrayed to the parents and children as "talking and listening games". Above all, they were told to make the homework regular, brief, positive and enjoyable. The homework activities were outlined week by week in an exercise book (the "speech book"). Each child's speech book was individually tailored to his or her specific needs and interests, so that no two were the same. The parents were encouraged to "sell" the speech book to the child as something very special and important. All of the children in the study responded well to this strategy, and typically regarded their speech book as a treasured possession, and loved doing the activities, and adding to the book. To emphasise the individuality of the speech books and to make them special, they would include some of the child's drawings, drawings or photographs of family members, and favourite fictional characters.

### **3.6.3 Typical Therapy and Homework Sessions**

In terms of content, there were a number of therapy and homework tasks and activities that recurred for all the children: for example, multiple exemplar training, metaphonological tasks, phonological processing activities, and phonetic production activities. A typical set homework routine might include:



1. Auditory bombardment;
2. A minimal contrasts task (e.g., sorting cards into pairs, or find the 2-step words);
3. A judgement of correctness task (e.g., "You be the teacher");
4. Listening to a tape of part of the preceding therapy consultation;
5. Auditory bombardment again;
6. Parents to concentrate on modelling and reinforcing a particular behaviour for the week (e.g., including consonants SFWF, or doing revisions and repairs).

The form of some of the particular homework tasks varied according to the child and the parents' needs and capacities. Some parents, for example, could easily respond to a broad homework task such as being asked to model velars (/k/, /g/, and /ŋ/) at opportune times. Others, whose child actually required almost exactly the same type of input, would not be able to cope with such general instructions, so they would be given a set routine to follow. Predictably enough, in general, the parents required most structure towards the beginning of the therapeutic process, and less towards the end. A typical therapy session might comprise much the same activities as those listed above for a homework routine (including listening to excerpts of therapy on audiotape), but instead of occupying 5 to 7 minutes, would be expanded and elaborated to spread over a longer period, with time allowed for discussion with the child's parent(s).

Whilst a homework routine was a condensed version of the most recent therapy session, a therapy session rarely included a total "re-run" of the previous week's homework. The effect of avoiding a re-run of the homework, in favour of getting straight on with different activities, was for the child to feel that they had something new and interesting to do each week, and for the parents to have an overall sense of progress. Care would be taken during the therapy sessions to determine that the child *could* perform the homework tasks. No task was ever included in the homework until the author was satisfied that the child could do it with reasonable ease, and that the parents understood what was required, of both themselves, and of the child for each task.

Tasks that the child patently took no pleasure in during therapy sessions were also eschewed as homework tasks; for example, a minority of the children disliked the "You be the teacher" game.

### **3.7 The Relationship between the Theoretical Background and the Model**

The impact of linguistic theory upon the speech-language pathology treatment of children with delayed and disordered language development in areas other than phonology is undeniable; but well into the 1990's, the phonological revolution has not resulted in the abandonment of traditional approaches to the remediation of phonological disability. As a review of the literature showed, although phonological analysis and description are widely applied, the remediation, procedures and activities which ensue often reflect the therapy approaches which have been employed by speech-language pathologists since the 1950's.

Commenting on the difficulty of making linguistic approaches to analysis "fit" with therapeutic practice, Howell and McCartney (1990) stated:

*Many published therapeutic approaches with a linguistic orientation appear to move directly from descriptions of phonological analysis to a variety of situations and exercises with a rather 'traditional' flavour and add rather ad hoc discussion of how some therapeutic discourse features might aid phonological organisation. (p. 56).*

*A Clinical Forum: Issues in Phonological Development* (Edwards, 1992; Elbert, 1992; Fey, 1992a, 1992b 1992c; Hodson, 1992; Hoffman 1992; Kamhi, 1992a; and Schwartz, 1992) incorporated the issue of the lack of coherence between theory and clinical practice as a recurring theme. A second theme, that of a relative lack of the application of phonological principles, to either assessment or intervention, was summed up by Hodson who said:

*My own observation, based on interactions with practising clinicians while giving clinical phonology presentations in some 40 states and 5 Canadian provinces, is that even now in the early 90's, only about 10% of the practising clinicians across the United States and Canada seem to be incorporating any phonological principles in their assessment and/or remediation. (p. 247)*

Having described the therapeutic model in detail, attention now turns to a discussion of which constituent aspects of it are "phonological" and which are not, and of how the model was informed by linguistic theory. In the course of this discussion, the above issues, relating to the application of phonological principles, and the need for theoretical cohesion and coherence, raised by Hodson (1992), and Howell and McCartney (1990), and many others, will be addressed.

### **3.7.1 What is a "Phonological" Approach?**

*"The defining characteristic of phonological therapy is that it is 'in the mind'" (Grunwell, 1988). The terms phonological therapy and phonological remediation permeate the current speech-language pathology literature. They are often used ambiguously, and it is not always immediately clear whether they refer to intervention for phonological disability, or intervention that is, by nature, somehow phonological. The term phonological therapy is used here to mean the application of phonological principles (see 3.7.5) to the treatment of children with phonological disability. Stoel-Gammon and Dunn (1985) provided a neat summation of the characteristics of phonological therapy. They believed that it: "(1) is based on the systematic nature of phonology; (2) is characterised by conceptual, rather than motoric, activities; and (3) has generalisation as its ultimate goal" (p. 168). In general agreement, Grunwell (1985a) believed that the aim of the therapy was: "...to facilitate cognitive reorganisation of the child's phonological system and his phonologically-oriented processing strategies" (p. 99). Similarly, Fey (1992b) stated that: "phonological therapy approaches are designed to nurture the child's system rather than simply to teach new sounds" (p.277).*

### ***3.7.2 Fey's Framework for Analysing the Form of Phonological Therapy***

Fey (1992b) referred to earlier work relating to a structural plan for analysing the form of language intervention approaches (Fey, 1986; Fey 1990; Fey & Cleave, 1990) in terms of their (1) hierarchy of goals; (2) intervention procedures; and, (3) intervention activities. Figure 1 summarises Fey's framework, and the steps involved in modifying and adapting theoretical principles into an intervention approach to developmental phonological disorders as workable phonological therapy activities.

Using the framework, Fey examined in detail the form of several phonological (and not so phonological, e.g., Hoffman, 1992) therapy approaches, highlighting certain points of departure between phonological and traditional therapies. Fey's analytical framework captured the clear distinction between intervention approaches, intervention procedures, and intervention activities. It also showed the process of converting a phonological theory into a theoretically principled phonological therapy.

Within the present work, in subsequent discussion and case studies, the terminology employed, and the clear and useful distinctions between the aspects of the therapy model (e.g., the distinctions between levels of goals, and those between approaches, procedures and activities), suggested by Fey, are used.

## PHONOLOGICAL THEORY

e.g., Natural Phonology (Stampe, 1973); Interactionist-Discovery Theory (Menn, 1976)

From which the clinician can conceptualise and formalise  
a theory of development, a theory of disorders, and a theory of intervention.

### CONGRUENT WITH



## PHONOLOGICAL ASSESSMENT APPROACHES



## PHONOLOGICAL THERAPY APPROACHES

GIVING RISE TO THREE LEVELS OF INTERVENTION GOALS

### 1. BASIC GOALS

(1) To facilitate cognitive reorganisation of the child's phonological system, and his/her phonologically-oriented processing strategies (Grunwell, 1985a) - a basic goal, or aim, unique to all phonological therapy approaches; and (2) to improve the child's intelligibility - a basic goal shared by traditional and phonological approaches.

### 2. INTERMEDIATE GOALS

To target *groups* of sounds related by an organising principle (Phonological Processes or Phonological Rules)

### 3. SPECIFIC GOALS

To target a specific sound or sounds, using vertical strategies - working on a goal until a criterion is reached, and then treating a new goal; or horizontal strategies - targeting several sounds within a process, and / or targeting more than one process simultaneously.



## INTERVENTION PROCEDURES

Which may or may not take the same form as procedures used in traditional approaches (e.g., homophony confrontation, inventory expansion, auditory bombardment, phoneme segmentation, lexical and grammatical innovation).



## INTERVENTION ACTIVITIES

Contexts and events, such as games and tasks, which may or may not take the same form as activities used in implementing traditional intervention procedures.

Figure 1: Hierarchical progression from phonological theory to theoretically congruent phonological therapy approaches, procedures and activities (after Fey, 1992b).

### ***3.7.3 Relationship between the Therapy Approach & Normal Development***

Stoel-Gammon and Dunn's (1985) summary of the four basic interacting components needed for the formulation of a model of normal phonological development provides a useful framework within which to consider the nature of the constituents of the therapy model.

#### **3.7.3.1 Auditory Perceptual Component**

The ability to attend to and perceive linguistic input was the essence of the auditory perceptual requirement of Stoel-Gammon and Dunn's model for phonological development. The auditory perceptual components of the therapy model were metalinguistic training, including tasks involving aspects of linguistic awareness and phonological processing; the stimulability aspects of phonetic production training; and multiple exemplar training.

#### **3.7.3.2 Cognitive Component**

Stoel-Gammon and Dunn's cognitive component encompasses the ability to recognise, store, and retrieve input, and to compare input with output. These abilities were obviously necessary for the implementation of all of the constituents of the model listed above: metalinguistic, phonological and phonetic. However, the cognitive component was chiefly to do with the multiple exemplar training aspects of the therapy model, which involved confronting the child in various ways with their own homophony.

#### **3.7.3.3 Phonological Component**

For Stoel-Gammon and Dunn, the phonological component encompassed the ability to use sounds contrastively, and to match the phonological distinctions of the adult language. Within the therapy model, the phonological constituents were found in the multiple exemplar training tasks, including the minimal contrasts activities and auditory bombardment.

#### **3.7.3.4 Neuromotor Component**

Stackhouse (1984) discussed the clear necessity to have separate phonetic and phonological goals. The Stoel-Gammon and Dunn neuromotor component encompassed the ability to plan and execute the articulatory movements underlying speech (c.f. Hewlett, 1990). The aspects of the therapy model that fitted with this component were related to phonetic production training, including stimulability and inventory expansion.

#### **3.7.4 The Principles of Phonological Therapy**

Pronunciation patterns are rule-governed and predictable. This fact, according to Grunwell (1985a) is the basis for all principles of phonological analysis and therapy, and it was this principle that underpinned the characteristics of the current therapy methodology, summarised as follows.

1. The therapy program was based on phonological analysis and assessment (Grunwell, 1985a), which also defined the basic, intermediate and specific goals (Fey, 1992b, see Figure 1) in treatment.
2. Therapy planning was predicated on the principle that there are predictable patterns or regularities in the child's productive phonology (Grunwell, 1985a; Ingram, 1986).
3. Therapy was based on the principle that the main function of phonological patterning is its communicative function in signalling meaning (Grunwell, 1985a; Stoel-Gammon & Dunn 1985).
4. Therapy emphasised the importance of fostering in the child an awareness that the purpose of phonological development was effective communication and hence, aimed to nurture metaphonetic and metaphonological awareness.
5. Therapy aimed to change the child's phonological patterns so as to facilitate the development of a more functional system of sound structures and contrasts (Grunwell, 1985a; Ingram, 1986).

6. Therapy was structured to take advantage of the organisation of phonological patterning by eliciting and establishing changes in the child's productive patterns, through the use of natural sound classes and structures (Grunwell, 1985b).
7. Therapy involved enlisting family participation in a range of formal and informal homework activities, for reasons inextricably bound up with the connections between communicative context, communicative intent, and communicative effectiveness.

### ***3.7.5 The Form of this Phonological Therapy***

What was there about the therapeutic model that made it phonological? Which aspects were based on phonological principles? The basic goals in phonological therapy were shared by both traditional (see 1.4.1) and phonological therapy approaches: namely, to improve the accuracy of sound production, and hence improve intelligibility. However, as Fey (1992b) discussed, phonological therapy had an additional basic goal - the reorganisation of the sound system (Grunwell, 1985a; see 3.6.1). This goal, which was of course entirely "phonological", was the primary one in the therapy model proposed here, and could be regarded as the central rationale for all components of the model. From it, arose the phonological procedures that the model contained, namely:

1. Minimal contrasts activities, involving the use of meaningful minimal contrasts (Weiner, 1981a; Blache, 1987b, 1982) in naturalistic games and activities where communicative context, intent, and effectiveness were highlighted, to facilitate the child's discovery of phonology rules (Menn, 1976; Menyuk, Menn & Silber 1986; Kiparsky & Menn, 1977; Fey & Gandour, 1982);
2. Metalinguistic training, including such procedures as the use of homophony confrontation (Weiner, 1981a);
3. Lexical and grammatical innovations, using new words, and plural and past tense morphemes to facilitate the emergence of new phonological contrasts (Shriberg & Kwiatkowski, 1980);



4. Auditory Bombardment (Hodson & Paden, 1983; Monahan, 1984a) used to provide repeated, concentrated exposure to multiple exemplars of phonological targets and contrasts.
5. Phoneme-grapheme correspondence awareness (Allerton, 1976), used to facilitate awareness of systematic sound patterning.

### **3.8 The Research Project**

The main components of the research project were: a between groups therapy efficacy study, a methodological study of measurement of phonological disability, and a within group study of the treatment group's response to the therapy.

#### **3.8.1 The Efficacy Study - Research Question 1**

To demonstrate empirically the effectiveness of the therapeutic model, a between groups study was designed to answer Question 1, which was: *"Using this therapeutic approach, can phonological development be accelerated beyond the improvement expected with age?"* The most convincing way of answering Question 1 was to use a longitudinal matched-groups design, in which a group of children who received the therapy were compared with a group of children who did not. The effectiveness of the therapy would be demonstrated by a selective or enhanced improvement in only the treatment group. There might be some improvement in the untreated children, but if there was *less*, the therapy could be deemed successful.

#### **3.8.2 The Measurement Study - Research Question 2**

In developing a method of answering Question 1, the desirability of having a severity index to classify the subjects' phonological disabilities, became apparent. The main dependent variable in the efficacy study was the speech-language pathologists' ratings of phonological status. In a normal clinical environment, it is impractical to monitor progress in such detail.

Accordingly, it was essential to try to develop an effective, time-efficient, reliable severity index, based on objective measurements. The validity of the proposed severity index would be determined by its correlation with the mean severity ratings. Hence, Question 2, which was more to do with methodology than with the therapeutic approach per se, was: *"Can a clinically practical, reliable, severity index for phonological disability be devised?"*

### **3.8.3 The Tasks Study - Research Question 3**

A small study was made of four selected phonological processing and metalinguistic tasks which formed part of the pre- and post-test (initial and probe assessment) battery for the two groups of children. This was done to answer question 3: *"Can the relative contribution to phonological progress of the four tasks be determined, and if so, which might be retained, and which might be excluded in a refined and "streamlined" adaptation of the therapy approach?"*

### **3.8.4 The Within Group Study - Research Question 4**

A within group study of the treated children was designed to answer Question 4: *"What factors predict how long it will take for a child treated with this therapy to achieve age-appropriate phonology?"* The factors taken into consideration would be the characteristics of the child (e.g., gender, initial age, the initial severity of the phonological disability, and receptive language function). Also of significance would be the response of the family of each child to the regime. In exploring Question 4, parental participation, wider family involvement, and the input of significant others, would be important considerations, as well as the performance of the children.

## **3.9 Hypotheses**

Four hypotheses were formulated in relation to the between groups study, concerning the development of the children's (1) phonological systems, (2) receptive vocabulary skills, (3) MLU's, and (4) performance of metalinguistic tasks.

Three hypotheses related to the within groups study were formulated, surrounding: (5) the significance of the severity of the phonological disability in predicting the amount of treatment required, (6) the relationship between the age of the child at initial consultation, and the amount of therapy needed, and, (7) the connection between developmental phonological disorders and early literacy development.

### ***3.9.1 Hypothesis 1: Selective Improvement in Phonology***

It was hypothesised that the therapy regime would facilitate phonological development, beyond the effects expected with age. A significant improvement would be evident in the treatment children's output phonology when they were re-assessed at the "probe" assessment, 3 to 12 months after initial consultation. By contrast, children in the non-treatment matched control group would show no such improvement, or very little improvement, in their output phonology when reassessed after a similar period.

### ***3.9.2 Hypothesis 2: PPVT-R Scores to Show Specificity of Treatment Effect***

It was hypothesised that no significant change attributable to the therapy regime, would be demonstrated in areas other than phonology; for instance, receptive vocabulary. A non-significant difference between the treatment and control groups in their receptive vocabulary standard scores on the Peabody Picture Vocabulary Test-Revised (PPVT-R) (Dunn & Dunn, 1981), at both initial consultation and probe consultation, was therefore predicted. The absence of an acceleration in the development of this aspect of receptive language function would be an indication of the specific nature of the therapy approach.

### ***3.9.3 Hypothesis 3: Selective Improvement in MLUm***

It was hypothesised that an increase in expressive language function, represented by MLUm and structural analysis, would be observed in the treatment group but not in the control group.

This improvement was hypothesised on the basis that (a) as the treatment children's speech became more intelligible, they would reduce the tendency to lexical selection; and (b) as their intelligibility improved, so would their communicative effectiveness, encouraging them to talk more, thereby enhancing expressive output in areas other than phonology.

#### ***3.9.4 Hypothesis 4: Selective Improvement in the Metalinguistic Tasks***

It was hypothesised that the performance of the treatment children on the metalinguistic tasks included in the initial and probe assessment battery would show selective or enhanced improvement, relative to the control children, if the skills they employed were important in contributing to enhanced phonological development in the treatment group.

#### ***3.9.5 Hypothesis 5: The Effect of Initial Severity on Number of Treatments***

It was hypothesised that the more severe the child's phonological disability at initial consultation, the more treatments s/he would require. This hypothesis was based on the view that initial severity would be the most significant factor determining phonological progress.

#### ***3.9.6 Hypothesis 6: The Effect of Initial Age on Number of Treatments***

It was hypothesised that the older the child at initial consultation, the more treatments s/he would require. The relationship between age and number of treatments was considered as a factor predicting progress, because of the commonly held belief among clinicians that "early intervention" is desirable, since phonological disabilities of long-standing can be more difficult to treat due to factors such as habituation, and "older" preschoolers being less amenable to, and less interested in, therapy.

### **3.9.7 Hypothesis 7: Early Literacy Skills Acquisition**

It was hypothesised that some of the treated children would evidence later literacy difficulties, reflected in their performance on measures of reading performance, which could be phonologically based. Tracking the progress of the children, all of whom would be pre-schoolers at the outset of the study, afforded an opportunity to observe the early literacy development of some of them, once they entered Infants' School (see 1.9).

## **CHAPTER 4**

### **METHOD**

A unique aspect of this project was the inclusion of a control group of phonologically disabled children who received no therapy while they were participants in the study. The clinical phonology literature is silent on the existence of therapeutic intervention studies for phonological disability using control subjects. Moreover, the ethical concerns surrounding the withholding of therapy from diagnosed populations, are, quite rightly, regularly invoked (for example, Hodson & Paden, 1981, Howell & Dean, 1991).

#### **4.0 Issues in Subject Selection**

Having identified an ethical means of obtaining control subjects, the difficulty involved in actually recruiting them, and retaining them in the study can hardly be overstated. This tortuous process is outlined in Section 4.1.1. However, there were less problematic aspects of the subject selection process, that need clarification.

##### **4.0.1 Age**

The criteria for entry into the study were that the children should be no less than 2 years 10 months at the younger end of the range, and have not yet started school, at the older end. A minimum age of 2;10 was set, because if the children were any younger, they would be too young for a reasonably sure clinical diagnosis of phonological disability.

#### **4.0.2 Medical Problems often associated with Phonological Disability**

Clinical experience suggested that potential subjects might have, or might develop, significant ear, nose and throat (ENT) pathology, including otitis media, recurrent tonsillitis, adenitis, chronic middle ear effusion, and associated conductive hearing problems. Therefore, in the original experimental design, it was proposed to assign any children with ENT difficulties to one experimental group, and those with no such histories to another. The same separation of the control children was also planned. Remarkably, none of the 22 children fitted the criteria for the proposed ENT groups, and as such, the distinction was abandoned in the experiment proper.

#### **4.0.3 Associated Communication Impairments**

It was also a condition of entry into the study that the children's communication impairments should represent reasonably "pure" examples of phonological disability. Receptive vocabulary and expressive language development were to be within six months of age expectations. Children with other communication impairments (for example, vocal nodules and stuttering) were excluded. However, if other communication difficulties arose after acceptance into the study, the children were retained in their respective groups.

In the treatment group, Subjects 4T, 7T, and 10T developed stuttering symptoms after they entered the study. Similarly, in the control group, Subjects 15C, 16C, and 17C developed stuttering symptoms. Subjects 4T, 7T and 10T were treated for stuttering concurrently with their phonological therapy programme.

Co-existence of stuttering and disordered phonology in young children is readily attested in the literature. Indeed, phonological disability, or "articulation disorders" as they are usually called in the research literature relating to stuttering, appears to be the communication disorder most commonly associated with stuttering (Wolk, Edwards & Conture, 1993). Cantwell and Baker (1985) found that around one third of children who stutter also exhibit "articulation difficulties". Bloodstein (1987) wrote:

*"There is hardly a finding more thoroughly confirmed in a whole range of comparative studies of stutterers and nonstutterers than the tendency of stutterers to have functional difficulties of articulation, 'immature' speech, and the like" (pp. 219-220).*

When Subjects 4T, 7T and 10T developed stuttering, the treatment planning dilemma was how to proceed with their phonological therapy, *and* treat them for stuttering. Leaving the stuttering untreated was not considered as an option, for obvious ethical reasons. The main issue, though, was how to improve their phonological skills without compromising their fluency skills further, and vice versa. For Subjects 4T and 7T this proved to be a straightforward exercise. However, for Subject 10T, treatment planning and progress were problematic. He will, therefore, be discussed in a subsequent case study (in Chapter 6).

#### **4.0.4 Monolingualism**

The children were all monolingual in Australian English at home. Subject 9T was the only one with significant exposure to a second language. His parents were first generation Australians of Italian parents. English was his mother's first language, while his father's first language was Italian. The parents spoke only English when Subject 9T and his siblings were present. However, he was frequently minded by his monolingual Italian speaking paternal grandparents, and would regularly attend social functions where both languages were used. He and his siblings understood Italian, but spoke only a few words of it. His parents had been in the habit of discussing matters they did not want the children to know about in Italian. However, they stopped when they realised how much of what they were saying the children could comprehend!

In the unlikely event that 9T's exposure to Italian compromised his monolingual status, then it might be considered a factor in *impeding* his progress phonologically, despite receiving the therapy. If so, it (his "borderline bilingualism") would work against the hypothesis that the therapeutic approach accelerates phonological acquisition beyond the effects expected with age, and cannot therefore be considered as a confounding factor.



#### ***4.0.5 Absence of Speech-Language Pathology Intervention***

None of the treatment group had received previous speech-language pathology assessment or intervention, entering the study as a subset of new referrals to the author's normal clinical caseload. The clinic is a private, multi-disciplinary group practice, located in metropolitan Sydney, New South Wales. The treatment subjects were seen on a normal fee-for-service basis, like all other clients attending the clinic.

Of the control group children, Subjects 15C, 16C, 17C and 22C were country children who lived between 600 and 700 Km from Sydney. They had undergone a 10 to 15 minute screening assessment (at a pre-school centre) by a speech-language pathologist from a publicly funded agency at a regional centre. In publicly funded speech-language pathology clinics in Australia there is no fee-for-service. The children had then been placed on a 5 to 11 months waiting list for treatment, due to lack of personnel and clinical resources.

None of the four country control children had received direct therapy, though each child's mother had been given brief management advice, on the telephone, by the clinicians who screened them. The clinicians who did the screening did not meet with the children's parents, or provide them with documentation of either the screening assessments or the management advice.

The remainder of the control group, Subjects 18C, 19C, 20C and 21C were on a 5 to 11 months metropolitan speech-language pathology clinic waiting list in a publicly funded agency. None of them had been screened or formally assessed, but their mothers had been given advice over the telephone as part of an "intake" procedure at the clinic. Again, none were sent any written information.

## 4.1 The Subjects

The entry characteristics of group, gender, age, Peabody Picture Vocabulary Test - Revised (PPVT-R) standard score, and Mean Length of Utterance in morphemes (MLUm) of all the children are set out in Table 1.

**TABLE 1**  
**Entry Characteristics of the Subjects**

Subject/Group T = treatment C = control	Gender F = female M = male	Initial Age in months; & years & months	Initial PPVT-R Standard Score	Initial MLUm
1T	F	52.00 (4;4)	115	5.30
2T	F	56.00 (4;8)	106	5.20
3T	M	46.00 (3;10)	105	4.50
4T	F	50.00 (4;2)	104	4.37
5T	F	50.00 (4;2)	106	3.17
6T	F	51.00 (4;3)	105	4.00
7T	M	57.00 (4;9)	127	4.00
8T	F	35.00 (2;11)	94	3.40
9T	M	49.00 (4;1)	91	4.30
10T	M	51.00 (4;3)	97	3.64
11T	F	46.00 (3;10)	99	3.50
12T	F	53.00 (4;5)	113	4.80
13T	F	44.00 (3;8)	114	4.00
14T	F	47.00 (3;11)	96	3.50
15C	M	51.00 (4;3)	126	4.00
16C	F	43.00 (3;7)	101	3.04
17C	M	50.00 (4;2)	94	3.10
18C	F	45.00 (3;9)	117	4.90
19C	M	56.00 (4;8)	94	4.10
20C	M	41.00 (3;5)	105	3.17
21C	M	34.00 (2;10)	103	3.45
22C	F	51.00 (4;3)	95	3.50

Fourteen children, 10 girls and 4 boys, comprised the treatment group; while eight children, 3 girls and 5 boys, comprised the control group. Upon entry into the study, the mean age of the treatment children was 4;1, in comparison to the mean age of the controls, which was 3;10. The difference in initial mean age was non-significant ( $F(1,20) = 1.01, p > .10$ ). The subjects had been referred to speech-language pathology because their speech was difficult to understand, but, as previously described, none had received direct intervention. All of the children spoke Australian English as their first language, and were monolingual at home, bearing in mind the slight reservations concerning Subject 9T (see 4.0.4, above).

Each child had passed a hearing screening test using Osborn and Doyle's (1983) protocol for preschool children, that conforms to the American Speech-Language-Hearing Association guidelines (1985) (20dB at 1000, 2000 and 4000 Hz). A Danplex AS50 audiometer was used, and the hearing tests were administered by Clinical Audiologists employed either by the New South Wales Department of Health or the New South Wales Department of Community Services. All other measures of speech and language function, and all subsequent treatment for the experimental group, were administered by the author. Receptive vocabulary, measured on the PPVT-R, was no more than 6 months below chronological age-expectations, upon entry into the study. There was no significant difference between the PPVT-R scores for the two groups ( $F < 1$ ). The mean PPVT-R score in the treatment group, was 105.14, and in the control group, 104.37.

An audiotaped language sample of no less than 200 consecutive utterances was analysed for each child. The samples were gathered in at least three communicative contexts, with the subjects conversing (1) parent to subject, (2) sibling to subject, and (3) examiner to subject. By obtaining representative samples in a variety of contexts the potential difficulty of the control subjects being more reticent with the author than the treatment subjects (i.e. because they were less familiar with her) was avoided. As it happened, the control children were at least as talkative with the author as the treatment children during language sample collection. Utterances that occurred during *Metaphon* or *PACS* administration were excluded from the MLUm calculations, because the nature of the tasks might reduce sentence length. MLUm (Brown, 1973; Chapman, 1981), and syntactic development (Brown, 1973; Paul, 1981), were within at least 6 months of chronological-age expectations for all 22 children. There was a non-significant difference between the MLUm's of the experimental and control children, which were 4.12 morphemes, and 3.65 morphemes, respectively ( $F(1,20) = 2.75, p > .10$ ).

Miller and Chapman (1981) showed a strong positive correlation between MLUm and age which has proved difficult to replicate, though it has since been done by some investigators. Therefore, these MLUm calculations were interpreted cautiously, particularly considering the reservations of both Crystal (1974), and Bennett-Kastor (1988). Both authors had concerns about the disadvantages of MLUm's in terms of definition, application and interpretation. It is readily acknowledged that the MLUm is a weak measure of language complexity above 4.0 They are simply included here as supporting evidence that the children's language skills in areas other than phonology were within the normal range, and to demonstrate the similarity between the two groups. Additionally, MLUm was the unit of measurement used in addressing Hypothesis 3, which was concerned with the specificity of therapy effects (see 3.8.3).

Because the role of primary caregivers was an important component of the study, and because the therapy methodology was family centred, an attempt was made to obtain subjects whose families' socio-economic status and family structure were similar. All except Subject 12T lived at home with both their biological parents. Subject 12T (in the treatment group) was in a single parent household. She had irregular weekend access visits to her father and his partner, who were encouraging, but who took no active part in the therapy. All of the children had one or more siblings. None had extended-family members living in the household, and all had at least one parent in full-time employment. Potential subjects were not excluded on the basis of family history of communication impairment or learning disability. Subjects 4T and 11T were sisters. Informed parental consent was obtained for all children to participate in the study.

#### ***4.1.1 Recruiting and Retaining the Control Subjects in the Study***

Once ethical clearance had been obtained, recruiting, and retaining the control subjects in the study, was fraught with difficulty. The children on waiting lists in the clinics involved were placed on the lists in the order in which they were referred to the agency, irrespective of factors such as age, nature of their probable communication disorder, or degree of urgency from the parents' perspective. They were assessed in the same order and, if they met clinical criteria for intervention, were eligible for immediate treatment.

Each of the control children on the waiting lists had their final re-assessment for the study just prior to commencing therapy. When they exited the study, they received immediate speech-language pathology intervention. As Table 2 shows, there was variation in the time they spent waiting, though they were all told at the outset that they would have to wait 5 to 11 months. Subject 22C had been on her waiting list for 6 months already at the time of her initial assessment for the study.

**TABLE 2**  
**Ages at Initial and Probe Assessment, and Interval Between these Assessments for the Control Group**

<b>Subject (c) = country (m) = metropolitan M = MALE; F = FEMALE</b>	<b>Age in Months at Initial Assessment</b>	<b>Age in Months at 'Probe' Assessment</b>	<b>Interval in Months between Initial and Probe Assessments (i.e., 'waiting time')</b>
15C (c) M	51.00	61.00	10.00
16C (c) F	43.00	54.00	11.00
17C (c) M	50.00	60.00	10.00
18C (m) F	45.00	53.00	08.00
19C (m) M	56.00	64.00	08.00
20C (m) M	41.00	49.00	08.00
21C (m) M	34.00	43.00	09.00
22C (c) F	51.00	56.00	05.00

The reason for the unequal numbers of experimental and control children raises some ethical and practical issues, that require explanation. Finding fourteen participants for the experimental group was relatively easy. As mentioned previously, they were referred for therapy as a subset of the author's usual clinical caseload, and became Subjects 1T, 2T, 4T, 5T, and 7T through 14T. These twelve suitable candidates were enrolled in the study in the order in which they presented themselves to the clinic for assessment.

Subjects 3T and 6T presented originally as potential control subjects. However, when their parents discovered they met the criteria for inclusion in the study, they chose to enter the treatment group instead.

There was no such ease in establishing a control group. For ethical reasons, all the parents of the potential control children were *encouraged*, by the author, to seek appropriate treatment for their children's phonological disabilities. In the early stages of setting up the study, potential control subjects were recruited from metropolitan Sydney speech-language pathology waiting lists (of 5 to 11 months duration). Of the 36 assessed, only four were engaged as controls (namely 18C, 19C, 20C and 21C). Of the remaining 32, all opted to withdraw from the waiting lists. Two, 3T and 6T were enlisted as treatment subjects, and the remaining 30 enrolled in private therapy with other clinicians near their own home. Thus, it became apparent that it was necessary to look further afield for subjects who would retain their non-treatment status, even after their phonological disability had been diagnosed, and therapy recommended. Accordingly, I gained access to a large sample of children in rural New South Wales. They were all on Department of Health waiting lists, and were supposedly unable to have therapy due to the lack of speech pathology services in country areas.

The waiting lists were perused for children in the right age group who appeared, from their parent's description on the telephone, to have phonological problems. After this initial "culling", the parents of 72 potential control subjects were approached. They were offered a full speech and language assessment and report for their children, and invited to have their children participate in the study as non-treatment controls if suitable. Astoundingly, 15 families declined and immediately found therapy services through the Department of Community Services in their areas. Two enrolled their children in private therapy. Four failed to respond to the invitation.

The remaining 51 children were screened. Of these, 28 fulfilled the criteria for entry into the study. Unfortunately, 11 of the 28 had to be excluded. Three of the eleven attended for the first assessment, and were then uncontactable. The parents of a further eight of the eleven either relocated, or decided not to attend for a follow-up assessment. This reduced the pool of control subjects to 17. The parents of the 17 children were all approached by a speech-language pathologist who offered to help them with their speech in a "speech stimulation group" setting at a greatly reduced group-fee rate. Thirteen of them accepted. Four (Subjects 15C, 16C, 17C and

22C) remained as control subjects until they became eligible for therapy at the agency on whose waiting list they were included. This made a total of eight control subjects, four metropolitan and four country children.

## **4.2 Methods of Measuring Phonological Characteristics**

Before looking at the subjects' phonological characteristics (see 4.2.4) it is necessary to describe how they were recorded and measured. The main dependent variable in the therapy efficacy study was the improvement in phonological development of the treatment group. Hence, it was crucial to attempt to develop a reliable means of recording and quantifying the severity of the children's phonological disabilities, and of recording and measuring change. Two ways of measuring the phonological characteristics of the subjects were applied: Incidence Category Scores described in Section 4.2.2, and the Sum of Phonological Deviations procedure, described in Section 4.2.3. Additionally, two ways of measuring the severity of phonological disability in children were developed: a Severity Rating Procedure (see 4.3.1) and a Severity Index Procedure (see 4.3.3).

### **4.2.1 Phonological Deviations**

The Incidence Category Scores, and Sum of Phonological Deviations were both ways of quantifying the phonological deviations (including phonological processes and idiosyncratic sound replacements) present in the individual children's speech. The application of the term phonological deviation was discussed in Section 1.0.8. "Deviation" is used in the sense that the child's speech attempt varied from, or did not match, the adult target. Some deviations, such as Gliding of Liquids (/l, r/ → /w, j/) and Gliding of Fricatives (/f, v/ → /w/; /s, z, ʒ/ → /j/), were counted as one phonological deviation, irrespective of word position. Others, such as Cluster Reduction were considered in terms of initial and final word position (but not inter-vocalic). If, for example, a child had Cluster Reduction SIWI and SFWF, Cluster Reduction would be counted as two phonological deviations.

It is important to note that age-appropriate *phonemic replacements*, such as /θ/ → /f/, and /ð/ → /v/, observed in the phonologies of 9T (aged 4;10), 11T (aged 4;5) and 14T (aged 4;8), were, of course, not counted as *phonological deviations*, for either group. Similarly, /s/ → /θ/ and /r/ → /w/, in 13T's phonology, at the age of 3;11, and /s/ → /θ/ and /z/ → /ð/ in 8T's at the age of 3;1, were noted, but not counted as phonological deviations. Hence, they were excluded from the two procedures used to measure severity (the Sum Deviations and the Rating Scale).

The following sound-class processes, within the sample, were counted as *one* phonological deviation, irrespective of word-position:

- Backing of Alveolar Stops
- Context Sensitive Voicing
- Gliding of Liquids

The following syllable-structure processes, within the sample were each counted as *one* phonological deviation:

- Initial Consonant Deletion (ICOD)
- Initial Cluster Deletion (not counted if ICOD was 100%)
- Final Consonant Deletion (FICOD)
- Final Cluster Deletion (not counted if FICOD was 100%)
- Weak Syllable Deletion

The remaining phonological processes within the sample were considered in terms of initial word position and final word position. The reason for this distinction was that some children would present with a phonological deviation word initially or word finally only, while others would present with the same deviation word initially and word finally. So, for example, if a child exhibited Fronting of Velars SIWI and SFWF, it would be counted as *two* phonological deviations. If they just exhibited Fronting of Velars SIWI or SFWF it would be counted as *one* phonological deviation. Within the sample there were:

Fronting of Velars	SIWI	SFWF
Palato-alveolar Fronting	SIWI	SFWF
Cluster Reduction	SIWI	SFWF
Stopping of Fricatives	SIWI	SFWF
Stopping of Affricates	SIWI	SFWF



The other phonological deviations in the sample, which were each counted as one phonological deviation, were:

**Word Final Devoicing**

Stridents Replaced by /h/ (glottal replacement)	SIWI	Subject 4T only
/s/ Replaced by /h/ (glottal replacement)	SIWI	Subject 7T only
/t/ and /k/ Replaced by /h/ (glottal replacement)	SIWI	Subject 11T only
Fricatives Replaced by /j/ (gliding of fricatives)	SIWI	Subject 12T only

#### **4.2.2 Incidence Category Scores**

The Incidence Category scores were based on the commonly applied procedure of dividing the number of actual occurrences of a deviation by the number of "opportunities", or potential occurrences, of a deviation, and expressing the result as a percentage of occurrence (see 1.4.8). The scores were allocated to five categories, as follows:

Category 5	80 to 100%	occurrence of the phonological deviation
Category 4	60 to 79%	occurrence of the phonological deviation
Category 3	40 to 59%	occurrence of the phonological deviation
Category 2	20 to 39%	occurrence of the phonological deviation
Category 1	≤ 19%	occurrence of the phonological deviation

In establishing baseline data for the study, incidence category scores below 15% were not included in the initial assessment figures. The lowest incidence category figures for individual deviations for each of the subjects were: 1T 66%; 2T 16%; 3T 16%; 4T 25%; 5T 25%; 7T 16%; 8T 25%; 9T 33%; 10T 37%; 11T 25%; 12T 33%; 13T 50%; and 14T 25% for the treatment group, and 15C 16%; 16C 50%; 17C 16%; 18C 15%; 19C 33%; 20C 50%; 21C 50%; and 22C 33% in the control group. In subsequent assessments, incidence category scores below 5% were excluded. In practice, the lowest score in Category 1 was 7%.

It will be seen in Section 4.3.1 that the incidence of occurrence of phonological deviations, expressed in percentage terms, was an essential component of the information provided to the raters who determined the Severity Ratings of the children's phonological disabilities.

### 4.2.3 Sum of Phonological Deviations

A broad indication of the severity, or otherwise, of a phonological disability involved the application of the Sum of Phonological Deviations procedure. This was done by tallying the sum of deviations in the incidence categories, but ignoring the distinction between categories. The following example, displayed in Table 3, comes from Subject 6T's data. It shows her Incidence Category scores, and Sum of Phonological Deviations, when she was assessed at the ages of 4;3, 4;7, 4;9 and 5;1.

**TABLE 3**  
**Example of the Application of the Incidence Category Scores and Sum of Phonological Deviations Procedure**  
**(Subject 6T)**

Age	Incidence Category 5 80-100%	Incidence Category 4 60-79%	Incidence Category 3 40-59%	Incidence Category 2 20-39%	Incidence Category 1 ≤ 19%	Sum of Phonological Deviations
4;3	1	1	2	1	1	6
4;7	0	1	0	2	2	5
4;9	1	0	0	1	0	2
5;1	0	0	0	0	0	0

Having described the ways used to measure the phonological deviations present in the children's output phonologies, it is now possible to delineate the phonological characteristics of the subjects when they entered the study. This will be done, in Section 4.2.4, in terms of their Sums of Phonological Deviations by Incidence Category, which involved an objective measure of the incidence of their phonological deviations. Then will follow a description of the development of the Severity Rating Scale (4.3.1), and the Severity Index for Phonological Disability (4.3.3).

### 4.2.4 Initial Phonological Characteristics of the Subjects

The phonological deviations evident at initial consultation for each subject, in terms of their Incidence Category scores and Sums of Phonological Deviations, are set out in Table 4. Group means for each incidence category are also included. Each of the 22 children had a

phonological disability, with at least three phonological deviations occurring greater than or equal to 50% of the time, in the absence of any known sensory, cognitive, neuromotor or physical problems, including sensorineural hearing impairment.

**TABLE 4**  
**Phonological Deviations by Incidence Categories and Sum of Phonological Deviations, at Initial Assessment**

Subject	Incidence Category 5 80 to 100% occurrence	Incidence Category 4 60 to 79% occurrence	Incidence Category 3 40 to 59% occurrence	Incidence Category 2 20 to 39% occurrence	Incidence Category 1 ≤ 19% occurrence	Sum of Phonological Deviations
1T	3.00	1.00	1.00	0.00	0.00	5.00
2T	2.00	2.00	2.00	0.00	1.00	7.00
3T	2.00	1.00	1.00	2.00	1.00	7.00
4T	4.00	1.00	1.00	1.00	0.00	7.00
5T	2.00	1.00	2.00	2.00	0.00	7.00
6T	1.00	1.00	2.00	1.00	1.00	6.00
7T	2.00	2.00	1.00	0.00	1.00	6.00
8T	4.00	0.00	1.00	1.00	0.00	6.00
9T	5.00	0.00	1.00	1.00	0.00	7.00
10T	5.00	2.00	1.00	1.00	0.00	9.00
11T	2.00	2.00	3.00	1.00	0.00	8.00
12T	4.00	1.00	1.00	1.00	0.00	7.00
13T	1.00	1.00	2.00	0.00	0.00	4.00
14T	4.00	0.00	0.00	1.00	0.00	5.00
Group Mean	2.92	1.07	1.35	0.85	0.28	6.50
15C	3.00	2.00	0.00	1.00	1.00	7.00
16C	4.00	0.00	1.00	0.00	0.00	5.00
17C	4.00	0.00	0.00	0.00	1.00	5.00
18C	9.00	0.00	0.00	1.00	2.00	12.00
19C	1.00	1.00	2.00	1.00	0.00	5.00
20C	6.00	1.00	1.00	0.00	0.00	8.00
21C	2.00	0.00	3.00	0.00	0.00	5.00
22C	4.00	1.00	1.00	2.00	0.00	8.00
Group Mean	4.12	0.62	0.62	0.62	0.50	6.87

### **4.3 Methods of Measuring the Severity of Phonological Disability**

Eighty one of the children's assessments were submitted to the Severity Rating Scale procedure and the Severity Index procedure.

#### **4.3.1 The Severity Rating Scale**

The Severity Rating Scale depended on the judgement of the severity of each child's phonological disability by four volunteer speech-language pathologists, all experienced clinicians in the area of phonological disability, and referred to here as "the raters". The raters were provided with: the child's age, gender, and the incidence of each phonological deviation in the child's phonology, expressed as a percentage of occurrence, from each of the 81 assessments. The information from each assessment was written on 81 index cards. The cards were given to the raters, arranged in ascending order of the ages of the children (youngest to eldest). The raters, working alone, then had to allocate the cards to four categories. Subject 17C's data from his second assessment are included below as an example.

<b>Boy 4;7</b>	
Cluster Reduction	100%
Palato-alveolar Fronting SFWF	66%
Fronting of Velars	50%
Context Sensitive Voicing	100%
Stopping of Affricates SIWI	63%
Initial Consonant Deletion	16%
Gliding of Liquids	100%
Severity Rating (please circle one)	
1	2      3      4

#### 4.3.1.1 Instructions for Raters

The raters were given written instructions, as follows:

*"The task is to sort the 81 cards into four categories:*

Severity Rating of 1.	Phonological system within normal limits.
Severity Rating of 2.	Mild phonological disability.
Severity Rating of 3.	Moderate phonological disability.
Severity Rating of 4.	Severe phonological disability.

*In deciding how to allocate the cards to the four categories, consider:*

1. The age of the child.
2. Developmental expectations of intelligibility.
3. The ages at which individual phonological deviations normally disappear.
4. The phonological "errors" that occur in a normal speech sample, considered acceptable in conversation, but which would have to be recorded in a phonological analysis. For example:

Weak Syllable Deletion:	/wi sɔː dɒn,tɛləʊ/	"We saw Donatello."
Cluster Reduction:	/aɪ ,nɪdə 'bɔlə 'strɪŋ/	"I need a ball of string."
Final Consonant Deletion:	/ɪts ə 'bɪ bɪt əv 'gəʊld stʌf/	"It's a big bit of gold stuff."

About the children:

The children range in age from 2;10 to 5;8. All have normal hearing. Although they either have, or have had, phonological disabilities, all of the children have normal language skills in areas other than phonology. Their PPVT-R Standard Scores range from 91 to 127. Some of the children have phonological disabilities. Others had phonological disabilities which have resolved."

### **4.3.2 Calculation of the Mean Severity Rating**

The mean Severity Rating for each phonological assessment was calculated by adding the scores assigned by the four raters, and dividing the sum by 4. Returning to Subject 17C, Rater 1 gave his phonology a Severity Rating of 3.00 (Moderate phonological disability) at his second assessment, while Raters 2, 3, and 4 allocated his phonology to category 4.00 (Severe phonological disability). His Severity Rating score was calculated thus:  $(3+4+4+4=15) \div 4 = 3.75$ . Hence his Severity Rating was 3.75.

Perusal of the individual Severity Ratings revealed that the raters were consistently "stricter" in the ratings they gave to the children five years of age or older. This tendency was exemplified by their probe assessment ratings for subjects 2T and 7T, both of whom required no further therapy after their probe assessments. When rating 2T's phonology, they considered that at the age of 5 years 7 months, 15% cluster reduction was too high, and she gained a mean Severity Rating of 1.50. Similarly, at the time of his probe assessment, 7T, aged 5 years 8 months, showed Cluster Reduction SFWF 10% and Weak Syllable Deletion 10%, gaining a mean Severity Rating of 1.75.

### **4.3.3 The Severity Index**

The Incidence Category scores were the basis for development of the Severity Index. The numbers in each Incidence Category were weighted by multiplying the figures in the most severe category (that is, Category 5) by 5, the next most severe (Category 4) by 4, and so on down to Category 1. In practice, the sum of the numbers enabled severity to be recorded on a simple numerical scale from 0 to 49. The range was 0 to 49 because 49 was the maximum Index score that occurred in the children's data. In fact it was Subject 18C's Index score at her initial assessment. Referring again to Subject 6T, her progress in therapy, using the Severity Index for phonological disability is demonstrated in Table 5.

**TABLE 6**  
**Calculation of Severity Index Scores from Incidence Category Scores**  
**(Subject 6T)**

<b>Age</b>	<b>Incidence Category 5</b>	<b>Incidence Category 4</b>	<b>Incidence Category 3</b>	<b>Incidence Category 2</b>	<b>Incidence Category 1</b>	<b>Severity Index Score</b>
	<b>80-100%</b>	<b>60-79%</b>	<b>40-59%</b>	<b>20-39%</b>	<b>≤ 19%</b>	
4;3	1x5=5	1x4=4	2x3=6	1x2=2	1x1=1	18
4;7	0	1x4=4	0	2x2=4	2x1=2	10
4;9	1x5=5	0	0	1x2=2	0	7
5;1	0	0	0	0	0	0

#### **4.4 Between Groups Study**

The between groups study was concerned with Research Questions 1, 2, and 3, and Hypotheses 1, 2, 3, and 4 (see 3.0 and 3.9).

##### ***4.4.1 Between Groups Study: Design & General Procedure***

The treatment efficacy study comprised a longitudinal matched groups design involving assessment, treatment and re-assessment phases. The main dependent variable was the change in the children's phonological development, determined by the difference between the initial and probe severity ratings. The secondary dependent variable was receptive vocabulary, represented by the PPVT-R standard scores. These scores were used to gauge the specificity of the treatment effect, against a more general effect of the treatment, in accelerating language acquisition. The independent variable was treatment vs. no treatment. Other relevant variables were gender, which was allowed to vary randomly, initial Sum of Phonological Deviations, which had to include at least three phonological deviations present 50% of the time, or greater, and entry age into the study which ranged from 2;10 to school entry age, in the event, 4;9.

The children went through an assessment procedure, described in 4.4.2, when they entered the study. The intervals at which the control children were assessed, and the numbers of assessments they had, were determined by the length of time they remained on their respective

waiting lists. All of them had at least an initial and final (i.e., probe) assessment. The probe assessment was administered as close as possible to the termination of their waiting list status. In the control group, Subjects 15C, 16C, 17C and 19C had an additional assessment between their initial and probe assessment. Hence, four of the control children had two assessments, and the other four had three.

After their initial assessment, children in the treatment group were re-assessed repeatedly throughout the study, as part of the usual ongoing clinical evaluation underpinning treatment planning. For each of the treatment subjects, one of their assessments, which fell between 5 and 11 months of their initial assessment, was selected as their probe assessment. The time-interval, of 5 to 11 months, matched the interval between the first and last assessments of the children in the control group. Subject 13T was the only exception, achieving age-appropriate phonology within three months of her initial assessment.

The total number of assessments, and number of the probe assessment for the treatment group are shown in Table 6. Importantly, the difference in the time interval between the initial and probe assessments for the treatment and control groups was non-significant ( $F < 1$ ). The mean time interval for the treatment group was 9.07 months, and for the control group 8.63 months.

**TABLE 6**  
**Total Assessments and Number of the Probe Assessment for the Treatment Group**

<i>Subject</i>	<i>Total Phonological Assessments</i>	<i>'Probe' Assessment was Number:</i>
1T	5	4
2T	7	7
3T	3	3
4T	6	3
5T	4	4
6T	4	4
7T	4	4
8T	5	4
9T	4	4
10T	10 to date	5
11T	4	4
12T	5	5
13T	2	2
14T	4	4



#### ***4.4.2 Family Participation in the Baseline Assessment***

One (usually just the mother) or both parents remained present with the subject to observe the baseline assessment. For this to happen with all 22 subjects, experimental and control, some negotiation was required. There were two main obstacles to having parents present during the initial assessments. First, some parents preferred to leave the child with the therapist for the assessment. Some suggested that their children would perform better one-to-one with the therapist, or that they might misbehave with the parent in the room. In such cases, it was necessary for the therapist to explain to the parent/s why their presence was important.

The second obstacle was that parents often wanted to bring their other child or children to the initial consultation. They were requested not to at the time the appointment was made. However, some people changed their minds, or child minding arrangements broke down at the last moment, and the therapist was faced with the choice of having too many distractions, in terms of noise in particular, in the room, or postponing the appointment. For the purposes of the study, when this occurred, the initial appointment was rescheduled for a time when the child could be assessed without the sibling's presence.

In the normal clinical routine, even when it is practice or clinic policy to ask parents to bring only the child to be assessed to an initial consultation, it is seldom an option to reschedule appointments in this way if they do not comply. This is unfortunate, because it means that some phonological assessments are conducted in unduly difficult listening, and recording, conditions.

At the conclusion of the initial consultation, the general outcome of the assessment was discussed with the parents, and their questions of immediate concern answered. To facilitate this discussion and information sharing, a display book of developmental expectations and material regarding phonological disability was developed. The parents were provided with a written report of the baseline assessment, including recommendations for intervention. The reports were written, as far as possible, in lay terms, were provided within 7 to 10 days, and were accompanied by an informed consent form which both parents signed (See Appendix B).

#### **4.4.3 Between Groups Study: Assessment Procedure**

The initial and probe assessments of both groups of children included items 1 to 5 of the following assessment battery:

1. Phonological evaluation;
2. Stimulability testing;
3. Structural analysis (with an emphasis on morphology) of a language sample, of no fewer than 200 utterances;
4. Assessment of receptive vocabulary; and
5. Assessment of selected aspects of metalinguistic awareness and phonological processing, involving four tasks:
  - (a) Task 1: a rhyme matching task, encompassing the ability to select a picture whose name rhymed with two given words (e.g., wall rhymed with tall and call) (see 4.5.6.1);
  - (b) Task 2: an onset matching task, encompassing the ability to sort or select pictured words by initial phoneme (e.g., John and jumper start with the same "sound") (see 4.5.6.2);
  - (c) Task 3: a word-structure sorting task, encompassing the ability to perform (spoken) word - picture matching tasks using minimal word pairs differing only in the inclusion or exclusion of a final consonant (e.g., high/hide) (see 4.5.6.3);
  - (d) Task 4: a lexical knowledge task, involving the ability to discriminate meaningfully between the terms "sound" and "word" , OR "sound" and "name" (see 4.5.6.4).

## **4.5 Components of the Assessment**

The assessments of the country children involved several visits to speech-language pathology clinics in large rural centres remote from Sydney. For convenience, an assessment kit, comprising tests, additional pictures, books and toys, plus items such as a tape recorder, oral torch, and so forth, was assembled to take on these country trips.

A screening procedure was administered to 51 country children, 20 of whom went on to have the full assessment battery listed in Section 4.4.3. In the course of the study, the kit was used again seven times to re-assess the country subjects, 15C, 16C, 17C and 22C. For the sake of consistency, items from the same kit were used to assess the metropolitan subjects also. The components of the assessment battery are described in the following sections.

### ***4.5.1 Oral Peripheral Examination***

Phonological evaluation began with a routine oral peripheral examination of the child's speech production mechanism (Hoffman, Schuckers & Daniloff, 1989) to exclude anatomical (e.g., dental malocclusion, ankyloglossia, submucous cleft) or neuromotor (e.g., dyspraxia, dysarthria, tremor) abnormalities. As an extension of the oral musculature evaluation, the phonetic production performance of the speech mechanism was evaluated.

### ***4.5.2 Phonological Evaluation***

Perhaps the most important part of the baseline assessment was the administration of a phonological screening test while the parents observed. In the absence of a screening component in the *PACS* (Grunwell, 1985a) at the time the study commenced, The *Metaphon* Resource Pack Screening Assessment (Dean, Howell, Hill & Waters, 1990), was selected for this purpose, but not all of the scoring procedures suggested by the authors were employed. The reasons for selecting the *Metaphon* were that it provides a reasonably comprehensive summary overview of phonological development, is quick and easy to administer, generally attractive to

three and four year olds, who like doing it, and it is an excellent basis for introducing and demonstrating for the parents key concepts about phonological approaches to intervention. Primarily, it was chosen because it gave the best *demonstration*.

The main modification to the *Metaphon* scoring procedure concerned age-appropriate phonetic sound replacements. Under the heading "What processes are profiled in the *Metaphon* Resource Pack?" (Dean, Howell, Hill & Waters, 1990), "Fronting of interdental fricatives" is included as a Systemic Simplification, to cover /θ/ → /f/, and /ð/ → /v/. In view of the above inclusion in the *Metaphon*, it is perhaps necessary to note again here that phonetic sound replacements, such as of /θ/ → /f/, and /ð/ → /v/, in 9T's, 11T's and 14T's phonology at the ages of 4;10, 4;5 and 4;8, respectively, and /r/ → /w/, in 13T's phonology, at the age of 3;11, and /s/ → /θ/ and /z/ → /ð/ in 8T's at the age of 3;1, were noted, but *not* counted as phonological deviations (see also 4.2.5).

More detailed phonological assessment upon which to base diagnosis and treatment planning was carried out, as required. The main assessment instruments used were the *PACS* (Grunwell, 1985a) and/or the procedures described by Stoel-Gammon and Dunn (1985), both of which approaches were described in Section 1.4.8. Additional phonological assessment materials accumulated or developed by the author over years of clinical practice, were also used.

Among the phonological assessment procedures available, very few have been standardised. Among those which have been "normed" are the *Assessment Link between Phonology and Articulation: ALPHA* (Lowe, 1986b), the *Bankson-Bernthal Test of Phonology* (Bankson & Bernthal, 1990), and the *Khan-Lewis Phonological Analysis* (Khan & Lewis, 1986).

Neither the *PACS* nor the *Metaphon* Screening Assessment were standardised. No accompanying information relating to reliability or validity was available, therefore, with either the *Metaphon* Resource Pack Screening Assessment or the *PACS*. Lowe (1994) reviewed the *PACS* and found that it appeared to have good construct and content validity. From the present author's perspective this appeared to be the case in that the test measured the theoretical construct

(phonological development) it was designed to measure (Anastasi, 1988; Murphy & Davidshofer, 1994) enabling the examiner to differentiate between children with or without phonological disability, determine developmental status (and change), and evaluate communicative adequacy. Content validity was also satisfactory in terms of the extent to which it provided relevant information about the behaviour being tested (Anastasi, 1988).

Phonological data samples of at least 200, but preferably 250 'spontaneous' (i.e., not imitated) words were elicited using the materials listed below, audiotaped, transcribed, and glossed orthographically where necessary. They were collected in the least time possible to obtain a satisfactory representative sample of the adult target system. At least two occurrences of each target were necessary in order to demonstrate variability. Tapes were transcribed as soon as possible after the assessment, and as much of the sample as possible was transcribed and glossed on-line. All of the samples included the child in conversation with his/her parent(s).

The main materials required were: Phonological Assessment of Child Speech (PACS)(Grunwell, 1985a), The *Metaphon* Resource Pack Screening Assessment (Dean, Howell, Hill & Waters, 1990), additional pictures, toys, objects, and children's books, as required, and an audio-tape recorder.

#### **4.5.2.1 Reliability of Phonetic Transcription**

The reliability of the phonetic transcriptions was determined by comparing the transcriptions of the author with the transcriptions of an independent transcriber (see Appendix C). The independent transcriber listened to 10% of the audio tape recordings of the initial speech sample of each subject. Inter-judge agreement was at a satisfactory level (Klee, 1992; Schriberg, Kwiatkowski & Hoffman, 1984) and ranged from 75% to 92% for the treatment group ( $\bar{x}$  = 84%), 75% to 89% for the control group ( $\bar{x}$  = 82%) and 75% to 92% for both groups ( $\bar{x}$  = 83%).

#### **4.5.2.2 Reliability of the Identification of Phonological Deviations**

The reliability of the identification of the children's phonological deviations was determined. An independent speech-language pathologist observed at least 95% of the children's phonetically transcribed utterances from their initial assessments, and allocated them to descriptive categories (e.g., velar fronting, cluster reduction, glottal replacement, etc). Inter-observer agreement upon the identification of phonological deviations was 97% across all the children (see Appendix C).

#### **4.5.2.3 Reliability of the Phonological Deviations Percentage of Occurrence Scores**

The reliability of the allocation of incidence (percentage of occurrence) scores for each process calculated by the author was also compared with the percentage of occurrence scores assigned by an independent clinician (Appendix C). Inter-observer agreement for the percentages of occurrence of the phonological deviations ranged from 87 % to 99% for the treatment group ( $\bar{x}$  = 92%); 80% to 99% for the control group ( $\bar{x}$  = 88%); and 80% to 99% for both groups ( $\bar{x}$  = 91%).

#### **4.5.3 Stimulability Testing**

Stimulability testing (as described by Stoel-Gammon & Dunn, 1985) was conducted to evaluate whether the children could perceive and produce the phonemes absent from their speech samples. Stimulation began at word level, then syllable level, and worked down to single phoneme level.

#### **4.5.4. Structural Analysis**

A sample of no fewer than 200 consecutive utterances was elicited. With some of the more talkative children, it was possible to use audiotapes of parts of the speech samples used for their phonological analyses for structural analyses also. Where possible, the child was engaged in conversation by the examiner. If their poor intelligibility (or the child's reticence)

precluded conversation and transcription, picture description, using the *PACS Pictures* and answering questions using the Action Picture Test procedure (Renfrew, 1971) was the usual alternative, augmented by talking about familiar objects and story books. The language samples were audiotaped, transcribed, and submitted to structural analysis, with emphasis on morphology. Mean Length of Utterance in morphemes (MLUm) was computed using the suggestions provided by Chapman (1981). The materials used included the *PACS Pictures* (Grunwell, 1985), the Action Picture Test (Renfrew, 1971), toys and picture books, and an audio tape recorder.

#### **4.5.5 Assessment of Receptive Vocabulary (PPVT-R)**

The Peabody Picture Vocabulary Test - Revised (PPVT-R) (Dunn & Dunn, 1981) was used to assess receptive vocabulary, according to the directions provided in the manual. The materials required were the PPVT-R and Record Form M, for preference, and Record Form L, when necessary, to avoid a practice effect.

Reliability coefficients for the PPVT-R within single age-groups have been found by several procedures. Internal consistency coefficients fell mainly in the .70's and .80's, with medians in the low .80's. Alternate form reliabilities with immediate retest yielded similar values (median .82) (Dunn & Dunn, 1981). In terms of its validity, the PPVT-R has been shown to correlate most highly with other vocabulary tests (e.g., the *Full- Range Picture Vocabulary Test* and the *Van Alstyne Picture Vocabulary Test*, referred to in the PPVT-R manual but not cited in the References), and to possess moderate correlations with tests of scholastic aptitude and verbal intelligence (e.g., the *Stanford-Binet Intelligence Scale*, and the *Wechsler Intelligence Scale for Children (WISC-R)*), and promising relations with performance on educational achievement tests (e.g., the *Wide Range Achievement Test*) (Dunn & Dunn, 1981; McCallum, 1985; Wiig, 1985; Anastasi, 1988).

#### **4.5.6 Selected Aspects of Linguistic Awareness and Phonological Processing**

The following four non-standardised tasks were also administered as part of the initial and probe assessments. The tasks were representative of some of the regularly used activities presented in therapy sessions and sent home for practice.

##### **4.5.6.1 Task 1: Rhyme Matching**

The purpose of this task was to determine whether the children could understand the concept of "rhyme" and sort pairs of rhyming words, pictured on cards, into minimal pairs. This task was included in the initial and final battery because of the emphasis in the therapeutic model upon awareness of rhymes, and rhyme matching, during multiple exemplar training tasks, and metalinguistic tasks, using minimal pairs. It would be interesting, and potentially helpful, therefore, to know whether the ability to recognise rhymes and perform rhyme matching tasks correlated with an improvement in output phonology.

The task was introduced by reading to the child a pop-up book, *"Big Bird's Rhyming Book"*, (Penick & Chartier, 1979) and talking about rhymes in a general way. The book contained the following sets of rhyming words: rock, clock, block, sock, lock; cats, bats; truck, duck; hoses, roses; cape, ape, grape; goat, boat; wing, swing; and pocket, rocket. Next, the child was shown a Sesame Street™ Big Bird Muppet Character© doll (Muppets Inc.®).

In introducing the training set, the children were told that Big Bird had already found two words (on picture cards) that rhymed: **clock** and **rock**. They were asked to help Big Bird find things that would rhyme with clock and rock from three arrays of three picture cards. The three arrays were presented one at a time. The cards had pictures on them, but no written captions. The examiner said the words to the child several times. Corrective feedback, and other help with the training task, was given by the examiner. The words in the training set were: cup, boat, **lock**; **block**, lion, bee; and wheel, **sock**, rain.



When the child understood what to do, they repeated the process with three more sets of three cards. The Task items are listed in Appendix D. The materials required were *“Big Bird’s Rhyming Book”*, the Big Bird doll, and picture cards. The maximum possible score for this task was 9.

#### **4.5.6.2 Task 2: Onset Matching**

Establishing whether the children were able to sort words by initial consonant phoneme, was the purpose of this task. It was important to determine whether any of the children could be taught to group, or sort, words according to their initial phoneme, and if so, whether such learning was associated with improvements in intelligibility.

To introduce the task, the children were shown a picture book of familiar television characters “John”, “Hamble”, “Slush” and “Benita” from the Australian Broadcasting Corporation’s children’s programme “Playschool”, which is telecast twice each weekday throughout the year. All the children could already name the characters with no prompting. Using a story-format, they were told that John’s name started with a “juh” (/dʒ/) sound, Hamble’s name started with a “huh” (/h/) sound, Slushes’ name started with a “sss” (/s/) sound, and Benita’s name started with a “buh” (/b/) sound. “Sounds” and “names” were talked about in a general way.

The children were told that John was looking for things that started with the same sound as his name (“Some juh (/dʒ/) words”) and asked if they would help him find them. The children were helped to find pictures of jelly, giraffe and jumper, from an array of 6 pictures on cards, presented in a different random order to each child. The words were said to the child, with the initial phoneme of each word emphasised slightly. The child was given help and corrective feedback while performing the training task. The six training words were: shell, bath, race, jelly, giraffe, jumper.

When the child understood the task, he or she was asked to find things for the other characters (Hamble, Slush, and Benita), who were also looking for things that started with the same sound as their name. The list of the three items for this Task are in Appendix D. The Materials required were two picture books: *"There's a Bear in Here"* and *"Toys"* (Meyer & Dolling, 1992), and sets of picture cards. The maximum possible score for task 2 was 12.

#### **4.5.6.3 Task 3: Word Structure Sorting**

This task's purpose was to see if the children could arrange non-rhyming words on picture cards into minimal pairs. As well as emphasising rhymes and word onsets, the therapy involved tasks requiring the children to sort non-rhyming minimal pairs, such as those relying on the inclusion or exclusion of a final consonant (e.g., cow-couch; moo-move). Again, it was important to find out whether any of the children could learn to perform such tasks, and whether the ability to do so appeared to be associated with enhanced phonological acquisition.

To introduce the task, the child was presented first with four picture cards representing the following minimal meaningful contrasts (MMC's): bow/boat; high/hide. They were then told that they were going to play a game called "Shake-ups and Match-ups". The word-pairs were repeated to the child several times, and then the picture cards were put into a container and "shaken up". The children were then asked to take the cards out of the container, and arrange them on the table "the same as they were before" (i.e., in pairs). When the child understood the task, three further items, detailed in Appendix D, were presented. The maximum possible score for task 3 was 3.

#### **4.5.6.4 Task 4: Lexical Knowledge**

The purpose of this task was to find out whether the children could distinguish meaningfully between the terms "sound" (i.e., phoneme) and "word" (or "name" if the child understood the idea of "name" more readily). This task was included because it was regarded as important to know whether the children understood these words that were frequently used in therapy. Knowing what these words meant would presumably have a direct bearing on successful

performance of the metalinguistic tasks included in the therapy regime; for instance, judgement tasks, in which the children would decide whether a word was said "the right way or the wrong way", or whether someone had said "the right sound or the wrong sound", or "the right word or the wrong word", and indeed, whether particular words rhymed or began with the same sound.

First, the child was presented with a set of 6 picture cue cards. The six cards comprised 3 sets of 2 identical pictures, which were: two snakes, two sleeping babies and two dripping taps. They were told that some of the cards had "special words" (or "names") on them, and some of them just had "ordinary sounds" on them that were not words (names) at all. The children were shown one picture each of snake, baby and tap, and told that the "special words" (names) that went with the pictures were "snake", "baby" and "tap". Then they were shown the remaining three pictures, and told that the "ordinary sounds" that went with them were /s/, /f/, and /t/. The connections between the pictures, words and sounds were explained to the children simply:

/s/	[snake cue card]	"A snake goes sss"
/f/	[sleeping baby cue card]	"People go shhh when a baby is asleep"
/t/	[dripping tap cue card]	"A dripping tap goes t-t-t"

When the child could point appropriately to the pictures, whether the examiner said a phone or a word, a plain cardboard box and a fancy enamelled box were produced. The child was told that "special words" (or "special *names*") belonged in the "special box", and "ordinary sounds" belonged in the ordinary box.

When the child understood what to do, 12 pictures were produced to use for the Task proper. There were two pictures of the tap paired with the word "tap", and two pictures of the tap paired with the phoneme /t/, and so on with "baby" (/f/), and "snake" (/s/). The examiner then handed the cards to the child one by one, in a different random order for each child, and the child sorted them into the two boxes according to whether the examiner paired them with a spoken word or phone. The materials required were picture cue cards and two boxes. The maximum possible score for task 4 was 12.

## **4.6 Between Groups Study: Therapy Procedure**

The aspects of the treatment that occurred in the clinic were administered in blocks. Therapy was conducted weekly for periods of ten weeks, alternated with 10 week breaks from therapy attendance. Early in the first treatment block, on the third or fourth visit, the parents were provided with a copy of the "Notes for Families and Teachers" (see Appendix A).

The duration of each treatment session was 50 minutes. Within this time-span, the child spent 30 to 40 minutes alone with the therapist. The minimum amount of parent participation at the clinic involved the accompanying parent joining the therapist and child for 10 to 20 minutes at the end of a session, or 10 minutes at the beginning and 10 minutes at the end, for the therapist to show the parents what to do for homework. This segment of parent participation required the child's continued involvement, in order to demonstrate properly what should happen during home-practice. The maximum parent participation entailed the parent actively involved in a treatment "triad" with their child and the therapist, for approximately half of the treatment session.

Parents were quite often apprehensive about being involved during therapy sessions in this way. Typically, they would predict naughty behaviour from the child with comments such as "He/she will misbehave when I come into the room". These concerns were addressed as they arose. In the event, behaviour management was not an issue for any of the treatment subjects. They, and their parents, soon gave every appearance of enjoying this style and degree of participation.

### ***4.6.1 Therapy Attendance, Homework, and Attendance Breaks in Practice***

Therapy attendance and punctuality figures for all the children were good, although a few appointments had to be postponed due to childhood illnesses, particularly upper respiratory tract infections, and chickenpox. Sometimes, it was not actually the treatment subject who was sick, but a sibling in quarantine, restricting the family's movements, or a sick parent.

Punctuality was important, because it meant the children all had treatment consultations of approximately the same duration (on average, 50 minutes). This would not have been possible had they arrived late for appointments, as typically there was no provision for extended time for individual consultations.

The good attendance figures meant that the approximately 10-weeks-on-10-weeks off pattern for the first therapy block and the first break from therapy was maintained consistently across subjects. In practice, the range of consultations in the first block, including assessments, was from 9 to 14. The duration of the first break from therapy ranged from 8 to 13 weeks. Ten weeks break was considered optimal, but this was not always possible to arrange, especially when the breaks incorporated school vacations, or coincided with parents' annual work leave, and the families were away from Sydney on holiday.

After the first break, therapy blocks did not exceed 11 consultations, one or two of which were assessment consultations. The range of consultations in Block 2 (required by all the subjects except 11T) was 5 to 11 consultations. Nine of the 13 subjects were seen for a third block. Four of them (6T, 7T, 12T, and 14T) simply had a final assessment and were discharged within normal limits. One (9T) had one assessment, and one treatment, and was then discharged. The other four had from 3 to 11 consultations (8T had 3; 1T and 2T had 7; and 4T had 11). Only three of the 13 subjects required a fourth block. Two of these children (1T and 8T) had 3 consultations, and one (4T) had 5 consultations before being discharged within normal limits.

All the children attended their appointments in the morning or early afternoon (8.00 a.m. to 2.00 p.m. appointments, finishing no later than 3.00 p.m.). They were usually accompanied by their mothers, with or without siblings. Six of the 13 fathers attended on one or more occasions. Four of the fathers attended the initial consultation. No siblings attended the initial assessments, though siblings were often present during ongoing assessment. Five of the children were accompanied by their grandmothers on one or more occasions. Table 7 shows a breakdown of who accompanied the children to the consultations.

**TABLE 7**  
**Total Consultations and Accompanying Family Members at Consultations**

<b>Subject</b>	<b>Consultations</b>	<b>Both Parents</b>	<b>Mother only</b>	<b>Father only</b>	<b>Grandmother only</b>	<b>Sibling/s (occasions)</b>
1T	27	0	27	0	0	5/27
2T	32	0	26	4	2	2/32
3T	12	0	12	0	0	11/12
4T	36	4	28	1	3	35/36
5T	15	0	15	0	0	14/15
6T	19	0	18	0	1	17/19
7T	24	1	21	2	0	2/24
8T	24	1	23	0	0	3/24
9T	22	0	22	0	0	21/22
11T	14	4	06	4	2	13/14
12T	23	0	23	0	0	1/23
13T	10	0	06	3	1	3/10
14T	21	0	21	0	0	2/21

The extent and range of homework, and with whom it was done, as reported by the mothers, is summarised in Table 8. It is noted that although grandmothers became involved in bringing the children to therapy, none participated in formal homework sessions.

All the families reported that they did the homework. They were compliant and consistent about the length of homework sessions, which they all estimated to be of 5 to 7 minutes duration (i.e., the suggested duration). They reported doing the homework 5 or 6 days a week, as

suggested. Within this range, however, there was variation in the frequency of homework. Twice or three times daily was the suggested frequency, but, by self-report, the families varied between once daily (Subject 11T) and four times daily (Subjects 3T, 6T, 12T and 13T). Most of the families, except those of 9T and 14T, adopted the suggestion to incorporate the homework into a story-time routine of practice-story-practice-story. They all used a behavioural reward system for doing the homework, following the guidelines in the "Notes for Families and Teachers" booklet.

**TABLE 8**  
**Participation in Homework**

Subject	Gender	Times per week homework with parent	Percentage of homework with mother	Percentage of homework with father	1 to 1 Homework with teacher (times per week)	Speech book to preschool (times per week)
1T	F	18	100	0	1	1
2T	F	12	60	40	0	<1
3T	M	24	50	50	0	1
4T	F	12	60	40	1	1
5T	F	8	100	0	0	1
6T	F	24	80	20	1	1
7T	M	12	20	80	1	1
8T	F	12	50	50	0	<1
9T	M	12	100	0	1	1
11T	F	6	0	100	0	<1
12T	F	24	100	0	0	1
13T	F	24	50	50	1	1
14T	F	12	100	0	1	1

During the breaks, the parents were asked to do no formal practice for about eight weeks. Two weeks prior to the next treatment block, they were asked to read the speech book with the child a few times and to do any activities the child was interested in doing. Throughout the breaks, they were to focus on providing modelling corrections, reinforcement of revisions and

repairs, and metalinguistic activities, incidentally, as opportunities arose. The frequency of consultations and the duration in weeks of the breaks are displayed in Table 9.

**TABLE 9**

**Frequency of Consultations per Therapy Block and Duration in Weeks of Breaks from Therapy**

<b>Subject</b>	<b>Consults in Block 1</b>	<b>Weeks off in Break 1</b>	<b>Consults in Block 2</b>	<b>Weeks off in Break 2</b>	<b>Consults in Block 3</b>	<b>Weeks off in Break 3</b>	<b>Consults in Block 4</b>	<b>Total Consults</b>
1T	09	10	08	10	07	14	03	27
2T	14	10	11	11	07	-	0	32
3T	11	10	01	-	-	-	-	12
4T	10	09	10	07	11	10	05	36
5T	10	10	05	-	-	-	-	15
6T	09	08	09	10	01	-	-	19
7T	14	11	09	10	01	-	-	24
8T	09	13	09	10	03	10	03	24
9T	11	10	09	10	02	-	-	22
11T	09	10	05	-	-	-	-	14
12T	11	08	11	10	01	-	-	23
13T	10	-	-	-	-	-	-	10
14T	11	09	09	08	01	-	-	21

#### ***4.6.2 Therapy and Homework Method***

The therapy method, and the specific components of therapy sessions were described in full in Chapter 3. To recap, they were: family education, metalinguistic tasks including aspects of linguistic awareness and phonetic and phonological processing, phonetic production procedures,



and multiple exemplar techniques, including minimal contrast therapy and auditory bombardment.

The homework component of the therapy program revolved around a "Speech Book" containing a new series of activities for parents and child to practice each week. The details of typical, specific, homework tasks and formats were described in detail in Chapter 3. Briefly, they usually comprised auditory bombardment, minimal contrasts activities, a judgement of (phonetic/phonological) correctness task, sometimes production practice of 6 to 12 words containing target phonemes, and modelling and reinforcement of specified behaviours (e.g., modelling velars SIWI, or reinforcing the performance of revisions and repairs). The therapy materials included: the "Notes for Families and Teachers" booklet; the Display Book used at the initial assessment, which was often referred to as therapy progressed; the child's "Speech Book", which was an exercise book containing homework, notes for parents, and so on; and the toys, books, pictures, tape recorders, mirrors, and so on, that form part of the usual paediatric speech-language pathology clinical stock-in-trade.

#### **4.7 Within Group Study (Treatment Group)**

Much of what was discussed in the preceding sections relates to both the between groups study and the within group study of the treatment group. Several points need highlighting, however, in relation to the issues and concerns involved only in the within group study.

The issues raised in Research Question 4 and Hypotheses 5, 6, and 7 were addressed when the treatment subjects' data were examined in detail, and submitted to statistical analysis. Question 4 was concerned with the factors involved in predicting how long it would take for a child treated with this therapy to achieve age-appropriate phonology.

Hypothesis 5 was that the initial severity of the child's phonological disability would be the strongest predictor determining the amount of therapy they would require.

Hypothesis 6 was concerned with the initial age of the child in relation to the amount of therapy needed. It was hypothesised that the older the child at initial consultation, the more treatment s/he would require.

Finally, Hypothesis 7, which involved following the children up after they had finished therapy and commenced formal schooling, addressed the probability that children with phonological disabilities as pre-schoolers might go on to exhibit difficulty with early literacy skills acquisition, which could be phonologically based. In this regard, reading test results, school reports, and verbal reports from teachers and parent(s) were obtained.

## **CHAPTER 5**

### **RESULTS AND DISCUSSION**

#### **5.0 Results of the Therapy Efficacy Study (Question 1 & Hypothesis 1)**

The first question addressed in the data analysis was: "Using this therapeutic approach, can phonological development be accelerated beyond the improvement expected with age?" By the time they had their probe assessments, for their output phonology, at least, it was clear from clinical observations that the treatment group children's phonological development was either within the normal range, or greatly improved. Clinical impressions of substantial phonological progress in the experimental group, and of little change in the control group, needed to be supported by statistical analysis, however, which should show a marked improvement in phonology only in the treatment group.

The Severity Rating Scale was used to measure phonological change. A description of the Severity Rating Scale is contained in Chapter 4. It will be recalled that the ratings ranged from 1.00, which indicated a phonological system within normal limits, to 4.00, which indicated a severe phonological disability. Improvement in phonological development was determined, in both groups, by obtaining the difference between the Severity Ratings at the initial and probe assessments.

The mean Severity Rating was the measure of choice for determining improvement in the children's phonology, because it allowed the raters to take into account: the age of the child, the number of phonological deviations present in their output phonology, and the incidence of those deviations, expressed as percentages. Additionally, the raters took into account the fact that the children's language skills, in areas other than phonology, were age-appropriate.

At the outset of the study, the groups of children were well matched in terms of phonological disabilities. The mean initial Severity Rating of the treatment group was 3.35, and of the control group, 3.50. A one-way ANOVA confirmed that this small difference was non-significant ( $F(1,20) = 1.59, p > .10$ ). The raters agreed that the children in both groups were phonologically disabled at the initial assessment, that they fell in the clinical range, and required therapy.

At the probe assessment the treatment subjects' mean Severity Rating was 1.51, a drop of 1.84. By contrast, the improvement in the control group children's phonology was markedly less than for the treatment group. Although there was a small reduction, of 0.47, in the mean Severity Rating in the control group at probe, it still stood at 3.03, compared with 3.50 at the outset. A two-way Analysis of Variance of the initial and probe Severity Ratings for both groups showed a significant group x time interaction ( $F(1,20) = 19.36, p < .01$ ).

The probe assessment data for the two groups were submitted to a one-way Analysis of Variance. This resulted in a significant main effect of group, which indicated that the difference between the mean Severity Ratings, at the probe assessment, was, as clinical observations suggested, highly significant ( $F(1,20) = 21.22, p < .01$ ). So the answer to the first question was, convincingly, yes; the therapeutic approach was effective in accelerating phonological development beyond the progress expected with age. Hypothesis 1, that the treatment would produce a selective improvement in the experimental group's phonology, was therefore, unequivocally supported.

#### ***5.0.1 Individual Differences in Phonological Change in the Treatment Group***

Table 10 contains a summary of the clinical observations for each subject, for Mean Severity Ratings and Sums of Phonological Deviations, at the initial and probe assessments. The interval between the assessment and the children's ages are included again, for ease of interpretation.

TABLE 10

Mean Severity Ratings and Sum of Phonological Deviations at the Initial and Probe Assessments, with the Time Interval in months between the two Assessments, and Ages in months at Assessment

Subject (Gender)	Initial Mean Severity Rating	Probe Mean Severity Rating	Initial Sum of Phonological Deviations	Probe Sum of Phonological Deviations	Interval between Initial & Probe Assessments in months	Initial Age in months	Probe Age in months
1T (F)	3.75	2.25	5.00	4.00	11.00	52.00	63.00
2T (F)	3.75	1.50	7.00	1.00	11.00	56.00	67.00
3T* (M)	2.50	1.00	7.00	0.00	06.00	46.00	52.00
4T (F)	3.75	2.50	7.00	4.00	12.00	50.00	62.00
5T* (F)	2.75	1.00	7.00	0.00	07.00	50.00	57.00
6T* (F)	2.75	1.00	6.00	0.00	10.00	51.00	61.00
7T (M)	3.25	1.75	6.00	2.00	11.00	57.00	68.00
8T (F)	2.75	2.00	6.00	4.00	10.00	35.00	45.00
9T (M)	3.50	1.00	7.00	1.00	09.00	49.00	58.00
10T (M)	4.00	3.25	9.00	6.00	11.00	51.00	62.00
11T* (F)	3.25	1.00	8.00	0.00	07.00	46.00	53.00
12T* (F)	3.75	1.00	7.00	0.00	10.00	53.00	63.00
13T* (F)	2.50	1.00	4.00	0.00	03.00	44.00	47.00
14T* (F)	2.75	1.00	4.00	0.00	09.00	47.00	56.00
15C** (M)	3.75	2.25	7.00	3.00	10.00	51.00	61.00
16C** (F)	3.75	2.00	5.00	3.00	11.00	43.00	54.00
17C (M)	3.50	3.75	5.00	8.00	10.00	50.00	60.00
18C (F)	4.00	4.00	12.00	11.00	08.00	45.00	53.00
19C** (M)	3.25	2.75	5.00	3.00	08.00	56.00	64.00
20C** (M)	3.50	3.25	8.00	8.00	08.00	41.00	49.00
21C (M)	2.50	2.50	5.00	6.00	09.00	34.00	43.00
22C (F)	3.75	3.75	8.00	6.00	05.00	51.00	56.00

Half of the treatment subjects: 3T\*, 5T\*, 6T\*, 11T\*, 12T\*, 13T\* and 14T\*, had no phonological deviations at the probe assessment. This meant that the probe assessment was their final assessment, and coincided with their discharge from therapy.

Subject 9T had only one phonological deviation (Gliding of Liquids 25%) at probe, and it was clear from recent progress, and from the continual revisions and repairs that he made during the probe assessment, that he was not a candidate for further therapy, so he too was discharged. The raters considered that his Gliding of Liquids was age appropriate (at 4;10), giving him a Mean Severity Rating of 1.00 (phonological system within normal limits). Speaking of age-appropriate deviations, of the eight children who were discharged at probe, three had age-appropriate phonemic replacements (or phonemic deviations from the adult target sound). Subject 9T (aged 4;10), 11T (aged 4;5) and 14T (aged 4;8) all realised /θ/ → [f], and /ð/ → [v]. The other five children (3T, 5T, 6T, 12T and 13T) showed no phonemic replacements at discharge.

Turning now to the six undischarged treatment subjects, with the exception of 10T, the children were close to having age-appropriate phonology. Therefore, decisions had to be made about their readiness for discharge, or, alternatively, their requirements for further intervention. It was decided not to offer subjects 2T and 7T further therapy immediately following their probe assessments.

When she had her probe assessment, at 5;7, Subject 2T (see Table 12) continued to have Cluster Reduction SIWI 15% evident in her output phonology. Her probe assessment came at the end of a ten week break from therapy. Clinical intuition (Anastasi, 1988), that she would require no further therapy after the probe, proved correct. She was placed on review, and had no phonological deviations (or phonemic replacements) when reassessed two months later. Meanwhile, 7T showed Cluster Reduction SFWF 10% and Weak Syllable Deletion 10% at his probe assessment. He had no further treatment, and had no phonological deviations, or phonemic replacements, when he was reviewed one month later at 5;9.

The remaining four undischarged treatment subjects, 1T, 4T, 8T and 10T, required, and received, further therapy following the probe assessment (see Table 11). Subject 1T had one therapy session after her probe assessment at 5;1, and was then placed on review. When reassessed six months later, at 5;7 the phonological deviations remaining in her output phonology

were Gliding of Liquids 20%, and Cluster Reduction SIWI 33%. She received no further therapy, and when she was followed up again, two months later at 5;9, no phonological deviations, or phonemic replacements, were apparent.

**TABLE 11**

**Initial and Probe Ages and Severity Ratings, and duration and Amount of therapy after the Probe Assessment, for the Undischarged Treatment Subjects whose Mean Severity Ratings Exceeded 1.00 at the Probe Assessment**

Subject	Mean Severity Rating at Initial Assessment (and age)	Mean Severity Rating at Probe Assessment (and age)	Mean Severity Rating at Discharge Assessment (and age)	Number of Therapy Sessions Attended after Probe Assessment	Number of Months after Probe that no Deviations were Present
1T	3.75 (4;4)	2.25 (5;1)	2.00 (5;7)	1	8.00 (5;9)
2T	3.75 (4;8)	1.50 (5;7)	1.50 (5;9)	0	2.00 (5;9)
4T	3.75 (4;2)	2.50 (5;2)	1.50 (5;6)	6	6.00 (5;8)
7T	3.25 (4;9)	1.75 (5;8)	1.75 (5;8)	0	1.00 (5;9)
8T	2.75 (2;11)	2.00 (3;9)	1.50 (4;0)	4	7.00 (4;4)
10T	4.00 (4;3)	3.25 (5;2)	not discharged	10 to date	-

Subject 4T (discussed in detail in Chapter 6) had her probe assessment at 5;2. She required a further six therapy sessions, at the end of which time, when she was 5;6, Cluster Reduction SIWI 12% was the only phonological deviation present. By 5;8 no deviations or phonemic replacements were evident. 4T's Severity Rating reduced until her third (probe) assessment, then increased, and reduced again. Meanwhile her sum of phonological deviations remained the same for the first two assessments, and then gradually reduced. The only other treatment subject for whom a fluctuation in Severity Ratings occurred was Subject 10T. For both of these children, 4T and 10T, the Severity Rating increase coincided with episodes of stuttering.

Subject 8T had her probe assessment at 3;9, after which she had a further four therapy sessions. At 4;0 her phonology was essentially within normal limits, though she showed Cluster Reduction SIWI 29%. By 4;4 no phonological deviations or phonemic replacements were present in her speech. Hence, her interdental lisp (/s/ → [θ], /z/ → [ð]) had also resolved by 4;4.

Subject 10T (also discussed in detail in Chapter 6) had his probe assessment at 5;2, when his Severity Rating was 3.25, compared with his initial Severity Rating of 4.0, when he was 4;3. By this stage, it was becoming clear that 10T's phonological disability was resolving much more slowly than the others in the treatment group. At 5;2 he still showed the following phonological deviations: Deaffrication 50%, Stopping of Fricatives 7%, Stopping of Affricates 25%, Gliding of Liquids 75%, Cluster Reduction SIWI 92%, Cluster Reduction SFWF 33%.

In general, the treatment subjects showed a consistent pattern of improvement. Subject 2T's Severity Ratings, displayed in Table 12, were more representative of the rest of the treatment group than those of the two "fluctuators" (4T and 10T) discussed above. Typically, the Severity Ratings, and Sum of Phonological Deviations, either gradually reduced, or appeared to plateau, and then reduced.

**TABLE 12**  
**Subject 2T's Incidence Category Scores and Mean Severity Ratings**

<b>Age</b>	<b>Incidence Category 5 80-100%</b>	<b>Incidence Category 4 60-79%</b>	<b>Incidence Category 3 40-59%</b>	<b>Incidence Category 2 20-39%</b>	<b>Incidence Category 1 ≤ 19%</b>	<b>Sum of Phonological Deviations</b>	<b>Mean Severity Rating</b>
4;8	2.00	2.00	2.00	0.00	1.00	7.00	3.75
4;11	1.00	0.00	3.00	3.00	0.00	7.00	3.50
5;1	1.00	1.00	3.00	2.00	0.00	7.00	3.25
5;4	1.00	1.00	0.00	2.00	1.00	5.00	3.00
5;7	0.00	0.00	0.00	0.00	1.00	1.00	1.50

### ***5.0.2 Individual Differences in Phonological Change in the Control Group***

By contrast with the consistent pattern of improvement in the treatment subjects, it was interesting to find in the control group that there was no consistent trend. The Severity Ratings for subjects 15C, 16C, 19C and 20C reduced; those for subjects 18C, 21C and 22C remained the same; and subject 17C's Severity Rating increased. The reduction in severity for 15C\*\*, 16C\*\*, 19C\*\* and 20C\*\* might have lent some support to the proposition that untreated phonologically



disabled children might grow out of the disability, but only if the improvement had been significant overall, which it was not (see 5.0). Moreover, unlike the treatment children, at the probe assessment, *none* of the control group children were found to have either an absence of phonological deviations, or a phonological system conforming to the developmental norm.

## **5.1 Results of the Measurement Study (Question 2)**

The systems used in the study to measure the subjects' phonological characteristics were introduced in section 4.2, and the ways of measuring the severity of phonological disability in section 4.3. The two measures of the phonological characteristics were the Incidence Category Scores and Sum of Phonological Deviations, while the two severity measures were the Severity Rating Scale and the Severity Index. The application of the four measures will be discussed in the following sections.

Research Question 2 concerned itself with the best and most economical measure to replace the ratings, and was: "Can a clinically practical, reliable, severity index for phonological disability be devised?" This begs the questions, why have more than one measure of severity if the Severity Rating Scale proved adequate for the study? Why not use the Severity Rating procedure?

To recap, and clarify the answers to these questions, four (volunteer) experienced speech-language pathologists were required to implement the Severity Rating procedure. The overriding disadvantage of the Severity Ratings, prompting the quest for an alternative, was that, in practice, it took the raters over one hour each to rate the severity of all the subjects. This use of professional personnel and time was justifiable in terms of the research project, as a "one off" effort for each of the raters. What is acceptable in a research context, is sometimes impractical, in terms of time, and use and availability of human resources, in clinical settings. Unfortunately, this was so with the Severity Rating procedure. As such, there was a need to search for an alternative which did not sacrifice accuracy for speed and ease of application.

### ***5.1.1 Application of the Sum of Phonological Deviations Measure***

The Sum of Phonological Deviations measure was an alternative to the Mean Severity Ratings. The Sum of Phonological Deviations gave a broad, but none-the-less objective, indication of phonological change, and was gained simply by tallying the different phonological deviations, across the Incidence Categories one to five. Although it was quick and easy to apply, the Sum of Phonological Deviations was not the measure of choice in estimating the children's progress. The mean Severity Ratings were preferred, because they took into account the ages of the children (and hence developmental expectations), and the incidence of their phonological deviations, rather than just the total number of deviations present.

The initial mean Sum of Phonological Deviations for the treatment group was 6.42, and for the control group 6.87. This difference was non-significant ( $F < 1$ ). At the probe assessment, the treatment group's mean Sum of Phonological Deviations had dropped to 1.57, which stood in contrast to the control group's comparatively high mean Sum of Phonological Deviations of 6.0. A one way analysis of variance showed that this difference was highly significant ( $F(1,20) = 17.30, p < .01$ ). Two-way Analysis of Variance revealed a significant two-way interaction of group x time, ( $F(1, 20) = 17.43, p = < .01$ ), even though the incidence of the phonological deviations within the categories, and the respective ages of the children were not taken into account.

### ***5.1.2 Application of the Incidence Category Scores***

As indicated above, when it was first considered, the Sum of Phonological Deviations, alone, was regarded as too general, and as having dubious value as a suitable measure of change. Statistical analysis, however, showed that it was surprisingly discriminating; sufficiently so as to be able to distinguish meaningfully between the groups at the probe assessment.

The Incidence Category Scores were an important component of the information the raters used to determine the children's Severity Ratings (see 4.2.2). Logically, then, it was

necessary to see how including the distinction between the incidence categories, as a variable in the analysis, would affect the results. Three-way Analysis of Variance showed a significant three-way interaction of group x time x incidence ( $F(4, 80) = 2.93, p = < .03$ ). This three-way interaction reflected a sideways shift (towards the lower incidence categories) which tended to occur with time in the treatment but not the control group. It suggested that Incidence Category should be a key component of the Severity Index procedure, and a description of its development follows in Section 5.1.3.

It was fascinating (and encouraging for both parents and clinician) to see the gradual shift, as it were, from left to right, of the children's Incidence Category Scores, reflected in the earlier mentioned three-way interaction. When tabulated, as in Table 13, where 7T's phonological improvement provides an example, the scores appeared to travel across the categories as the children's phonological disabilities resolved. This pattern of results was apparent in all the treatment children's phonology. Initially, at the age of 4;9, 7T had two phonological deviations in the 80-100% category, two in the 60-79% category, one in the 40-59% and one in the  $\leq 19\%$ . By 4;11, none remained in the 80-100% category, while there were still two in the 60-9% category and one in each of the other three categories. At 5;2 there were no longer any deviations in the highest two categories, and by 5;8, when he had his probe assessment only two deviations were present in the lowest category,  $\leq 19\%$ . The Sum of Phonological Deviations and Mean Severity Ratings for 7T's four assessments are included in Table 13 as well, to show how they also indicated his progress.

**TABLE 13**  
**Example of the Shift in Incidence Category Scores Reflecting the Changes in 7T's Phonology**

<i>Age</i>	<i>Incidence Category 5 80-100%</i>	<i>Incidence Category 4 60-79%</i>	<i>Incidence Category 3 40-59%</i>	<i>Incidence Category 2 20-39%</i>	<i>Incidence Category 1 <math>\leq 19\%</math></i>	<i>Sum of Phonological Deviations</i>	<i>Mean Severity Rating</i>
4;9	2.00	2.00	1.00	0.00	1.00	6.00	3.25
4;11	0.00	2.00	1.00	1.00	1.00	5.00	2.50
5;2	0.00	0.00	1.00	2.00	1.00	4.00	1.50
5;8	0.00	0.00	0.00	0.00	2.00	2.00	1.75

7T's pattern of improvement was in contrast to control group Subject 17C's Incidence Category Scores, displayed in Table 14. At 4;2 Subject 17C had four phonological deviations in the 80-100% range and one in the  $\leq 19\%$  range. At 4;7 a spread across the categories was becoming apparent, with three deviations remaining in the 80-100% category, three in the 60-79% range, one in the 40-59% range and one in the  $\leq 19\%$  range. Ten months after his initial assessment, however, he still had three deviations in the most severe category, of 80-100%, three in the 20-39% category and one each in the 40-59% and  $\leq 19\%$  categories.

**TABLE 14**  
**Example of the Spread of Incidence Category Scores Reflecting the Changes in 17C's Phonology**

Age	Incidence Category 5 80-100%	Incidence Category 4 60-79%	Incidence Category 3 40-59%	Incidence Category 2 20-39%	Incidence Category 1 $\leq 19\%$	Sum of Phonological Deviations	Mean Severity Rating
4;2	4.00	0.00	0.00	0.00	1.00	5.00	3.50
4;7	3.00	3.00	1.00	0.00	1.00	8.00	3.75
5;0	3.00	0.00	1.00	3.00	1.00	8.00	3.75

### **5.1.3 Development and Application of the Severity Index Procedure**

An alternative to the Mean Severity Ratings might have been the Sum of Phonological Deviations procedure, which was quick and easy to apply. It was rejected as too broad a measure, as it did not take account of Incidence Category or developmental expectations. It was interesting to note, however, that here was a moderate correlation between the initial mean Severity Ratings and the initial Sum of Deviations ( $r(22) = .51, p < .01$ ).

How, then, could a clinically practicable procedure be devised, which incorporated developmental stage and incidence, but was also time-and-cost-efficient in its application? The best alternative to suggest itself appeared to be the Severity Index procedure, which fulfilled the criteria of speed, ease and incidence, but not age.

The initial mean Index Score for the treatment group was 25, and for the control group 28.50. This difference was non-significant ( $F < 1$ ). At the probe assessment, the treatment group's mean Index Score had reduced to 4, in contrast to the control group's mean Index Score of 20.50. A one-way analysis of variance showed that this difference was highly significant ( $F(1,20) = 18.81, p < .01$ ). A two-way Analysis of Variance of the initial and probe mean Index scores for both groups, revealed a significant two-way interaction of group x time ( $F(1,20) = 19.90, p < .01$ ). Hence the Index procedure had the capacity to distinguish between the two groups.

#### ***5.1.4 Correlation between the Severity Ratings and the Severity Index***

It was recognised that the three factors of speed, ease and incidence, and the significant interaction reported above, were insufficient to justify application of the Index as a clinical measure of severity and change. It was still necessary to determine whether there was a correlation between the raw scores of the two measures.

The scatterplot in Figure 2 shows what appears to be a reasonably neat correspondence. This positive relationship was confirmed statistically using a parametric (Pearson) correlation ( $r(79) = .87, p < .01$ ) which indicated that there was indeed a high correlation between the two measures. In practice, the correlation between the subjects' Severity Ratings and Index Scores at the initial assessment was moderate ( $r(22) = .62, p < .01$ ), and very strong at probe ( $r(22) = .91, p < .01$ ). The stronger correlation at probe was probably because of the high proportion of Ratings of 1.00 (normal function) corresponding to Index Scores of 0 in the treated group.

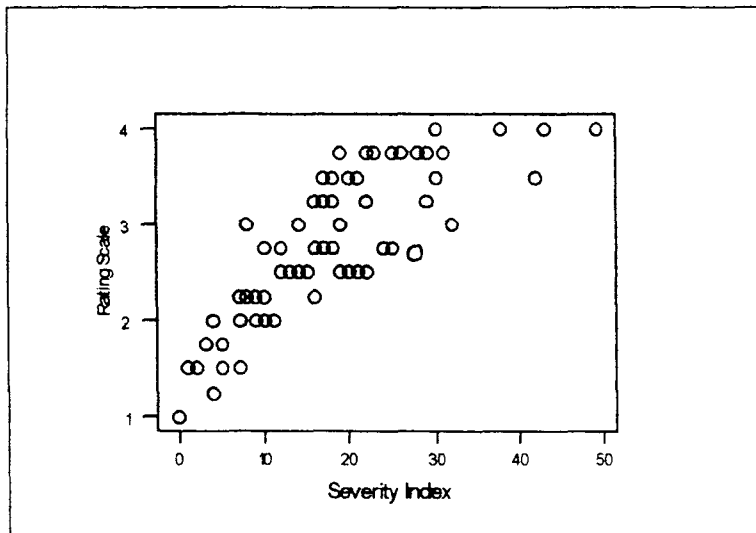


Figure 2: Scatterplot of 81 observations of the correspondence between the Severity Ratings and the Index Scores [Note that in the scatterplot only 60 of the 81 data points can be seen, because there were 21 overlapping scores]

### 5.1.5 Comparison of the Sum of Deviations, the Ratings, and the Index

Table 15 enables a comparison of the initial and probe assessment mean Sums of Phonological Deviations, mean Severity Ratings and mean Severity Index Scores. All three measures showed the same pattern of improvement in the treatment group and of little improvement in the control group. Being able to make such comparisons, and considering the strong correlation between the Index and the Rating Scale, encouraged optimism in persisting with the development of the Severity Index as a clinical tool. On the down side, however, it was anticipated that without an exact "age" component, the Index procedure might not be optimal.

It would, of course, have been defensible to use the Severity Index as an independent scale, in its own right. This approach was not adopted because it was regarded as preferable to develop a system which correlated well with the Severity Ratings assigned by the experienced speech-language clinicians (the raters). It was considered important to develop an economical system of classification, not unlike that used by the raters, which allowed the clients'

phonological systems to be assigned to normal, mild, moderate and severe categories. It was, therefore, desirable to aim for an idealised version of the Index, in order to make such a conversion.

**TABLE 16**

**A Comparison of the Groups' Initial and Probe Assessment Mean Scores for the Sum of Phonological Deviations, Severity Rating Scale, and Severity Index; and the Difference between the Mean Scores for each Measure**

Measure/Group	Initial Assessment	Probe Assessment	Difference
<b>Mean Sum of Phonological Deviations</b>			
Treatment Group	6.42	1.57	5.14
Control Group	6.87	6.00	0.75
<b>Mean Severity Ratings</b>			
Treatment Group	3.20	0.94	1.73
Control Group	3.50	3.00	0.53
<b>Mean Severity Index Scores</b>			
Treatment Group	24.64	04.07	20.57
Control Group	28.50	20.50	07.37

### ***5.1.6 Overlap between the Raw Index Scores***

Upon first inspection it appeared that the Index Scores might not fall into discrete enough groupings, or increments in severity, for them to be applied usefully. Considerable overlap was apparent between the individual Index raw scores, as previously illustrated in the scatterplot in Figure 2.

### ***5.1.7 Translation of the Severity Ratings into Index Equivalents***

The way in which the correspondence between the Rating Scale and the Index was worked out was as follows. The mean Index Score corresponding to each Severity Rating was

calculated. For example, in the children's data, a Severity Rating of 2.75 corresponded with nine Index scores: one each of 10, 12, 16, 17, 24, 25 and 28, and two of 18 (with a mean of 18.66).

The correspondences between the Severity Ratings and the mean Severity Index Scores are shown in Data columns (1) and (2) of Table 16. Data column (3) shows the mathematical adjustment that was made to some of the figures, to round them into whole numbers. Data column 4 shows a gloss of the Index Scores, providing an idealised optimal range of Index Scores, for each severity level category (as described below), which, potentially, could be applied clinically. The border points were selected by minimising the number of subjects misclassified (see Appendix E).

**TABLE 16**

**Correspondences Between the Severity Ratings and Mean Severity Index Raw Scores, with Adjustments to the Raw Scores to Make Whole Numbers**

<b>(1) Severity Ratings and Descriptive Categories</b>	<b>(2) Mean of Severity Index Raw Scores</b>	<b>(3) Adjusted Figures</b>	<b>(4) Optimal Index Scores to Apply Clinically</b>
1.00 NORMAL PHONOLOGY	00.00	00.00	00.00
1.25 VERY MILD	04.00	04.00	1.00 to 6.00
1.50 PHONOLOGICAL	02.80	03.00	
1.75 DISABILITY	04.00	04.00	
2.00 MILD	08.00	08.00	7.00 to 16.00
2.25 PHONOLOGICAL	10.00	10.00	
2.50 DISABILITY	17.10	17.00	
2.75	18.66	19.00	
3.00 MODERATE	18.26	18.00	17.00 to 34.00
3.25 PHONOLOGICAL	21.26	21.00	
3.50 DISABILITY	24.66	25.00	
3.75	26.33	26.00	
4.00 SEVERE PHONOLOGICAL DISABILITY	40.00	40.00 to 49.00	35.00+

The Severity Rating Scale that the Raters applied comprised four pre-determined descriptive categories, which were: Normal Phonological Development, Mild Phonological Disability, Moderate Phonological Disability, and Severe Phonological Disability. When the mean Index Scores were examined, it became apparent that the inclusion of a descriptive category



between Normal and Mild, catering for the children with Severity Ratings of 1.25, 1.50 and 1.75, corresponding to Index scores 1 to 6, would be helpful. The descriptive category Very Mild Phonological Disability was, therefore, created.

It can be seen in Data Column 2 of Table 16 that there was an anomaly in the Index Scores, where ratings of 1.25 and 1.75 corresponded with mean raw Index Scores of 4.00, while a Severity Rating of 1.50 corresponded with a mean Index Score of 2.80. It was hypothesised that the anomaly may have been due to the smallness of the sample, but testing this hypothesis was beyond the scope of the current project, and in any case, not particularly important. Apart from that anomaly, the mean raw index scores ascended in an orderly fashion. The creation of the Very Mild Phonological Disability category in the *Severity Index*, which included all the anomalous scores, provided a simple solution to this difficulty.

So, it emerged that the expectation that the Index procedure might not prove satisfactory without an exact "age" component was unfounded. With very minor mathematical adjustments, related to the misclassified scores, which were eventually included in the very mild category, a good equivalence was demonstrated between the Severity Index and the Severity Rating Scale.

In view of this equivalence, or correspondence, and the strong correlation between the severity measures, it was inferred that as long as the children fell into a prescribed age-range, the index could be usefully applied. In essence, for these data at least, relating to children in the current project, who were within the age range 2;10 to 5;8, with language development in areas other than phonology within normal limits, and notwithstanding the presence of episodes of stuttering in some of the children, more precise developmental details were, apparently, not a necessary component of the Severity Index.

### **5.1.8 Suggested Procedure for Applying the Severity Index Clinically**

The procedure for applying the Severity Index clinically involved tallying and weighting a child's phonological deviations, as described in 4.3.3. to arrive at an Index Score, and corresponding descriptive category, using the following steps.

1. Perform a comprehensive phonological analysis of 200 to 250 words and determine the percentage of occurrence of each phonological deviation (e.g., Ingram 1981; Grunwell, 1985a; Stoel-Gammon & Dunn, 1985; or comparable procedures, see 1.4.8 and 4.2.2). For initial assessments, include incidence scores 15% and over in Category 1. For subsequent assessments of children receiving therapy include incidence scores 5% and over in Category 1.
2. Count each of the following deviations as ONE deviation:

Fronting of Velars SIWI	Fronting of Velars SFWF
Palato-alveolar Fronting SIWI	Palato-alveolar Fronting SFWF
Cluster Reduction SIWI	Cluster Reduction SFWF
Stopping of Fricatives SIWI	Stopping of Fricatives SFWF
Stopping of Affricates SIWI	Stopping of Affricates SFWF

3. Count all other phonological deviations as ONE deviation (e.g., Context Sensitive Voicing, pre-vocalic+ inter-vocalic + post-vocalic is counted as one phonological deviation). If phonological deviations co-occur, count each one.
4. Allocate each phonological deviation to its appropriate incidence category (see 4.2.2). For example, if the sample contained one phonological deviation in the 80 to 100% range, two phonological deviations in the 60 to 79% range, three in the 20 to 39% range, and one in the  $\leq 19\%$  range, put a 1 in Category 5, a 2 in Category 4, a 3 in Category 2 and a 1 in Category 1.

5. Multiply the numbers of deviations by the category number, to weight them, as shown below (continuing the same example):

Category 5 80 to 100%       $1 \times 5 = 5$

Category 4 60 to 79%       $2 \times 4 = 8$

Category 3 40 to 59%      0

Category 2 20 to 39%       $3 \times 2 = 6$

Category 1  $\leq 19\%$        $1 \times 1 = 1$

5. Add the weighted numbers, (in this example  $5 + 8 + 6 + 1 = 20$ ) to gain the Severity Index Score.
6. Refer to the Severity Index (see Table 16) for the appropriate descriptive category, in this example, a Severity Index Score of 20 corresponds with Moderate Phonological Disability.

## **5.2 Results of the Between Groups 'Tasks' Study (Question 3 and Hypothesis 4)**

A key constituent of the therapeutic model regularly involved activities designed to employ and develop the children's metacommunicative abilities and phonological processing skills. Many tasks and games were developed in order to focus on the particular skills which appeared to be important in relation to improving the children's output phonology (see 3.3.2).

Tests of the ability to perform four of the many tasks developed were chosen as part of the pre- and post-test battery for the project. The children's initial and probe assessment performance of these representative tasks were the subject of Research Question 3: "Can the relative contribution of the four tasks be determined, and, if so, which might be excluded, and which might be retained in a refined and "streamlined" adaptation of the therapy approach?"

The selected tasks were listed in section 4.4.2, and described in section 4.5.6. Table 17 displays the mean correct responses of both groups, for the four tasks, at the initial and probe

assessments. Tasks 1 (Rhyme Matching) and 3 (Word Structure Sorting) were selected for pre- and post testing, because they were regarded as important, even essential, aspects of the therapy. Conversely, tasks 2 (Onset Matching) and 4 (Lexical Knowledge) were included, because they were regarded as less important, or even dispensable aspects of the therapy regime, especially for the younger children.

Attention turns first to what were regarded as the essential tasks, 1 and 3, and then to the ones thought to be non-essential, tasks 2 and 4. The children's Task scores are contained in Appendix D. Task 1 was a metaphonological (phonological processing) rhyme matching task, encompassing the ability to select a picture whose name rhymed with two given words (e.g., wall rhymed with tall and call). The maximum possible score for task 1 was 9. At the initial assessment, the control group children's mean correct score of 2.37 was slightly higher than the treatment group's mean of 2.14. At the probe assessment, the control group's mean correct score had increased marginally to 2.87. However, all the treatment children scored 9/9 on the post-test, giving them a mean correct score of 9.00. The control subjects' scores at the probe assessment ranged from 0/9 to 4/9. It was not surprising, then, to find that a two-way analysis of variance of the initial and probe assessment scores showed a highly significant interaction of group x time ( $F(1,20) = 208.72, p < .01$ ).

**TABLE 17**  
**Mean Correct Responses at the Initial and Probe Assessments for aspects of Metalinguistic Knowledge and Phonological Processing**  
**Max = Maximum Possible Score for Each Task**  
**(Task 1: Rhyme Matching, Task 2 Onset Matching, Task 3: Word Structure Sorting and Task 4: Lexical Knowledge)**

Group	Task 1 (Max = 9)	Task 1 (Max = 9)	Task 2 (Max = 12)	Task 2 (Max = 12)	Task 3 (Max = 3)	Task 3 (Max = 3)	Task 4 (Max = 12)	Task 4 (Max = 12)
	Initial	Probe	Initial	Probe	Initial	Probe	Initial	Probe
Treatment	2.14	9.00	.64	3.14	.14	2.07	4.35	7.64
Control	2.37	2.87	.87	2.37	.12	0.50	4.00	5.00

In practical, clinical terms what this result reflected was the emphasis in therapy upon minimal contrasts activities involving rhyming, the ease with which the treatment children learned the tasks, and the fun and enjoyment they derived from them. Furthermore, the evidence was consistent with the view that the ability to learn to perform rhyme matching tasks enhanced their phonological progress. This being the case, it was easy to justify keeping rhyme matching as an important part of the therapy regime.

Task 3 was a metaphonological (phonological processing) word-structure sorting task, encompassing the ability to perform (spoken) word - picture matching tasks using minimal word pairs differing only in the inclusion or exclusion of a final consonant (e.g., go/goat; sew/soap; pea/peep). The maximum possible score for task 3 was 3. Again, there was a minimal difference between the groups at the pre-test, when the mean correct score for the treatment group was 0.14, and for the control group 0.12. At the probe assessment, the control group's mean correct score was 0.50, while the treatment group's had risen to 2.00. Two-way analysis of variance again showed an enhanced improvement in the treatment children's performance, relative to the controls, with a significant interaction of group x time ( $F(1,20) = 10.36, p < .01$ ).

The practical significance of the improvement evident in the treatment children's ability to sort words according to their structure, was that it also reflected the emphasis in the therapy upon word-structure sorting tasks, and the enjoyment they derived from them. The treatment children would frequently ask if they could play the card games involving word-structure sorting, and would ask (and of course, be permitted) to take the cards home.

It should be pointed out that when the children performed task 3 as pre- and post-tests for the study, neither the examiner, nor the parent(s) observing the assessment participated in the tasks in the sense of helping the children to perform them. In a typical therapy context, as soon as the children began to have difficulty completing such tasks, an adult would lend some sort of assistance, or even show them again how to complete the task. Because they were attuned to help being readily available, some of the treatment children expressed surprise when they had to perform the post-test for task 3 independently. For example, 4T asked, "Why don't

you help me?" Similar reactions from the treatment group did not occur for the task 1 probe assessment, because by that time all the treatment children could perform task 1 confidently and independently. For instance, 7T elbowed his hovering father out of the way, insisting that, "I can do it on my own!" (which he could).

Task 2 was a metaphonological (phonological processing) phonemic onset matching task, encompassing the ability to sort or select pictured words by initial phoneme (e.g., John and jumper start with the same "sound", /dʒ/). The maximum possible score for task 2 was 12. An improvement in the children's ability to perform the task was observed in both groups. The treatment group's mean correct response rose from 0.71 at initial assessment to 3.14 at probe, while the control group's mean correct response rose from 0.87 to 2.37. This difference at probe was non-significant ( $F < 1$ ), and there was no group x time interaction ( $F < 1$ ). Again, the treatment children anticipated being helped if they became "stuck" performing the task. It was difficult to justify a clinical intuition that the nonselective nature of the improvement was insufficient reason to abandon phonemic onset matching from the therapy battery.

The treatment children's low level of performance of Task 2 might also have provided a justification for omitting the task in future, or, alternatively, making the task easier. Indeed, perhaps this particular task was an unfortunate choice for the pre- and post- test, and a less complicated version of it might have been more convincing. Alternatively, the task may have contributed to the treatment children's progress in a general way, because they *had* to enlist adult help in order to perform it correctly, thereby actively confronting the limits of their phonological awareness, in a supportive, didactic linguistic environment. In any case, unconvincing as it might appear, task 2 still seemed to be worthwhile maintaining in the therapy battery, with comparable tasks, as the subject of further investigation.

Task 4 was a metalinguistic lexical knowledge task, involving the ability to discriminate meaningfully between the terms "sound" and "word", OR "sound" and "name". This activity was something that the treatment children seemed to be able to do, and enjoy, during therapy

sessions. The maximum possible score for task 4 was 12. The mean correct response for the treatment group at the initial consultation was 4.35, and for the control group 4.00. Both groups showed improved scores over time. At probe, the treatment group's mean correct response rate was 7.64, while the control group's was 5.00. A two-way Analysis of Variance showed no significant interaction ( $F(1,20) = 2.41, p > 0.10$ ), but a significant main effect of time (Initial vs probe assessment) ( $F(1,20) = 12, p = < .01$ ). Clearly, though, the effect was small, only lifting them to about chance, and since there was an improvement in both groups, probably developmental.

What the task 4 result reflected was the amount of adult assistance that the treatment children had in performing parallel tasks during therapy. The children did seem able to respond appropriately to instructions involving the words "sound", "word" or "name", while the tasks were being conducted. However, they clearly did not retain this ability, or transfer it to the test situation, as their post-test performance indicated. As with tasks 2 and 3, several of the treatment children indicated that they expected to be helped with this task, and found it difficult to perform it independently. Since both groups improved to some degree, but neither group significantly, task 4 might well have been dispensable.

A final consideration in relation to whether tasks 2 and 4 should stay or go was their overall contribution to the appeal (to the children and parents) of the total therapeutic package. It was worthwhile considering leaving them in the package to provide some balance, and as a foil for the tasks which were clearly more contributory to phonological progress, but possibly less enjoyable for some of the children. There was no doubt from clinical observations that both of these tasks had some merit in stimulating metalinguistic performance.

### **5.3 Results of the Receptive Vocabulary Study (Hypothesis 2)**

The second dependent variable was the PPVT-R standard scores, which were used to gauge the specificity of the treatment effect, as against a more general effect of the therapy in

accelerating language development. The initial and probe assessment mean PPVT-R standard scores for both groups are set out in Table 18.

**TABLE 18**  
**Initial and Probe Assessment Mean PPVT-R Standard Scores**

Group	Initial Assessment	Probe Assessment
Treatment	105.14	109.42
Control	104.37	107.62

There was a small but significant increase in the standard scores for both groups, but one-way Analysis of Variance demonstrated that the difference in scores between the two groups at probe remained non-significant ( $F < 1$ ) as it had been at the outset ( $F < 1$ ). A two-way ANOVA showed a non-significant interaction between group and time ( $F < 1$ ). Therefore, it was concluded that Hypothesis 2 was correct, the treatment was too specific to effect an increase in PPVT-R scores in the treatment group, beyond the improvement expected with age.

#### **5.4 Results of the Between Groups MLUm Study (Hypothesis 3)**

The initial assessment Mean of MLUm's were 4.12 for the treatment group and 3.65 for the control group. As noted in Section 4.1, this pre-treatment difference was non-significant ( $F(1, 20) = 2.75, p > .10$ ). At the probe assessment, the mean of MLUm's for the treatment group was 5.35 contrasted with 4.72 in the control group. The post-treatment difference was also non-significant ( $F(1,20) = 2.71, p > .10$ ). Therefore, Hypothesis 3, that an increase in expressive language function, represented by MLUm and structural analysis, would be observed in the treatment group but not in the control group was not supported.

This finding was interesting, and obviously, unexpected. Subjectively, the expressive language skills of the treatment children, in the areas of length and complexity of utterance, seemed to the author to be increasing as therapy proceeded. Further, the parents, the children's



preschool teachers, and significant others, generally commented on their impression that the children were "expressing themselves" better, using a wider vocabulary, and growing in confidence as their speech clarity improved.

It emerged though, that the improved intelligibility (and, no doubt, better communicative effectiveness) gave an illusion of improved expressive language skills in areas other than phonology, which objective measurement and statistical analysis failed to support. This result was an object lesson in the fallibility of subjective assessment. In retrospect, it might have been interesting to take initial and probe measures of *expressive* vocabulary, in that "vocabulary" and "confidence" were the areas most frequently commented upon by the parents.

### **5.5 Summary of the Between Groups & Measurement Study Findings**

In the data analysis it was ascertained that the therapeutic approach was effective in accelerating phonological development beyond the improvement expected with age.

Further, the *specific* nature and effect of the therapy was demonstrated by a non-significant difference in the PPVT-R receptive vocabulary scores of the treatment and control groups at both the initial and probe assessments, which increased only slightly in *both* groups.

Pre- and post- test results for the non-standardised tasks (1 to 4 above) of linguistic awareness and phonological processing proved interesting, and pointed to the need for further investigation, beyond the scope of this study. Performance of tasks involving rhyme matching and word-structure sorting showed significant improvement in the treatment group compared with the control group. The treated children's improved ability to perform these two tasks (and, presumably, similar tasks) appeared to be a strong contributory factor in the treated group's enhanced phonological improvement, justifying retaining them in the therapeutic battery.

Statistical analysis of a task involving phonemic onset matching was disappointing. There was a non-selective and small improvement in both groups. The failure to demonstrate a

constructive role for phonemic onset matching as part of the therapy battery may have been due to the nature of the particular task chosen for pre- and post- testing (i.e., it may have been too difficult), and insufficient justification for excluding it without further investigation.

A metalinguistic task involving the ability to discriminate meaningfully between the terms "sound" and "word" was performed more accurately by only some of the treatment children, over the control children. Again, excluding it and similar tasks from the battery was regarded as unwarranted, because of its contribution to the therapeutic package overall. Nonetheless, the result did point to the need to be careful not to use seemingly familiar words, such as "sound" and "word", that pre-school aged children clearly do not always fully comprehend.

An expectation that improved phonological skills might be associated with greater increase in MLUm in the treatment group over the MLUm increase in the control group was not supported by statistical analysis, despite subjective impressions to the contrary. The MLUm study results suggested that in future research, standardised measures of expressive vocabulary should be included.

The question of the feasibility of developing an efficient and reliable Severity Index for developmental phonological disorders, addressed in the Measurement Study, culminated in a satisfactory outcome. It was found that the Index, which was quick and easy to apply, had a high correlation with the Rating Scale, which reflected the clinical judgement of a panel of four experienced speech-language pathologists.

Further discussion and conclusions relating to the between groups study will be contained in due course in Chapter 7, but attention now turns to the within group study of the treatment group.

## **5.6 Results of the Within Group Study (Question 4 and Hypothesis 5 & 6)**

As we have seen, the main dependent variable, and the focus of interest, in the between groups therapy efficacy study was the improvement, phonologically, of the treatment group, relative to the controls. Arising from this interest, the within group study, of improvement in the children's phonology in response to the therapy, had as its focus research question 4: "What factors predict how long it will take for a child treated with this therapy to achieve age-appropriate phonology?" Thirteen of the fourteen treatment subjects' data (1T through 9T; 11T through 14T) were submitted to statistical analysis in order to address this question.

Subject 10T's data were excluded from the analysis. At the age of 5;10, and after 41 consultations over 19 months, his family were satisfied with his progress thus far, and also, for the second time, felt the need for a longer break than the 10 weeks off originally agreed. They decided, therefore, to take a full school term off, plus the summer December-January semester break (approximately 19 weeks in all) before resuming therapy. By acceding to this request, the author had to exclude 10T's data from the analysis, because, by taking a longer break, the temporal rules for participation in the study had been disrupted. His mother kindly agreed to attend for an assessment when 10T was aged 6;1, solely for the purpose of the research project, increasing his total number of consultations to 42, and the duration to 22 months.

### ***5.6.1 The Relevance of Predicting Duration and Frequency of Therapy***

In clinical case management, knowing approximately how much intervention may be required for an individual patient is important administratively and educationally as well as clinically. Clinical administrators want such information to aid staffing decisions, client allocation to staff, and the management of speech-language pathology waiting lists where applicable. Preschool and school administrators use it to justify special funding and to implement individualised services at preschool (e.g., early intervention teachers) or school (e.g., resource

teachers). Individual speech-language pathologists need the information in order to plan and manage their caseloads. Parents require it to make decisions relating to how, when, and where to pursue intervention. Among the first questions parents ask are "How long will the therapy take?", "How many times will we attend?", and "How much will it cost?"

Such questions from parents are largely motivated by time and budgetary considerations. In general, they do not want their children to miss pre-school or school in order to attend appointments. Indeed, they may have to deal with teachers, who, understandably, object to children being absent from pre-school or school on a regular basis to attend therapy, because it disrupts their programmes. Additionally, parents have their other obligations to take into account, for example: work, commitments with their other children (playgroup, swimming classes, volunteer activities at school, etc), and their own leisure pursuits and interests (sporting, religious or social). In many young families, availability of child-minding and transport are also important considerations.

Finally, there are the questions of waiting lists and cost. In most urban, and many rural, Australian communities, families have to decide whether to wait for speech-language pathology services (from 5 to 11 months, or more) through a publicly funded agency, or pay for private therapy. The critical factor in opting for private services is frequently the degree of private health insurance cover the family has. All of these issues and concerns become more complicated in certain families, for instance, in sole parent families, geographically or socially isolated families, and families in which more than one child, or one or both parents has a disability.

### ***5.6.2 Duration and Frequency of Therapy***

The duration of treatment and the number of consultations for the treatment group, are displayed in Table 19. The children's descriptive categories (relative to the Severity Index) for the severity for their phonological disabilities are included, and also their initial (Optimal) Severity Index Scores (see Table 16), and initial Severity Ratings.

TABLE 19

**Duration of Treatment and Number of Consultations**  
(WNL = within normal limits; \* Optimal Index Scores as per Table 16)

Subject	Descriptive Category	Initial Severity Index Score*	Initial Severity Rating	Initial age in months	Age in Months Phonology WNL	Months from Initial Assmnt to Phonology WNL	Total Treat-ments	Total Assess-ments	Total Consult-ations
1T	Moderate	22	3.75	52	69	17	22	5	27
2T	Moderate	25	3.75	56	69	13	25	7	32
3T	Moderate	22	2.50	46	52	6	9	3	12
4T	Moderate	29	3.75	50	68	18	30	6	36
5T	Moderate	24	2.75	50	57	7	11	4	15
6T	Moderate	18	2.75	51	61	10	15	4	19
7T	Moderate	22	3.25	57	69	12	20	4	24
8T	Moderate	25	2.75	35	52	17	19	5	24
9T	Moderate	30	3.50	49	58	9	18	4	22
10T	Severe	38	4.00	51	>73	>22	>34	>10	>42
11T	Moderate	29	3.25	46	53	7	10	4	14
12T	Moderate	29	3.75	53	63	10	18	5	23
13T	Mild	15	2.50	44	47	3	8	2	10
14T	Moderate	22	2.75	47	56	9	17	4	21

### 5.6.3 Age and Severity as Predictors of Progress (Hypotheses 5 & 6)

It was predicted that the children's initial severity of their phonological disabilities (see hypothesis 5), and age of commencing therapy (see hypothesis 6), might be significant factors in determining their rate of response to therapy. In addition, various other predictor variables were tested in the data analysis, including gender, initial PPVT-R standard scores, and initial sum of deviations.

The amount of treatment the children had was determined. The frequency of consultations was analysed in terms of treatment consultations only, and total consultations (i.e., assessment consultations plus treatment consultations). The total consultations figures were the

more meaningful ones, because the assessments were, as previously discussed, an integral component of the therapeutic management.

A set of correlations was computed for each of the three treatment variables; namely, [1] Number of Treatments, [2] Number of Consultations, and [3] Duration of Treatment in months. In each case, the following five subject variables were incorporated: [1] Initial Severity Rating, [2] Initial Age, [3] Gender, [4] Initial PPVT-R Standard score, and [5] Initial Sum of Phonological Deviations. The results are summarised in Table 20. Initial Severity Rating was the only variable to achieve significance in any set of analyses, accounting for between 33.8% of the variance (in Treatment Duration) and 58.7% if the variance (in Number of Consultations).

**TABLE 20**  
**Summary of Correlations between 5 Subject Variables and [1] Number of Treatments,**  
**[2] Number of Consultations, and [3] Duration of Treatment in Months**

Variable	Number of Treatments	Number of Consultations	Duration in Months
Initial Severity Rating	.755**	.766**	.580*
Initial Age	.404	.374	.075
Gender	.140	.160	.200
Initial PPVT-R	.046	.026	.002
Initial Sum of Deviations	.113	.140	.041

\*  $p < .05$

\*\*  $p < .01$

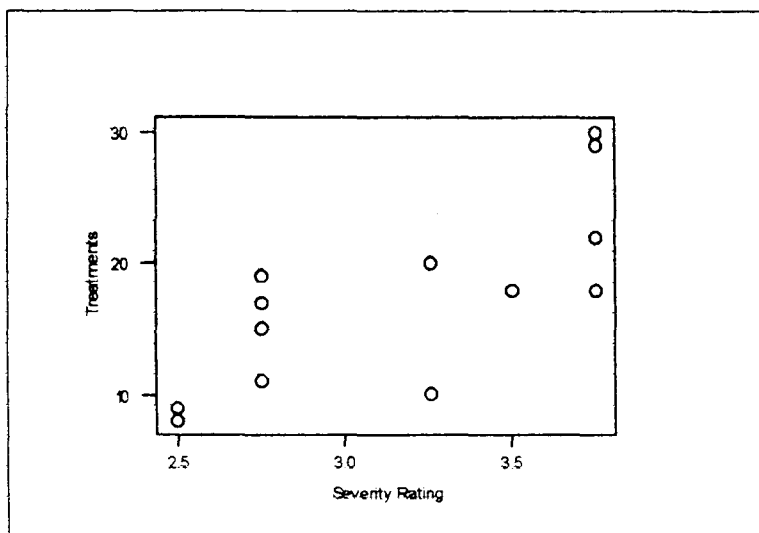
Thus it was found in the correlational analysis that the children's ages at initial consultation did not emerge as a significant variable, at least for this restricted age sample. This finding failed to confirm Hypothesis 6, that initial age would be associated with phonological progress. This was an important and salutary finding, in the sense that, in the current climate of early intervention wherever possible, parents are often placed in a position of feeling guilty if they present for therapy "late" with their phonologically disabled children.

The desirability of early intervention may be argued in relation to emotional or interpersonal factors, and in relation to later literacy acquisition (Bird, Bishop & Freeman, 1995) but not, according to these data, in terms of an accelerated improvement in productive phonology.

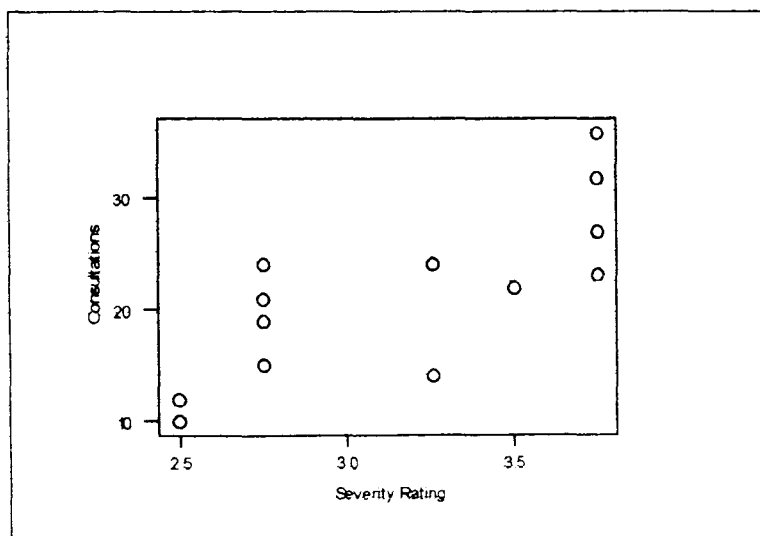
#### ***5.6.4 Correlation between Severity Rating and Frequency of Consultations***

There were strong (Pearson's) correlations between the initial severity rating of the children's phonological disabilities and the number of treatments they received ( $r(11) = .75, p = < .01$ ).

A similar correlation was shown between the initial severity rating and the total consultations ( $r(11) = .77, p = < .01$ ). A moderate correlation was found between initial severity rating and the duration of therapy ( $r(11) = .58, p = < .01$ ). These relationships are illustrated in Figures 3, 4 and 5.



**Figure 3: Total Treatment Consultations x Initial Severity Rating (N = 13)**



**Figure 4: Total Consultations x Initial Severity Rating (N = 13)**



### 5.6.5 Correlation between Initial Severity Rating and Duration of Therapy

The duration of the children's participation in the therapy was measured in months (see figure 5), from initial consultation (i.e., initial assessment) to their final treatment or assessment consultation (that is, when there were no phonological deviations present).

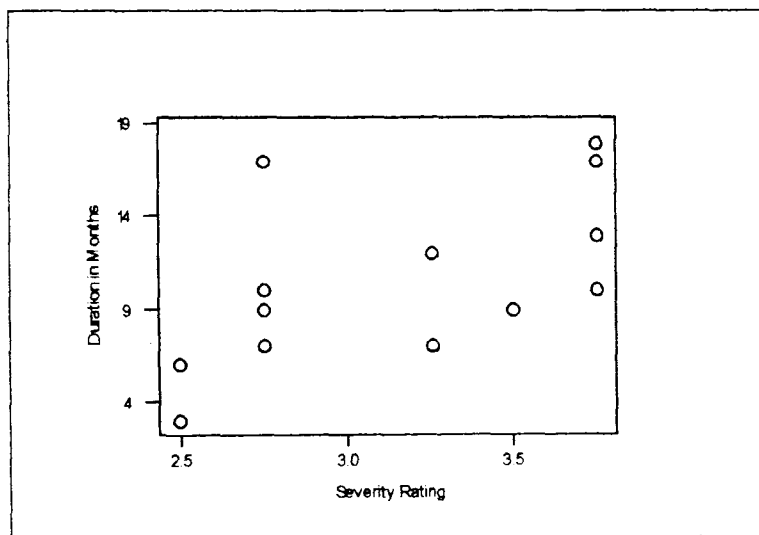


Figure 5: Duration of Therapy in Months x Initial Severity Rating (N = 13)

Clearly, number of consultations or number of treatments were the criteria that provided the best reflection of the extent of the children's participation in therapy. The consultations or treatments count were regarded as more meaningful than duration, because the duration of therapy criteria incorporated a time lag between the final treatment consultation and a final assessment consultation, approximately 10 weeks later for many of the children. Additionally the duration was sometimes inflated by other factors such as being unavailable for therapy due to illness or family holidays.

### ***5.6.6 Family Participation in Therapy (in Consultations and Homework)***

It is arguably the case that part of the normal role for the therapist, with parents whose children are engaged in phonological therapy, or, for that matter, any speech-language therapy, is to provide them with support, reassurance, encouragement and information, in addition to appropriate clinical intervention for their child's disability. In the current therapy approach, all of these factors were regarded as important, and particularly the information sharing aspect.

Providing the parents with a clearly explained, but not oversimplified, structured plan, and involving them actively in the therapeutic process appeared to have the dual, inter-related effects of reducing anxiety and enabling them to work constructively with the therapist on their child's phonology. All the accompanying adults (i.e., mother, father or grandmother) participated in the therapy consultations. The general trend was for them to take an increasingly active role as the therapy proceeded.

Subjective impressions of the parents' perception of the introductory phase (in the first to third consultations) of the family education and training process were interesting. Without exception, they expressed relief when given information about the disorder, particularly written information which they could read at their own pace, and later discuss. What empowered them most, however, was being given some 'direction' and something concrete to do in communicative contexts with the child. This, in turn, appeared to have a beneficial effect on the three-way relationship between child, parent and therapist.

Written information included the display book used in assessment and therapy sessions to facilitate explanations and discussion, the report to parents arising from the initial consultation, the booklet, "Notes for Families and Teachers", and written communication, as the need arose, by the therapist in the child's speech book. Providing written explanations of the disorder and its management proved an invaluable adjunct to clinical intervention. It was particularly useful for conveying information to the parent who did not usually accompany the child to therapy, grandparents, who were commonly interested in becoming actively involved, and pre-school teachers. All of the preschool teachers wanted copies of the "Notes for Families and Teachers".

### **5.6.7 Parents' Responses to Specific Aspects of the Therapy Regime**

Having described the parents' general level of participation in the parent education and homework components of the model, their responses to some of the specific constituents of the therapy model will be discussed as follows.

#### **5.6.7.1 Parents' response to administering Metalinguistic Tasks**

Metalinguistic tasks, designed to facilitate linguistic discovery by stimulating the children and their parents to think and talk about language, particularly at a phonological level, were popular with the parents and easy for them to implement and extend. The children responded to the parents' enthusiasm, and liked playing the games and doing the activities. The most enjoyable ones were those involving rhymes and judgements of correctness.

#### **5.6.7.2 Parents' response to administering Phonetic Production Procedures**

It was perplexing for most of the parents to regard phonetic production procedures as just another constituent of the therapy regime. Like a lot of speech-language pathologists, many of the parents thought of production practice as 'the' key component. The concept that the path to phonological change was to do with the child discovering solutions to their intelligibility problems for themselves, through a *combination* of auditory and conceptual and phonetic production tasks, was hard to convey. At times it was almost as though a Van Riperian Zeitgeist was telling the parents that production practice drill of therapy targets should be the primary focus in intervention. It was very hard for most of the parents *not* to emphasise production practice over and above the auditory and conceptual aspects of the model.

The only regularly recurring misunderstanding of what was required for homework, was for the parents to have the child practise saying word lists intended for auditory bombardment or rhyme matching tasks.

All the parents made the error of having the children rehearse the bombardment words at least once, despite discussion, reminders, and page headings in the homework such as "Thinking Task", "Listening Task" or "Talking Task", to alert them to what was required. Mostly, when asked, the parents said that they would have preferred homework with a strong emphasis on practising saying word lists, because they believed it would have been easier for them to do. They certainly all thought that a little extra production practice along the way was highly desirable!

#### **5.6.7.3 Parents' response to administering Multiple Exemplar Techniques**

Apart from tending to practise saying the bombardment and minimal contrasts words unnecessarily, as discussed above, the multiple exemplar tasks were enjoyable, and came easily to the parents. The mothers of 1T, and 2T both said that they felt "silly" reading the bombardment lists, but that it did not prevent them from doing them. All of the parents reported that if they were short of time, it was the auditory bombardment that they omitted from a homework session. The logic of using a minimal contrasts approach to remediation was immediately apparent to most of the parents, who could see that the main purpose in doing it was to help the child to discover the import of using words contrastively in order to distinguish words with different meanings.

#### **5.6.8 Teachers' Participation**

All the treatment subjects had different pre-school teachers. Even 4T and 11T, who were sisters, attended different pre-school centres, and had different teachers. All the teachers spoke to the author about the children's phonological disabilities, once, twice or three times throughout the therapy period, and inquired regarding ways they could assist.

Of the thirteen in the within group data analysis, ten of the treatment subjects took their speech books to pre-school regularly on the same day each week, by prior arrangement with their teachers, who would photocopy, or take a note of, the week's activities.

Seven of these ten children (1T, 4T, 6T, 7T, 9T, 13T, and 14T) did 5 to 7 minutes of the homework tasks one-to-one with their pre-school teachers once weekly. Subjects 2T, 8T and 11T took their speech books to preschool less than once weekly, because their parents forgot. However, their three teachers did photocopy the homework, and reinforced the activities in general, without having specific one-to-one homework sessions with the children. The mother of 4T and 11T was conscious that the teacher at 4T's pre-school had been more involved in her sister's homework programme. She explained her "forgetfulness" as being related to 11T's teacher being "busier and less organised" than 4T's had been.

The teachers of 3T, 5T, and 12T were interested to see the speech books, but they did not copy them or do any specific homework. In all three instances the pre-schools involved employed resource teachers to work with developmentally delayed children. Part of the pre-schools' culture was that following up therapy programmes was the role of resource teachers, not regular teaching staff. Having a phonological disability did not make 3T, 5T and 12T eligible for resource teaching, however, so they somehow fell between two stools.

## **5.7 Results of the Literacy Study: early reading acquisition (Hypothesis 7)**

The final hypothesis was that some of the treated children would continue to evidence difficulties with early literacy acquisition, which could be phonologically based. The results of the children's' reading tests, where applicable, are summarised in Table 21.

Three of the children, 8T, 13T and 14T had not started school at the time of the follow up reviews of reading acquisition, and none had received formal reading instruction, so were not included in the Literacy Study.

TABLE 21

## The Treatment Group Children's Acquisition of Pre-Reading and Reading Skills (End of School Year) N = 11

Approximate median age ranges in NSW Infants Schools:

Kindergarten - 4;9 to 5;8, Year 1 - 5;9 to 6;8, Year 2 - 6;9 - 7;8

Subject (Initial Severity Rating)	Age	Grade	Reading Test Results	Details
1T 3.75	6;9	Year 1	Test: Woodcock Word Identification SS 109; Word Attack SS 96; Passage Comprehension SS 103.	1T required extracurricular reading help. At 6;5 her Reading Age was 5;9. At 6;7, after intensive intervention, her reading was at an age-appropriate level.
2T 3.75	7;8	Year 2	Test: Neale-R Rate 10;9. Accuracy 8;8. Comprehension 8;9.	At 6;5 2T's Reading Age was 5;5. She had two terms of remedial help. At 7;8 her reading ability was above age expectations.
3T 2.50	6;7	Year 1	Waddington Diagnostic Reading Test: Reading Age 8;3.	3T was a competent reader by the end of his second year at school.
4T 3.75	6;10	Year 1	Test: Neale-R Rate <6;0. Accuracy 6;6. Comprehension 8;1. Test: Daniels & Diack Reading Age 6;7	4T was a non-reader until 6;0. At 6;2 she was receiving reading help at school. At 6;4 her Reading Age was 5;2. By 6;10 her accuracy and comprehension were in the average range, but rate of reading was very slow.
5T 2.75	6;10	Year 1	Test: Neale-R Rate 7;6. Accuracy 8;8. Comprehension 8;0.	5T was an early reader who was reading well by the middle of her first year of school.
6T 2.75	6;8	Kinder	30 sight words (below grade expectations)	6T was progressing slowly with reading by the end of her first year at school. Planned additional help at school in Year 1.
7T 3.25	6;4	Year 1	Tests: Neale Analysis & Daniels & Diack No score (below grade expectations)	7T was still essentially a non-reader at 6;4 with only 12 sight words. To have additional help at school in Year 2.
9T 3.50	5;11	Kinder	Tests: Neale-R & Daniels & Diack No score (below grade expectations) 9 sight words.	9T was to have additional help at school in Year 1.
10T 4.00	6;1	Kinder	Test: Daniels & Diack Reading Age 5;3. Test: Neale-R Rate <6;0. Accuracy <6;0. Comprehension 6;3.	10T was identified at school at 5;3 as requiring individual help with pre-reading activities. He had 4 sight words at 5;11. At 6;1 his Reading Age was 5;3. To have additional help at school in Year 1.
11T 3.25	5;6	Kinder	20 sight words (below grade expectations)	11T was to have additional help at school in Year 1.
12T 3.75	6;1	Kinder	Test: Neale-R Rate 7;6. Accuracy 8;2. Comprehension 8;0.	12T was a competent, avid reader by 5;0.

14T was old enough to have started school. However, school entry was deferred for 12 months when she was screened (at the school) for "school readiness", and found to be well below expectations for reading readiness.

Of the remaining eleven children, three, 3T, 5T and 12T had learned to read along normal lines, without the need for extra help. Their initial severity ratings were 2.50, 2.75 and 3.75 respectively. None of them had experienced episodes of stuttering.

Two children, 1T and 2T, received extra help with reading in their second year of school (i.e., Year 1), after which they progressed satisfactorily. 4T also had extra help in Year 1, after which her reading accuracy and comprehension were within the average range. However her reading rate was very slow.

7T was a non-reader at the end of Year 1, and had been selected for extra help at school in Year 2. Similarly, 6T, 9T, 10T and 11T were all below grade expectations at the end of their kindergarten year, and for all of them extra help was planned in Year 1.

Thus it was found, at the end of the school year (December), that of the eleven children who had started school, and who had received reading instruction, eight had either already received extra help, or had been identified as requiring it in the following school year, and three had learned to read with no apparent difficulty.

As an interesting aside, it was somewhat surprising, and very pleasing, to find that all 11 children who had been exposed to reading instruction liked the idea of reading and were enthusiastic about books. All 14 welcomed having stories read to them.

The sample was too small to draw firm conclusions from these data via statistical analysis. Table 22 gives an impression of the interrelationships between age, initial severity, presence or absence of stuttering, and difficulties with reading acquisition.

TABLE 22

Relationships Between Reading Acquisition &amp; Age, Severity, Stuttering &amp; Help/Planned Help with Reading N = 14

Subject (Gender)	Initial Age	Initial Mean Severity Rating	Total Consult- ations	Stuttering Episodes	Has had help with reading	Help with reading planned	Current Reading Status ✓ = WNL x = not WNL	Age at Review of Reading Progress
1T (F)	4;4	3.75	27		Yes		✓	6;9
2T (F)	4;8	3.75	32		Yes		✓	7;8
3T (M)	3;10	2.50	12				✓	6;7
4T (F)	4;2	3.75	36	Yes	Yes		x for rate	6;10
5T (F)	4;2	2.75	15				✓	6;10
6T (F)	4;3	2.75	19			Yes	x	6;8
7T (M)	4;9	3.25	24	Yes		Yes	x	6;4
8T (F)	2;11	2.75	24	-	-	-	-	(4;10)
9T (M)	4;1	3.50	22			Yes	x	5;11
10T (M)	4;3	4.00	>42	Yes	Yes	Yes	x	6;1
11T (F)	3;10	3.25	14			Yes	x	5;6
12T (F)	4;5	3.75	23				✓	6;1
13T (F)	3;8	2.50	10	-	-	-	-	(5;2)
14T (F)	3;11	2.75	21	-	-	-	-	(5;6)



## **5.8 Summary of the Within Group Findings**

The Within Group Study dealt with the factors predicting how long it would take a child treated with the therapy to achieve age-appropriate phonology. Two hypotheses were addressed, connected with (5) the significance of the initial severity of the children's phonological disability, and (6) the children's ages at the commencement of therapy, in determining the amount and duration of therapy. A final hypothesis explored the probability that (7) some of the treated children would have later difficulties with early literacy skills acquisition.

As we have seen, the statistical analysis for the between groups efficacy study included the data of thirteen of the fourteen experimental children. Regrettably, one subject's data were excluded, because of non-compliance with the original agreement regarding frequency of therapy attendance. In the within group analysis, it was found that all thirteen of the children whose participation did comply with the recommended protocol were discharged from therapy with age-appropriate phonology. Of these 13, the two children who had had stuttering episodes, in addition to phonological disability, achieved normal fluency prior to achieving age-appropriate phonology, and hence prior to discharge. The entire group of 13 children had no phonological or phonetic deviations at their final assessments.

When the significant factors predicting phonological progress were analysed, it was found that the initial severity of the children's phonological disabilities was the only significant variable to emerge. This finding supported Hypothesis 5, but it meant, of course, that age at the commencement of therapy (proposed as another predictor of progress in Hypothesis 6) was non-significant.

At the time the data relating to reading acquisition were gathered, all but three of the thirteen treated children in the data analysis had completed at least one year of formal schooling. In the Literacy Study it was found, at the end of the school year (December), that of the eleven

children who had started school, and who had received reading instruction, eight had either already received extra help with reading, or had been identified as requiring it in the following school year, while only three had learned to read with no apparent difficulty, lending support to Hypothesis 7.

A general discussion of the conclusions that can be drawn from the results of the project overall are contained in Chapter 7, but first, Chapter 6 contains representative case examples of the therapy methodology in action.

## CHAPTER 6

### THE THERAPEUTIC MODEL IN PRACTICE

Case history summaries, and outlines of individualised intervention goals, procedures and activities for four of the treated children are presented in this chapter, using the terminology and framework suggested by Fey (1992b) (see 3.7.2, Figure 1). In addition, aspects of the therapy of a fifth child, 9T, are discussed in relation to some of the differences between the current therapy approach and efficacy study and the *Metaphon* approach (Dean & Howell, 1986; Dean, Howell, Hill & Waters, 1990) and efficacy study (Hill, Howell & Waters, 1988; Howell & Dean, 1991).

#### **6.0 Subject Selection for Case Examples**

1T, 4T, 10T and 12T, were selected for full case studies because they were representative of the presenting phonological disabilities, the variety of responses to the therapy, and the intervention issues that arose. 9T was chosen for a less detailed study because his case highlighted aspects of treatment goal setting which distinguished the current approach from previous approaches, particularly the *Metaphon* efficacy study (Hill, Howell, Waters & Dean, 1989).

Three of the case example subjects, 1T, 4T and 12T, represented typical responses to the therapy. All of them were girls, aged 4;4, 4;2 and 4;5 respectively when they were assessed initially, and all with initial mean severity ratings of 3.75. The other case study subject was a boy, Subject 10T. He was aged 4;3 when he was initially assessed, and had a mean severity rating of 4.0. He was chosen as a case example essentially because he had the most severe phonological

disability in the treatment group, and because his response to the therapy was atypical. Importantly, the problems associated with his management raised some pertinent issues in clinical management. Subjects 1T, 4T, and 10T were among those children in the treated group who went on to experience early difficulties with reading acquisition. They differed from each other in that 4T (like 10T) had episodes of stuttering, while 1T had no associated communication impairment. Meanwhile, Subject 12T had a phonological disability which was uncomplicated by difficulties in other areas of linguistic function, though her management was influenced by emotional issues, related to her parents' recent separation.

Distinct from 1T, 4T, and 10T, Subject 12T did not experience early difficulties with literacy acquisition. In this respect, she provided one of the "purest" examples of phonological disability. Several other children (5T, 6T, or 11T, for instance) might have fulfilled the "pure phonological disability" role. Subject 12T was favoured, however, because of the methodical and meticulous record her mother kept of her homework participation. In general in the treatment group, the task of reporting of homework participation fell to the mothers. They would provide a "self-report" of their part in the homework, and also, where applicable, an estimate (second hand, as it were) of the father's, and/or teacher's participation. These second hand reports were regarded as less reliable than the self reports. Subject 12T's mother was involved in all of her homework, with her father and his partner, with whom 12T had infrequent contact, and her pre-school teacher, only providing general encouragement to speak clearly.

We have seen strong correlations between the number of consultations, and the number of treatments, required by the children, with the initial severity of their phonological disabilities. Of the 13 children who completed therapy, 4T had more consultations (36), and a longer duration of therapy (18 months) than any of the others. 1T had fewer consultations (27) spread over 17 months. 12T had 23 consultations over 10 months. Subject 10T was engaged in therapy for the longest (22 months to date, from 51 to 73 months of age), and had the most consultations (42), with his therapy participation unfinished at the time of writing (34 treatments and 10 assessments

to date). Two of his therapy sessions were extended consultations involving both an assessment and a treatment

It will be remembered that, for the purpose of the study, The *Metaphon* Resource Pack Screening Assessment (Dean, Howell, Hill & Waters, 1990), was the screening procedure employed. It was chosen principally because it provided a demonstration for the observing parents of the nature of the assessment procedure involved. More detailed assessment upon which to base treatment planning largely utilised the *PACS* (Grunwell, 1985a) and/or the procedures described by Stoel-Gammon and Dunn (1985).

Any child's phonology with a Severity Rating of 3.00 or more was submitted, minimally, to at least the following three analytical procedures of the *PACS*, or their equivalent: (1) the phonetic inventory (the phonetic characteristics of the child's output phonology); (2) the contrastive assessment (the phonetic and phonological matches and mismatches, and hence the communicative potential of the output phonology); and, (3) the developmental assessment (the developmental status of the child's output phonology), chronologically matched to the *LARSP* Profile Chart stages (Crystal, Fletcher & Garman, 1976; Crystal, 1982). As the children's phonological systems improved, their phonological assessments became less exhaustive.

In the course of history taking for each child, developmental history and family information were provided by the children's parents. Details such as gestation period, birth weight, neonatal condition, early health history, ages of onset of walking, first words, and two-word combinations were confirmed by reference to clinic 'blue book' entries by "Clinic Sisters" (from Early Childhood Health Centres: New South Wales Department of Health). Details of early development, family structure, family dynamics, and family history, have been omitted from the case studies to preserve the anonymity of the children and the families.

A few words of clarification are required regarding the tables in this chapter, and in Appendix F. The Index Scores recorded for the subjects in this chapter (i.e., Tables 24, 26, 30 and 34), and in Appendix F are the optimal scores, as shown in Table 16, data column 4. The

Descriptive Categories correspond with the optimal Severity Index scores as shown in Table 16, (not the severity rating categories used by the raters). It is noted again that the Sum of Deviations procedure involved tallying phonological deviations from 15-19% for Category 1 for the initial assessment, and phonological deviations from 5-19% for Category 1 for subsequent assessments (i.e., deviations <15% were not included in the Sums of Deviations of the children's initial assessment data, and deviations <5% were not included subsequently).

## **6.1 Subject 1T - Case Example**

Subject 1T (see Table 23 for a history summary) was an energetic, determined, somewhat anxious little girl, whose mother described herself as "a worrier". 1T had persistent separation anxiety at preschool and at home, and had a history of psychosomatic symptoms. From the outset of therapy, 1T was quite aware of her poor intelligibility. She would never repeat an utterance if asked for clarification, but would say, "Doesn't matter" ([ˈdæməne]), and become silent and unhappy for a few moments.

### **Therapy Block 1 (1T)**

Phonological assessment data were gathered over one assessment session, and a 220 word sample, largely of spontaneous utterances, submitted to analysis. The over-riding feature of 1T's productive phonology was her restricted phonetic inventory, especially the absence of fricatives. Affricates were also absent from her speech output, although she was stimutable for /tʃ/. Stopping of fricatives and affricates was evident 100%. She was surprisingly intelligible at single word level and at short phrase level in context, but at phrase level out of context largely unintelligible to everyone, including her family.

The basic goals in therapy were to facilitate the cognitive reorganisation of 1T's phonological system, and to improve her intelligibility. The (initial) intermediate goals, therefore,

were to expand her inventory and target fricatives and affricates. The specific goals were phonetic production training for the targets /s/ and /tʃ/; and to establish plosive:fricative:affricate contrasts in meaningful contexts.

The intervention procedures used to address these specific goals were multiple exemplar activities (minimal contrasts therapy and auditory bombardment) and metalinguistic tasks of judgement of correctness, both involving plosive:fricative:affricate contrasts.

**TABLE 23**  
**History Summary: Subject 1T**

<b>HISTORY SUMMARY</b>	<b>Details 1T (FEMALE) Initial Severity Rating 3.75</b>	<b>Comment</b>
Initial Consultation Age Initial Severity Index Score Initial PPVT-R SS Initial MLUm	52 months (4;4) 22 Moderate Phonological Disability 115 5.30	Very rapid speech.
Consultations Treatments Assessments Duration of Therapy	27 22 5 17 months	Number of Treatments after Probe = 1. Probe Assessment was # 4. Interval between Initial Assessment and Probe was 11 months. Number of Months after Probe that no Deviations were present = 8.
Initial Incidence Category Scores and Specific Phonological Deviations	<u>Incidence Category 5: 80 - 100% 3 Phonological Deviations</u> Stopping of Fricatives; Stopping of Affricates; Cluster Reduction SIWI <u>Incidence Category 4: 60 - 79% 1 Phonological Deviation</u> Cluster Reduction SFWF <u>Incidence Category 3: 40 - 59% 1 Phonological Deviation</u> Gliding of Liquids	Sum of Deviations = 5 Phonetic Inventory: /p/, /b/, /t/, /d/, /k/, /g/, /m/, /n/, /ŋ/, /h/, w/, /j/ Stimulable for: /tʃ/, /t/ Not stimulable for: /s/, /z/, /f/, /v/, /ʃ/, /ʒ/, /θ/, /ð/, /dʒ/, /r/ Unintelligible at phrase level out of context.
Accompanying Family Members	Mother accompanied 1T to all consultations.	
Homework	All homework was with mother. 1 to 1 with teacher once per week. Speech book to preschool once per week.	Mother kept good records of homework participation. 18 homework sessions per week.
Therapy Blocks and Breaks	Block 1: 9 Consultations. Break : 10 weeks. Block 2: 8 Consultations. Break 2: 10 weeks. Block 3: 8 Consultations. Break 3: 14 weeks. Block 4: 3 Consultations.	Break 3 was 14 weeks due to chickenpox. Mother reported continual difficulty getting 1T to come happily to therapy. Once she arrived she was fine, but then had to be coaxed to leave for pre-school.

Because one of the intervention activities which would be used extensively in 1T's management involved rhyme matching, a metaphonological rhyme matching card game was taught. In teaching the rhyme matching card game, /r/ vs /w/ minimal contrasts were used, thereby introducing liquid vs. glide contrasts as an intermediate goal. By session 4, 1T was producing /s/, /z/, /ʃ/, /f/ and /tʃ/, and the beginning of phonological generalisation (from one syllable position to another, and from one phoneme to another) was apparent.

In sessions 5 and 6 consonant clusters SIWI were targeted for intervention, with /s/ vs /st/ and /t/ vs /st/ SIWI as exemplars, using multiple exemplar training, judgement of correctness games, and rhyme matching, but no production practice.

Session 7 saw the introduction of /s/ vs /sp/ and /p/ vs /sp/ SIWI and /t/ vs /st/ SFWF as specific goals, but still not for production practice. In sessions 8 and 9 Subject 1T was showing productive phonological generalisation from /st/ and /sp/ to /sk/, /sm/, and /sk/, and lexical generalisation to other words containing these targets, at single word level. 1T's mother reported no socio-environmental generalisation, beyond saying the words correctly during homework sessions.

Session 10 comprised an assessment, and discussion with 1T's mother of management during the ensuing 10 week break. Analysis of a 150 word spontaneous speech sample showed that her phonetic inventory was complete. Stopping of affricates had reduced from 100% to 66%, Gliding of Liquids from 50% to 25%, cluster reduction SIWI from 88% to 78%, and cluster reduction SFWF from 66% to 33%.

During the break, 1T's parents were to reinforce correct use of consonant clusters and fricatives. The reason that they were not instructed to reinforce the contrastive use of affricates, even though it had been a therapy target, was that 1T was tending to produce them with lateral air escape which her mother was unable to discern. This lateralisation of /tʃ/ and /dʒ/ began when /l/ was introduced as a production target, and was probably a form of over generalisation.



1T's mother sought, and was given, reassurance about the lack of functional generalisation outside the clinic, as she saw it. It was emphasised that gradual phonological progress was to be expected. An unexpected development at this point was that whilst 1T's mother was, to some extent, disappointed with progress, her father was aware of considerable gains, and telephoned to say how pleased he was with 1T's improved phonology.

## **Therapy Block 2 (1T)**

Session 1 was an assessment. Previous gains with the phonetic inventory and production of clusters had been maintained, and syntactic generalisation (from single words to phrases and sentences) was beginning for consonant clusters. Stopping of affricates had gone back up to 100% (remembering that affricate use had not been reinforced during the break) and liquid gliding had reverted to 50%. However, stopping of fricatives had reduced from 100% to 87%. 1T was no longer lateralising any fricatives. She was producing occasional correct /l/ clusters.

For economy, it was decided to target liquids and clusters SIWI jointly by using minimal contrasts and bombardment words comprising stops or fricatives + /l/ (i.e., /pl/, /bl/, /kl/, /gl/, /sl/ and /fl/) contrasted with /l/ SIWI. The effect on 1T's phonology within the clinic was dramatic. By the end of the therapy block, fricatives were established in all initial positions including initially in /l/ clusters. The Stopping process remained at only 11%, and Gliding of Liquids had reduced to 25% again. Cluster Reduction SIWI stood at 64% and SFWF 33%.

By now 1T's parents were experiencing some conflict, of which 1T was aware, surrounding their differing perceptions of how she was progressing. A taped language sample, which 1T's mother made at home voluntarily, *supported* her report of little socio-environmental generalisation from the clinic to other speaking environments. 1T's father maintained the opposite view, despite objective evidence, and redoubled his efforts to encourage and reassure 1T about her speech.

### **Therapy Block 3 (1T)**

The most prominent aspect of 1T's phonology by this stage was her omission of /s/ and /z/ where it served a morphological function. Lexical and grammatical innovations (Shriberg & Kwiatkowski, 1980), utilising plurals (-s, -z) and third person regular present tense (he runs) morphemes to facilitate the emergence of new phonological contrasts were used to target consonant clusters SFWF.

Intervention activities to teach Metaphonological knowledge of phoneme-grapheme correspondences or sound symbol relationships, e.g., recognising that the letter "s" corresponded with /s/ were incorporated, as were activities directed at improving self-monitoring and self-correction abilities.

The assessment at the end of Block 3, when 1T was aged 5;1, was her Probe assessment. It revealed Cluster Reduction SIWI 64%, Cluster Reduction SFWF 33%, Gliding of Liquids 25% and Stopping of Fricatives SFWF 11%. A taped spontaneous language sample (requested by the author) from home confirmed that 1T was now generalising her new phonological skills to other situations, and that there was little difference between within-clinic and out-of-clinic productive phonology. This pattern persisted for the remainder of therapy, with all within-clinic gains generalising rapidly to all other communicative contexts.

Home management during the next 10 week break consisted of general reinforcement of intelligibility, praising 1T for making spontaneous revisions and repairs, and modelling corrections as appropriate. The break had to be extended to 14 weeks because 1T and her two siblings were housebound, consecutively, with chickenpox.

### **Therapy Block 4 (1T)**

1T had one combined assessment/therapy session after her probe assessment at 5;1, aimed at her /r/ → /w/ sound replacement, and was then placed on review. When re-assessed six months later, at 5;7 the phonological deviations remaining in her output phonology were Gliding

of Liquids 20%, and Cluster Reduction SIWI 33%. Clusters and liquids were therefore largely established, and she received no further therapy. When she was followed up again, two months later at 5;9, no phonological deviations, or phonemic replacements, were apparent in 1T's phonology. 1T's gradual progress is shown in Table 24. It was interesting to see that although her Index Score and Sum of Phonological Deviations remained relatively stable in the first few months of therapy, her Severity Ratings showed a steady decline.

**TABLE 24**  
**1T's Progress in Therapy**

Age	Incidence Category 5 80-100%	Incidence Category 4 60-79%	Incidence Category 3 40-59%	Incidence Category 2 20-39%	Incidence Category 1 ≤ 19%	Sum of Dev's	Severity Index Score	Descriptive Incidence Category relative to Index Score	Severity Rating
4;4	3	1	1	-	-	5	22	Moderate	3.75
4;7	1	2	-	2	-	5	17	Moderate	3.50
4;9	2	1	1	1	-	5	19	Moderate	3.00
5;1	-	1	-	2	1	4	09	Mild	2.25
5;7	-	-	-	2	-	2	04	Very Mild	2.00
5;9	-	-	-	-	-	-	0	Normal	1.00

#### **Follow-up at 6;5 and 6;7 (1T)**

When 1T was discharged from therapy her mother confided that she was anticipating separation problems and learning difficulties, once she started school. Luckily, the difficulties 1T had with the first stages of reading acquisition were quite quickly overcome with appropriate help.

The mild problems 1T had with early reading acquisition were associated with four months of escalating school-refusal. At 6;5, in her second year of Infants' School (Year 1) her Reading Age was 5;9 (Grade Average 6;9). She received 9 weeks twice weekly individual reading remediation with a specialist teacher.

When re-tested at 6;7, on the Woodcock Test (Woodcock, 1987), 1T's reading skills were age-appropriate and approximated the grade average (Word Identification SS 109; Word

Attack SS 96; Passage Comprehension SS 103). With the improvement in her reading came a reduction in her reluctance to go to school.

Her mother remained very concerned about 1T's general progress and requested the assessment and management advice of a Clinical Psychologist. Accordingly, the Wechsler Preschool and Primary Scale of Intelligence - Revised (the WPPSI-R) was administered, with the following result: Performance Scale 85-103; Verbal Scale 83-99; Full Scale 84-98.

The Achenbach Child Behaviour Checklist was completed and showed that 1T's anxious and nervous behaviours placed her in the clinical range for internalising behaviours and for behaviour overall. She showed a high degree of performance anxiety, and was (as previously observed) subject to psychosomatic symptoms.

### **Discussion (1T)**

1T provided an example of steady progress phonologically despite her mother's anxiety, and poor parental unanimity regarding her linguistic development. Her mother carried out all homework with care, but was more inclined to correct mismatches than to praise or otherwise reinforce correctly produced targets. Her father's more optimistic approach may not have been very influential, because he was rarely present, and was not involved in bringing 1T to therapy, nor in implementing the homework component of her programme. 1T was aware that there was some conflict between her parents relating to her speech. Her cautiousness in her first two therapy blocks in experimenting with her phonology was probably anxiety-based, and may have partly accounted for 1T's slow socio-environmental generalisation early in therapy.

## 6.2 Subject 4T - Case Example

4T (see Table 25 for a case summary) was a quiet, intense, affectionate, and enthusiastic little girl who suffered frequently from asthma. This did not preclude her from attending scheduled appointments, but it did sometimes affect her ability to participate adequately in therapy.

**TABLE 26**  
**History Summary: Subject 4T**

HISTORY SUMMARY	Details 4T (FEMALE) Initial Severity Rating 3.75	Comment
Initial Consultation Age	50 months (4;2)	Speech was rapid, and very quiet.
Initial Severity Index Score	29 Moderate Phonological Disability	
Initial PPVT-R SS	104	
Initial MLUm	4.37	
Consultations	36	Number of Treatments after Probe = 6. Probe Assessment was # 3. Interval between Initial Assessment and Probe was 12 months. Number of Months after Probe that no Deviations were present = 6.
Treatments	30	
Assessments	06	
Duration of Therapy	18 months	
Initial Incidence Category Scores and Phonological Deviations	<p><u>Incidence Category 5: 80 - 100% 4 Phonological Deviations</u></p> <p>Context Sensitive Voicing, Palato-alveolar Fronting, Cluster Reduction SIWI, Stridents → /h/ SIWI</p> <p><u>Incidence Category 4: 60 - 79% 1 Phonological Deviation</u></p> <p>Cluster Reduction SFWF</p> <p><u>Incidence Category 3: 40 - 59% 1 Phonological Deviation</u></p> <p>Velar Fronting SIWI</p> <p><u>Incidence Category 2: 20 - 39% 1 Phonological Deviation</u></p> <p>Velar Fronting SFWF</p>	<p>Sum of Deviations = 7</p> <p>Phonetic Inventory:</p> <p>/m/, /n/, /p/, /b/, /t/, /d/, /k/, /g/, /v/, /s/, /z/, /h/, /w/, /l/, /j/</p> <p>Not stimulable for:</p> <p>/ʃ/, /ʒ/, /θ/, /ð/</p> <p>/tʃ/, /dʒ/, /r/</p> <p>Unintelligible beyond a single word level out of context.</p>
Accompanying Family Members	Both parents attended 4 consultations; mother accompanied her to 28, father to 1 and grandmother to 3. Siblings 35/36.	Parents made therapy attendance a "special outing".
Homework	Mother 60%; Father 40%; 1 to 1 with teacher once per week; Book to preschool once per week	12 homework sessions weekly.
Therapy Blocks and Breaks	<p>Block 1: 10 consultations; Break 1: 9 weeks.</p> <p>Block 2: 10 consultations (over 7 months); Break 2: 7 weeks.</p> <p>Block 3: 11 consultations. Break 3: 10 weeks.</p> <p>Block 4: 5 consultations</p>	4T loved every aspect of coming to therapy.

4T was eager to participate, and all phonological gains immediately generalised to other situations. When she talked unselfconsciously, 4T tended to become faster and softer. Her mother and four siblings all had asthma in varying degrees, and all talked rapidly and quietly. They would sometimes *all* attend an appointment with 4T - but sit in the waiting room so quietly that it would be a surprise to open the door and find them all there! 4T's mother was very empathic with the children, generally, and in terms of their asthma, particularly. She interpreted 4T's quietness as being due to her often being "too out of breath to speak up".

### Therapy Block 1 (4T)

Phonological assessment in the first visit revealed a restricted phonetic inventory which only included four fricatives /s/, /z/, /v/ and /h/, although she was stimulable for /f/. The most obvious features of her productive phonology were that stridents were replaced by /h/ SIWI 88%, and that homonymy reduced intelligibility out of context virtually to zero. Examples of her homonymy included:

hub, cup, sharp, tub → [hʌb];

high, sky, tie, shy, sty, try, child, cry, eye → [haɪ];

hair, stair, chair, share, scare, air → [hæə]; and,

glow, slow, blow, whoa → [woʊ].

4T replaced /f/, /r/ and /l/ clusters SIWI with /w/ - hence read, weed, feed, swede → [wid]; play, sway, ray, Fay, way → [weɪ] (but, say and Shea → [heɪ]). She used no initial voiceless consonants. Cluster reduction SIWI was evident 100%. What was interesting about this was 4T's preference for /w/ in place of /l/ clusters ( fly → [waɪ]; plane → [weɪn]; blue → [wu]), except for /sl/ clusters where she reduced the cluster to /l/ inconsistently (so that slow was

realised as [lʊʊ] or [wʊʊ]). Her sound-replacement for all other clusters was /h/, except those containing /n/ and /m/, which she reduced to those phones (smoke → [moʊk]; snake → [neɪk]).

The puzzle phenomenon was described by Smith (1973, see 1.2) whose son Amahl produced “puzzle” as [pʌdəl], but “puddle” as [pʌgəl]. Subject 4T’s variation of the puzzle phenomenon revolved around the fact that singleton // SIWI consistently matched the adult target. Her use of the /w/ replacement for many initial // clusters, rather than simply reducing the cluster to // had the effect of reducing homonymy. For example, lane was realised as [lern], while plane was pronounced [weɪn].

Like 1T, subject 4T was aware of her communicative inadequacy from the outset. If asked to repeat an unintelligible utterance, she would say, “I can’t say those ones” ([haɪ hən 'heɪ vʊn wʌnz]). With slight encouragement and reassurance, she would repeat the utterance once, without attempting to modify her production. Some obvious lexical selection was apparent.

Naturally the basic goals in therapy were to facilitate the cognitive reorganisation of 4T’s phonological system, and improve her intelligibility. Intermediate goals were to expand her phonetic repertoire, and to disrupt 4T’s systematic sound preferences for /h/ and /w/, which were largely responsible for her communicative inadequacy. Plosive:fricative contrasts were therefore targeted, along with a variety of strategies to encourage her to speak louder.

4T’s quietness posed a difficulty in clinical management. It was often very hard to determine what she was saying, anyway, because of her phonological system, but her very soft voice compounded this problem. The idea of “loud sounds and quiet sounds” was introduced, not in the metaphoric sense (cf. Dean, Howell, Hill & Waters, 1990, in the *Metaphon* approach, which used a “Mr Whisper and Mr Noisy” metaphor to target context sensitive voicing), but literally, in terms of decibels! Happily, after four or five sessions, she was able to talk loudly enough to be heard clearly during therapy. By the end of the first therapy block she and her mother were both using normal loudness during sessions.

Multiple exemplar training techniques were used to expose 4T to the range of fricative : plosive contrasts, starting with /p/, /b/ vs /s/. She quickly learned to produce /f/ SIWI, in non-linguistic contexts, and this now became her only potential initial voiced:voiceless contrast. Minimal contrast activities for /f/ vs /w/ (feel - wheel; fork - walk; fire - wire; fell - well; find - wind; etc) were incorporated.

A breakthrough to 4T using /f/ in a linguistic context came via a popular “rude” joke that could only appeal to a 4 year old (Child: “Say wire”. Adult: “Wire”. Child: “Your pants are on fire!”). 4T practised telling the joke over and over, with relish. She was then happy to play homonymy confrontation games endlessly in a similar joke format (say walk - your daddy broke the fork; say white - do you wanna fight?; etc). The whole family had fun with these jokes, which proved to be an effective vehicle for phonological learning.

In session 6 the voiced voiceless distinction between /f/ and /v/ was selected as a production target SIWI (fan - van; fine - vine; etc), and palato-alveolar fronting SIWI as a multiple exemplar training target. By session 7, 4T was stimulable for the full range of English consonants.

4T’s systematic sound preference for /h/ seemed unshakeable, and she was unable to recognise auditorily the distinction between /h/ and any initial sound other than /f/ at a single word level. For example she could distinguish he/Fee (Fiona) but was unable to distinguish any of the following contrasts: he/tea, he/key, he/sea, he/she, he/ski, he/tree. She could, however, distinguish E/tea, E/key, E/sea, etc. Taking /t/ as the exemplar, therefore, 4T was bombarded (auditorily) with activities contrasting initial /t/ with no initial consonant (eye/tie, oh/toe, ear/tear). This was extended to contrasting /s/ SIWI with /t/ SIWI and no initial consonant (oh/toe/sew), and then including /h/ SIWI (oh/toe/sew/hoe) and finally /ʃ/ (oh/toe/sew/hoe/show). The effect on 4T’s phonology was almost immediate. Over two therapy sessions context sensitive voicing reduced from 86% to 17%. Meanwhile, in the same period, palato-alveolar fronting reduced from 100% to 83%, and /h/ replacements for stridents dropped slightly (from 88% to 70%).



During the first break from therapy (of 9 weeks) the family were to provide modelling corrections only for all /h/ replacements SIWI, and reinforce the use of acceptable volume.

## **Therapy Block 2 (4T)**

When the family re-presented after the break, they reported that 4T had begun stuttering two weeks after therapy had ceased - seven weeks of stuttering in all. They had not contacted the author by telephone during this period, because 4T appeared unaware of the stutter. She had also reverted to talking very softly. Previous phonological progress had been maintained, and /h/ replacements for stridents remained at 70%, so that it continued to be the most deviant aspect of her productive phonology. She still realised /f/ as /v/. However, she now realised /θ/ as /f/ and, /ð/ as /d/, reflecting the progress made in marking the voiced : voiceless distinction.

Fluency management now became the primary concern. 4T's stutter was at a 4 to 10% syllables stuttered (SS) level within the clinic, and at home (according to a covertly taped speech sample provided by her parents). Four once weekly sessions were devoted to fluency intervention, using behavioural management techniques. 4T's speech was normally fluent at the end of this time.

It was decided to give her another break (of approximately 5 weeks) before resuming her phonology programme. The rationale for including this break was that it was hypothesised that focussing again on phonology might have a detrimental effect on 4T's newly-acquired ability to monitor and control her fluency, *and* maintain adequate loudness. During the break the family were to work on maintaining fluency and acceptable speech rate and loudness. Her parents had just the right touch as language teachers, and were unerring in their capacity to reinforce appropriate phonological skills, and also in knowing when to "back off".

After the 5 weeks break 4T had a further six therapy sessions of phonological therapy. Multiple exemplar techniques, and a minimum of production practice (because it did not appear to be necessary, in that the primary difficulty she had was still with perceiving /h/ contrasts) were used to re-target the idiosyncratic use of /h/.

By the end of the therapy block, five weeks later, when she had her probe assessment, the systematic sound preference for /h/ had reduced from an incidence of 70% to zero in all speaking situations. Gains in the areas of fluency control, vocal loudness and speech rate had been maintained. During the break the family provided general reinforcement of clear speech only, including praising 4T for making spontaneous revisions and repairs.

### Therapy Block 3 (4T)

In Block 3, 4T was seen weekly for 11 weeks. At the beginning of the therapy block velar fronting SFWF stood at 25%, palato-alveolar fronting 66%, cluster reduction SIWI 35% and cluster reduction SFWF 66%. Velars (contrasted with alveolars) and clusters (contrasted with singletons) were targeted, again with a minimum of production practice. 4T's next phonological assessment was at 5;5 (see Table 26). Palato alveolar fronting remained, and 4T was quite unable to distinguish auditorily between /s/, /ʃ/, /z/, and /ʒ/. Velar Fronting was now absent, and Cluster Reduction SIWI had dropped to 21%, and Cluster Reduction SFWF to 33%.

**TABLE 26**  
**4T's Progress in Therapy**

Age	Incidence Category 5 80-100%	Incidence Category 4 60-79%	Incidence Category 3 40-59%	Incidence Category 2 20-39%	Incidence Category 1 ≤ 19%	Sum of Devs	Severity Index Score	Descriptive Incidence Category	Severity Rating
4;2	4	1	1	1	-	7	29	Moderate	3.75
4;7	2	1	1	2	1	7	22	Moderate	3.75
5;2	-	2	-	2	-	4	12	Mild	2.50
5;5	-	1	-	2	-	3	08	Mild	3.00
5;6	-	-	-	-	1	1	01	Very Mild	1.50
5;8	-	-	-	-	-	-	0	Normal	1.00

### Therapy Block 4 (4T)

4T's therapy sessions after her assessment at 5;5, were directed exclusively at the /s/ vs /ʃ/ contrast, using the letters 's' and 'sh' as additional visual cues throughout. At 5;6 the only

remaining phonological deviation was Cluster Reduction SIWI 12%. By 5;8, no phonological deviations or phonetic replacements were present, and her fluency remained within normal limits. 4T's pattern of steady phonological improvement is seen in her Index Scores in Table 26. The stuttering episode occurred between 4;5 and 4;8.

4T still tended to talk very quietly, and because of this pragmatic difficulty, the student counsellor at her school queried an expressive language disorder and asked for a formal language assessment, using the Clinical Evaluation of Language Fundamentals - Revised (CELF-R) (Semel, Wiig & Secord, 1987), in third term of her Kindergarten year (her first year in Infants' School). 4T was aged 5;6 at the time.

It was customary in that period for district school counsellors to make specific requests for CELF-R's because they had attended in-service courses relating to its use. This unexpected request provided an unanticipated opportunity to examine some of 4T's other language skills in greater detail. It came as no surprise that 4T's scores indicated high average to above average language skills, across the board (as displayed in Table 27).

**TABLE 27**  
**4T's CELF-R Results at 5;6**

<b>Scoring Summary</b>	<b>Standard Score</b>	<b>Percentile Rank</b>
Linguistic Concepts	12	75
Sentence Structure	13	84
Oral Directions	12	75
<b>RECEPTIVE LANGUAGE SCORE</b>	<b>116</b>	<b>84</b>
Word Structure	12	75
Formulated Sentences	11	63
Recalling Sentences	13	84
<b>EXPRESSIVE LANGUAGE SCORE</b>	<b>112</b>	<b>79</b>
<b>TOTAL LANGUAGE SCORE</b>	<b>116</b>	<b>84</b>
<b>Language Age Equivalent 6;4 (C.A. 5;6)</b>		

#### **Follow-up at 6;4 and 6;10 (4T)**

4T was a non-reader until 6;0, when she acquired a few sight words. At 6;2 (at the beginning of Year 1) she was receiving additional reading help at school. When reviewed at 6;4 she gained no score on a Neale-R, because she refused to attempt it. Using the Daniels and Diack Standard Reading Test (Daniels & Diack, 1977), which she found less threatening, she gained a reading age of 5.2, 14 months below age expectations. When asked why she would do the Daniels and Diack test, and not the Neale-R, 4T said it was because it had no pictures and therefore did not look like a "reading book"! Six months later, at the age of 6;10 (still in Year 1), she tackled the Neale-R, gaining age-appropriate scores for accuracy and comprehension, but a very slow reading rate. Her Daniels and Diack Reading Age had risen to 6;7.

#### **Discussion (4T)**

The way in which 4T's family co-operated with the therapy approach was very positive. They made therapy attendance and homework into part of their family routine, taking it seriously, but at the same time making it fun for 4T (and later for her sister, 11T). All homework was carried out as though it was a special treat, and they were regretful when therapy came to an end. Their response to 4T's reading difficulties was similarly sensible, with both parents taking part in the school's reading recovery programme, as tutors. In terms of their positive contribution to the therapy process, 4T's family were representative of the majority of the parents in the study.

### **6.3 Subject 10T - Case Example**

Subject 10T (see Table 28) provided another example of gradual phonological acquisition, associated with episodes of stuttering. Perhaps the most influential factor in the slowness of 10T's progress was the initial severity of his phonological disability, but added to this was the severity and persistence of his stuttering. Also of importance were the responses of he and his mother to the therapy (he loved coming, and she strongly disliked it), and the family's child-rearing style.

10T presented as a placid, gentle natured, inactive little boy, whose interests revolved around television, television "super heroes" and other cartoon characters (Power Rangers, etc). Prior to his referral for speech and language assessment, his parents had in place a system of tangible rewards for desired behaviour (usually a toy, or a meal at the Pizza Hut or McDonalds).

At first in therapy 10T was difficult to motivate with rewards such as praise and small (non-food) tokens such as stamps and stickers. Throughout the first and second therapy block, 10T's mother would bring him to appointments with the promise of a highly desired toy immediately after each and every session. Often he would actually bring the new toy with him - in its packaging - but not to be opened until he had participated in the session. This being so, he would continually mention the toy he was waiting to receive or open, and have his mind constantly on it, rather than the tasks at hand. His mother was convinced that this was the only way he could be motivated, and became very concerned if modifications to the reward system were suggested.

Homework was completed without fail, but also with an enticing toy or food reward, on view, and preoccupying 10T's thoughts throughout. Eventually, in the third therapy block, it was possible to convince 10T's mother to leave the reward food or toy in their car, for him to be given after the session.

**TABLE 28**  
**History Summary: Subject 10T**

<b>HISTORY SUMMARY</b>	<b>Details 10T (MALE) Initial Severity Rating 4.0</b>	<b>Comment</b>
Initial Consultation Age Initial Severity Index Score Initial PPVT-R SS Initial MLUm	51 months (4;3) 38 Severe Phonological Disability 97 3.64	
Consultations Treatments Assessments Duration of Therapy	42 to date (including 2 assessment + treatment consultations) 34 to date 10 to date 22 months to date	Number of Treatments after Probe = 10 to date. Probe Assessment was # 5. Interval between Initial Assessment and Probe was 11 months. Number of Months after Probe that no Deviations Present > 12
Initial Incidence Category Scores and Phonological Deviations	<u>Incidence Category 5: 80 - 100% 5 Phonological Deviations</u> Velar Fronting SIWI; Velar Fronting SFWF; De-affrication; Cluster Reduction SIWI; Cluster Reduction SFWF. <u>Incidence Category 4: 60 - 79% 2 Phonological Deviations</u> Final Consonant Deletion; Gliding of Liquids <u>Incidence Category 3: 40 - 59% 1 Phonological Deviation</u> Stopping of Affricates <u>Incidence Category 2: 20 - 39% 1 Phonological Deviation</u> Stopping of Fricatives	Sum of Deviations = 9  Phonetic Inventory: /m/, /n/, /p/, /b/, /t/, /d/, /l/, /s/, /ʃ/, /w/, /j/  Not stimulable for: /ŋ/, /k/, /g/, /v/, /z/, /ʒ/, /h/, /θ/, /ð/, /tʃ/, /dʒ/, /r/, /r/,  Intelligible utterances were rare, and only occurred in known contexts.
Accompanying Family Members	Mother 100%; siblings at 2 consultations.	Mother strongly disliked attending consultations.
Homework	Mother 85% and father 15% of homework. 1 to 1 with teacher: nil. Book to preschool < once per week.	Mother found homework a chore, but it was always done (12 sessions per week).
Therapy Blocks and Breaks	Block 1: 11 consultations; Break 1: 10 weeks. Block 2: 10 Consultations; Break 2: 6 weeks. Block 3: 1 Consultation; Break 3: 9 weeks. Block 4: 8 Consultations; Break 4: 13 weeks. Block 5: 10 Consultations; Break 5: 19 weeks. Blocks 6 & 7: pending.	Block 3 consisted of only one consultation because, unexpectedly, 10T's mother did not wish to attend in hot summer weather. Similarly, at the end of Block 5, a resumption of therapy after the hottest period of summer was requested.

Added to the situation with the reward system, was the double bind (Bateson, 1972) inherent in his mother's frequently stated dedication to helping 10T, whilst commenting at regular intervals, often in his hearing, upon how much she disliked coming to therapy and doing the

homework with him. She was troubled by a weight problem, which made getting to therapy difficult and unpleasant for her, particularly in hot, humid weather.

### Therapy Block 1 (10T)

At 4;3 inclusion of final consonants was the most obvious specific goal to tackle. With a phonotactic repertoire of V, C, CV, VC, CVC and CVCV, and only /m/, /n/, /j/ and /s/ SFWF, and a restricted phonetic inventory, he was extraordinarily difficult to understand. For example, his realisations of some of the *Metaphon* Screening Test words were as follows:

cup → [tʌ]      sharp → [sa]      glass → [da]      leaf → [ji:]      jam → [dæɪ]      sweet → [fi]  
gun → [dʌn]      fish → [fi]      watch → [wɒʃ]      house → [jʌs]      train → [seɪs]      sleeve → [fi]  
knife → [naɪ]      kiss → [ti]      yawn → [ɔ]      splash → [bæ]      crab → [sæ]      zipper → [ʃɪtʌ]

The results of the *PACS* Contrastive Assessment and the Phonological Process Analysis pointed to the need to expand his phonetic inventory and help him to include final consonants. Nasals were targeted because 10T was already including /n/ SFWF in many CVC words, and because nasals were an appropriate choice developmentally. Ingram, in 1978, found that the first final consonants to emerge in a child's repertoire were probably nasals (see also Renfrew (1966)). Comparatively speaking, 10T was quite well endowed with fricatives, but lacked the velar:alveolar contrast (/k/, /g/, /ŋ/ vs. /t/, /d/, /n/). When nasals were targeted in the first two sessions he was quickly able to produce /ŋ/, and by the third visit, was managing to produce /k/ SIWI, elicited via backward chaining and rebuses (see 2.0.4.3) using word combinations such as monkey-key, donkey-key, Blinkey-key, cranky-key, etc.); and /k/ SFWF elicited via facilitative contexts such as (1) kink, conk, plink, plonk; and ink, oink, Unc (uncle); and (2) lucky-luck, ducky-duck, yucky-yuck, etc.

There is an argument in favour of introducing fricatives before plosives in that fricatives may be the preferred order of emergence developmentally (Ingram, 1978; Grunwell, 1982b).

Because the inclusion of velar plosives was considered to be potentially powerful in improving 10T's intelligibility, however, and because he appeared to be "working" on acquiring fricatives himself without too much prompting, it was decided to bypass fricatives, and concentrate on the velar plosives.

By the eighth visit he had added /g/ to his inventory, without any direct work on it as a production target, and was using it in CV's (cow, coo, core, go, goo, guy) and CVC's with syllable final nasals (come, Coon, king, gone, gum) and final /k/ and /g/ (cook, kick, goog (/gʊg/: colloquial Australian for 'egg')). In Week 9 he was able to produce /l/, and multiple exemplar training for l-clusters SFWF was introduced (Mick vs milk, etc).

A review of his phonology at 4;5 showed that simply by expanding 10T's inventory to include all velars and /tʃ/ and /l/, and doing a lot of multiple exemplar training directed at final consonant deletion, and velar fronting; final consonant deletion had dropped from 66% to 33%, and velar fronting had reduced from 100% to 50% (SIWI, SFWF). Having targeted /tʃ/ SFWF in the course of working on final consonant inclusion, there was also a small reduction in his stopping of fricatives, from 37% to 25%.

Two months into his first therapy block 10T's Severity Rating had reduced from 4.00 to 3.00, and in terms of his Index Score of 32, was now in the Moderate Phonological Disability range. Such progress, whilst encouraging, was marred by the fact that Week 7 saw the onset of moderately severe stuttering (35 to 45% SS).

The basic goal in therapy in Weeks 7 to 11 was behavioural stuttering management. By Week 11 (aged 4;6), Subject 10T was normally fluent again. In the break from therapy 10T's parents were instructed (verbally and in writing) to reinforce clear, fluent speech at suitable opportunities, but not to revise the homework. Also included in the "instructions" for the break was a request to contact the clinician immediately if the stuttering recurred.

During the period of stuttering management it was strongly apparent that 10T's parents were far more concerned about fluency than speech clarity. 10T's father had an untreated



moderately severe stutter himself, and recounted that he had experienced teasing as a child, and discrimination in the workplace as an adult, because of it.

### **Therapy Block 2 (10T)**

When 10T's progress was reviewed at 4;9 he had maintained his phonological gains, and his Index Score had reduced slightly again to 28. Cluster reduction SFWF had dropped from 100% to 88%, stopping of fricatives from 25% to 14%, and stopping of affricates from 50% to 25%. He was stuttering severely (around 60% SS within the clinic), and had been, according to his mother, for approximately 4 weeks. They had apparently forgotten about the arrangement to contact immediately if stuttering recurred.

Stuttering therapy was re-instated, and 10T was fluent in all contexts within 4 weeks. This progress with fluency control appeared to be at the expense of his phonology, as at 4;10 his Index Score went back up to 30, and his Severity Rating to 4.00.

Also at 4;10 it was noted, particularly at pre-school, that 10T's fine and gross motor skills were below age-expectations. Referral was made for Occupational Therapy assessment. Difficulties with fine motor control, manipulating small objects, visual perceptual tasks (shape copying and drawing), and gross motor tasks were identified, and a programme of Occupational Therapy intervention recommended. The recommendation was not pursued, because 10T's mother felt overcommitted already with the speech-language pathology intervention arrangements. They did not want to reduce these, in order to attend at least some of the occupational therapy programme recommended, as they were, at this particular stage, greatly concerned about avoiding a recurrence of stuttering. They also tended to rationalise (and identify with) his gross motor difficulties as a lack of interest in physical activity.

Cluster Reduction SIWI was still 100% in evidence. Clusters SIWI were targeted, beginning with all initial // clusters and /s/+ stop combinations (/st/, /sp/ and /sk/). At the same time 10T was slowly taught to produce /h/.

A major breakthrough came at 4;11 when 10T finally added /h/ to his phonetic inventory. He was so thrilled with himself that he began, for the first time, to engage in therapy activities in an active way - monitoring his own production and expecting less tangible rewards. It made working with him much easier, now that he was not constantly distracted by thoughts of the toy that was waiting for him. Sadly, his mother's response to this change was one of disappointment. She could only see it as 10T's having lost interest in the toys, and her concern was "How do we motivate him now?" She was also experiencing difficulty dealing with 10T's obvious enjoyment of therapy, while she disliked attending so much.

During the episode of stuttering at 4;10 the regression in phonological development had involved a rise in Velar Fronting SIWI from 50%, back up to 100%. Velar:alveolar contrasts were therefore re-targeted. By 5;0 his phonology was almost exactly as it had been at 4;7, except that he was now including an occasional /h/ in his output phonology. It was decided, with his mother's complete agreement, to give 10T a short break of only 6 weeks because so much of his second therapy block had been taken up with fluency management.

### **Therapy Block 3 (10T)**

When 10T returned for assessment at nearly 5;2 he was still fluent in all contexts. His probe assessment showed his lowest Index Score (17) and Severity Rating (3.25) to date. Unexpectedly, his mother requested an extended break from therapy, so that his third block did not actually commence until he was 5;3. At the beginning of the third block he had just started Infants' school, and had an insightful and concerned teacher who initiated referral back to Occupational Therapy to assess his motor skills. Once again intervention to improve fine and gross motor functioning, was recommended by the Occupational Therapist, and not taken up by his parents - this time for fear of overloading 10T, now that he had both school and speech-language pathology to cope with.

The main specific goals in therapy in Block 3 were to target alveolar fricatives, expanding his phonemic repertoire to include /v/, extending his use of /h/ in his productive

phonology, and improving the accuracy of his production of /ɜ/, /ɪə/, /ʊə/, and /aʊə/. At the same time he was exposed to continual multiple exemplar training for consonant clusters SIWI and SFWF. He had another episode of mild stuttering, co-incident with resuming therapy (5% SS) at 5;3 which lasted for two weeks, and resolved again in response to behavioural management.

Table 29 shows a record of 10T's phonological deviations, at 5;2, 5;5, 5;8 and 5;10. At 5;2, when he had his probe assessment, he had the following phonological deviations: Deaffrication 50%, Stopping of Fricatives 7%, Stopping of Affricates 25%, Gliding of Liquids 75%, Cluster Reduction SIWI 92%, Cluster Reduction SFWF 33%.

By the end of the third block (at 5;5) Deaffrication and Stopping of Fricatives had gone, and Palato-alveolar Fronting SIWI 66% and SFWF 100% had emerged, while Stopping of Affricates had risen to 50%. The overall effect on his communicative functioning was a marked improvement in intelligibility.

**TABLE 29**  
**10T's Phonological Progress between 5;2 and 5;10**

Phonological Deviation	Percentage of Occurrence at 5;2	Percentage of Occurrence at 5;5	Percentage of Occurrence at 5;8	Percentage of Occurrence at 5;10
	%	%	%	%
Deaffrication	50	-	-	-
Stopping of Fricatives	7	-	-	-
Stopping of Affricates SIWI	25	50	50	-
Gliding of Liquids	75	50	50	25
Cluster Reduction SIWI	92	64	78	43
Cluster Reduction SFWF	33	33	-	-
Palato-alveolar Fronting SIWI	-	66	16	33
Palato-alveolar Fronting SFWF	-	100	-	-

Children with difficulties acquiring the target vowel system are less prevalent than those with phonological disabilities affecting only consonants (Gibbon & Shockey, 1992), and some would say that the failure of phonological assessment procedures to include vowel evaluations routinely is a serious oversight (e.g., Butcher, 1989). Vowel development and disorders have featured in recent research (e.g., Reynolds, 1990; Stoel-Gammon & Herrington, 1990; Pollock & Keiser, 1990; Pollock & Hall, 1991; Gibbon, Shockey & Reid, 1992; Penney, Fee & Dowdle, 1994). Interestingly, as his intelligibility improved, 10T's vowel mismatches became more observable, particularly the difficulty he had with /ɜ/, /ɪə/, /ʊə/, and /aʊə/; for example, at 5;5 just prior to another break, during which his family were to concentrate on modelling consonant clusters, and correcting vowel mismatches, the following pronunciations were recorded:

/ɜ/	/ɪə/	/ʊə/	/aʊə/
bird → [bɒd]	real → [ri'wɔɪ]	tour → ['tuɪə]	power → ['paʊə]
purple → ['pɒpl]	peel → [pi'wɔɪ]	sewer → ['suɪə]	our → ['aʊə]
turtle → ['tɒtɔw]	lan → [i'wɔn]	cure → ['kjulə]	shower → ['ʃaʊə]

#### Therapy Block 4 (10T)

Three months later, at 5;8, 10T's speech was clearer than it had ever been at normal speech rates. When conscious of being assessed, he was able to maintain excellent control of his output phonology. Indeed, in a single word picture naming task using the *Metaphon* screening words, only 14 out of 44 failed to conform to the adult target, as follows:

sharp → [sap]	watch → [wɔʃ]	mouth → [maʊf]	sweet → [fwik]
yawn → [wɔn]	thumb → [flʌm]	snake → [sə'neɪk]	crab → [kə'ræb]
fast → [fats]	path → [paf]	smoke → [soʊk]	
bridge → [brɪʒ]	train → [t'reɪn]	splash → [blæʃ]	

The above sample was in contrast to what happened to 10T's phonology, in terms of variability and intelligibility, when he was talking spontaneously, and unaware of being "assessed", especially when he attempted to pronounce words beyond a single syllable level. Productions 1 and 2, below, were spontaneous pronunciations during the same conversation, and production 3 occurred when the words were presented to 10T as a single word naming task in which he knew he was being assessed (✓ = a match with the adult target).

TARGET WORD	(SPONTANEOUS) PRODUCTION 1	(SPONTANEOUS) PRODUCTION 2	("CONSCIOUS") PRODUCTION 3
bicycle	[ˈbazuːkəl]	[ˈpasɪtsul]	✓
argument	[ˈandəˈmɛnt]	[ˈanumˈnɛt]	✓
vacuum cleaner	[ˈbæpjumtɪnə]	[ˈvætumtɪnjə]	✓
rhinoceros	[waɪˈnɒʔjəˈwɛs]	[waˈnɒjɪˈwɛs]	[waɪˈnɒsˈwɛs]
measuring	[ˈmɛzəʊɪŋ]	[ˈmɛzəʊɪŋ]	✓
barbecue	[ˈbadeku]	[ˈbadɪgju]	✓
kangaroo	[kæŋˈju]	[kæŋəˈju]	✓
butterfly	[ˈbʌʔwəfaɪ]	[ˈbʌtəfaɪ]	[ˈbʌtəfaɪ]
pineapple	[ˈpaɪˈæːpɔl]	[ˈpaɪŋæbɔ]	[ˈpaɪˈæːpɔl]
sunflower	[ˈsʌnˈfale]	[ˈsʌnˈfawə]	[ˈsʌnˈfawə]
volcano	[bɒŋˈkeɪnɒʊ]	[vɒlˈdeɪnɒʊ]	✓
champion	[ˈtæmpənən]	[ˈtʃæntʃəʔjə]	✓
paintbrush	[ˈpeɪnbwʌs]	[ˈpeɪnbʌʃ]	[ˈpeɪntbwaʃ]

It was noted that most of the vowel deviations that were still occurring at 5;5 were gone by 5;8, though he still regularly realised /aɪ/ as /a/ (e.g., bicycle → [ˈbazuːkəl]). From 5;8 to 5;10 10T maintained his fluency, and all therapy was focussed on his phonology, particularly communicative effectiveness, self-monitoring and self-correcting.

Polysyllabic words and nasals SFWF were targeted (in view of realisations such as Jim → [dʒɪn]; uniform → [ˈjunəfɒn]. Progress was steady and encouraging for 10T and for his mother. By 5;10 his Index Score was 7.

At the conclusion of 10T's fourth therapy block, his mother again requested a longer break from therapy than the 10 or so weeks originally planned, and arrangements were made to review progress when 10T was aged 6;1. Two therapy blocks were scheduled to run from ages 6;2 to 6;6 and 6;9 to 6;11. 10T's parents were delighted with his progress with his phonology, but were still worried that stuttering might recur. His progress to date is displayed in Table 30.

**TABLE 30**  
**10T's Progress in Therapy**  
 (Probe Assessment for the Between Groups Study was his 5th Assessment at 6;2)  
 (n/a = not available)

Age	Incidence Category 80-100%	Incidence Category 60-79%	Incidence Category 3 40-59%	Incidence Category 2 20-39%	Incidence Category 1 ≤ 19%	Sum of Devs	Severity Index Score	Descriptive Incidence Category	Severity Rating
4;3	6	2	1	1	-	9	38	Severe	4.00
4;5	3	1	3	2	-	9	32	Moderate	3.00
4;9	2	2	1	3	1	9	28	Moderate	3.75
4;10	3	2	1	1	2	9	30	Moderate	4.00
5;0	2	2	1	3	1	9	28	Moderate	3.75
5;2	1	1	1	2	1	6	17	Moderate	3.25
5;6	1	2	-	3	-	6	19	Moderate	n/a
5;8	-	1	2	-	1	4	11	Mild	n/a
6;10	-	-	1	2	-	3	07	Mild	n/a
6;1	-	-	-	1	2	3	03	Mild	n/a

#### Assessment at 6;1 (10T)

When 10T returned for assessment at 6;1 he had just finished his first year at school. At 5;3 he had been identified as requiring additional help with his pre-reading skills. At 5;11 he had 4 sight words. At 6;1 his Reading Age was 5;3 and he was to have additional help with reading at

school the following semester. It was good to find that 10T was very keen on the idea of reading, and was eager to display his prowess.

In terms of phonological deviations, the progress he had made is displayed in Table 31. This time, however, phonological progress seemed to be at the expense of fluency control, as 10T was stuttering mildly again (7% SS). Therefore the arrangements to see him again for therapy, for phonology and fluency, the following year (in the cool months) were confirmed.

**TABLE 31**  
**10T's Phonological Progress between 5;10 and 6;1**

Phonological Deviation	Percentage of Occurrence at 5;10 %	Percentage of Occurrence at 6;1 %
Gliding of Liquids	25	20
Cluster Reduction SIWI	43	15
Palato-alveolar Fronting SIWI	33	15

### Discussion (10T)

A disappointing aspect of 10T's management was the failure on the author's part to communicate to the parents the desirability of his attending therapy according to the recommended frequency. It was felt that had his therapy attendance been according to the original arrangements then his problems with phonology (and possibly fluency) might not have persisted for so long. However, as clinical experience constantly shows, for many reasons, not everyone will comply with recommended management plans. In terms of the overall study, it was unfortunate that the parents of the most severely involved child in the treatment group were the least compliant. It was heartening, however, that at his last assessment for the year it was clear that 10T was showing considerable progress.

## 6.4 Subject 12T - Case Example

12T (see Table 32 for a history summary) was a bright, sensitive, interested, conforming and conscientious four year old. Her father had left the family home one day before 12T's initial assessment. She, her mother and elder sibling were in distress. It was suggested that it might be advisable to defer therapy until the family had time to adjust to this profound change in circumstances, but 12T's mother felt *she* (the mother) would be more anxious if she did not proceed immediately.

**TABLE 32**  
**History Summary: Subject 12T**

HISTORY SUMMARY	Details 12T (FEMALE) Initial Severity Rating 3.75	Comment
Initial Consultation Age	53 months (4;5)	
Initial Severity Index Score	29 Moderate Phonological Disability	
Initial PPVT-R SS	113	
Initial MLUm	4.8	
Consultations	23	Number of Treatments after Probe = 0.  12T and mother enjoyed the therapy sessions.
Treatments	18	
Assessments	5	
Duration of Therapy	10 months	
Initial Incidence Category Scores and Phonological Deviations	<u>Incidence Category 5: 80 - 100% 4 Phonological Deviations</u> Velar Fronting; Palato-alveolar Fronting; Cluster Reduction SIWI; Gliding of Fricatives SIWI  <u>Incidence Category 4: 60 - 79% 1 Phonological Deviation</u> Cluster reduction SFWF  <u>Incidence Category 3: 40 - 59% 1 Phonological Deviation</u> Gliding of Liquids  <u>Incidence Category 2: 20 - 39% 1 Phonological Deviation</u> Stopping of Fricatives SFWF	Sum of Deviations = 7  Phonetic Inventory: WNL
Accompanying Family Members	Mother accompanied 12T to 100% of consultations. Sibling attended one treatment consultation.	
Homework	100% with mother. 1 to 1 with teacher: nil. Speech book to pre-school once per week.	Mother kept very good homework records. 24 homework sessions per week.
Therapy Blocks and Breaks	Block 1: 11 Consultations. Break 1: 8 weeks.  Block 2: 11 Consultations. Break 2: 10 weeks.  Block 3: 1 Consultation.	



At the initial consultation 12T was unintelligible to the author beyond a single word level, mainly due to her gliding of fricatives and inconsistent vowel deviations\*. Her pronunciation of some of the *Metaphon* screening words was as follows:

cup → [ʌp]	gun → [gʌn]	knife → [nɔɪs*]	sharp → [jap]
fish → [jɪts]	kiss → [tɪθ]	sock → [j ɒk]	thumb → [jam]
jam → [djæm]	tent → [tɪnt]	sun → [jʌn]	fly → [wɔ*]
sky → [dɔ*]	crab → [wæp]	sleeve → [jiz]	zip → [jɪp]
plane → [weɪn]	bridge → [dɪɪdz]	train → [dəweɪn]	splash → [gwæs]
salt → [joot]	van → [dæɪn]	foot → [jɔt]	stairs → [dɛd]
mouth → [maot]	scissors → [ʔɪɪdɪd]	bathing → [ˈbatɪn]	river → [ˈwɪdʌ]
soldier → [ʔooɔɔʒʌ]	umbrella → [ʌmɛˈwaɪʒʌ*]		

Both 12T and her mother enjoyed coming to therapy. All homework was done exactly as suggested, except for occasional production practice of bombardment words, and 12T's mother kept a precise record of what they did at home.

Emotional factors were prominent in 12T's presentation and management, and over the time she was in therapy she became increasingly demanding of her mother's attention. She was self conscious about her speech and had been teased by her sibling, and her sibling's friends. She was embarrassed at times in therapy by her difficulties with auditory discrimination, and was not tolerant of homonym confrontation activities.

### **Therapy Block 1 (12T)**

12T's first therapy block began when she was 4;5, and ended when she was 4;8. Discussing aetiology and emphasising to 12T's mother that phonological disability was nobody's

"fault" (particularly that it was not attributable to the marriage breakdown) was an important first step in therapeutic management.

The first targets were velars and liquids. Initially, 12T was unable to distinguish auditorily between /l/ and /j/ beyond a single phoneme level, but she could distinguish between consonant clusters and singletons. Therefore, she was exposed to multiple exemplar training involving /kl/ and /gl/ clusters (cap:clap, keen:clean, core:claw, go:glow, gum:glum, etc).

When she was able to sort minimal contrasts such as these into rhyming pairs, the task was changed to a judgement of correctness game, in which she had to "be the teacher" and judge whether the (by now familiar) words were being produced correctly by the adult working with her (e.g., clap = [klæp] or [kjæp]). In this way 12T learned to recognise the /l/ and /j/ contrast in words, and after three weeks could sort words such as lawn:yawn, lucky:yucky, and lap:yap.

At first, 12T was also unable to distinguish auditorily between fricatives beyond phoneme level. For example, she was unable to select between fine; shine; sign but after three weeks of multiple exemplar training could recognise the presence of absence of fricatives SIWI (e.g., eat:seat, eat:feet; eat:sheet).

In week four it was observed that 12T was using Velars SIWI correctly between 85% and 100%, and that /kl/ and /gl/ SIWI were being used correctly approximately 35% of the time. At this point /s/ vs /l/ and /s/ vs /j/ SIWI contrasts were introduced. For the next two weeks, therapy was entirely concerned with talking about revisions and repairs.

In week seven the first production task was introduced in the form of 7 words starting with /l/ (leap, low, lap, lip, lamb, leave and lime). In week eight these words were paired with sleep, slow, slap, slip, slam, sleeve and slime for conceptual (multiple exemplar training) tasks only. In week nine she was given 25 words with intervocalic /l/ for production practice. By this stage 12T really recognised an /l/ when she heard one!

In the final two weeks of the therapy block, multiple exemplar training using /s/ vs /s/, /f/ vs /f/ SIWI was introduced. 12T suddenly acquired the ability to produce fricative + /l/ SIWI, and was soon using it correctly all the time.

There was a concurrent improvement in her other consonant clusters. Cluster Reduction SIWI went from 100% at 4;5, to 64% at 4;8, while Cluster Reduction SFWF dropped from 66% to 33%. Palato-alveolar Fronting went from 100% to 33% in the same period.

As Table 31 shows, Gliding of Fricative SIWI increased from 87% to 100%, and Stopping of Fricatives rose from 33% to 83%, representing a reduction in the variability of 12T's phonology. At the end of 11 weeks, 12T had eight weeks break from therapy. During the break, the only follow-up suggested was to praise 12T for making spontaneous revisions and repairs.

### **Therapy Block 2 (12T)**

When 12T resumed at the age of 4;10, Palato-alveolar fronting SFWF had reduced to zero, and Cluster Reduction SIWI had gone from 64% to 35%. Gliding of Liquids, which had gone from 50% to zero in the first therapy block, had gone back up to 25%. Gliding of Fricatives SIWI was once again at the 87% level, while Stopping of Fricatives SFWF was still on 83%.

After two weeks of multiple exemplar training for all fricatives SIWI, 12T was able to produce /j/ SIWI in words. The following week she was using initial /j/ in around 40% of appropriate contexts, and self correcting constantly. In week four she acquired the ability to produce /s/ and /f/ followed by a vowel, without an intervening /j/ (previously she had been producing, for example, seed → [sjid], feed → [fjid], and she'd → [ʃjid]).

The stop vs fricative contrast SFWF was the final contrast to be targeted directly, in weeks 5 to 10. The emphasis was upon multiple exemplar training, and no production practice was involved. Parts of all sessions were audiotaped and sent home for 12T to listen to as frequently as she wished. Her mother reported that 12T listened to the tapes, voluntarily, at least once daily. Sending tapes of segments of therapy home for the children to listen to was

commonly practised with all of the treatment children, but not frequently enough for them to become bored with them. In general, the children enjoyed listening to their recordings, and the parents also found them helpful in terms of modelling. 12T was the only child in the study keen enough on the tapes to warrant making one for her at each consultation.

By the concluding session in the second block, at the age of 5;0, the only phonological deviation present was Stopping of Fricatives SFWF 50%. She took a three months scheduled break, during which her mother was to praise correct use of syllable final fricatives when they occurred spontaneously, and comment favourably on any revisions and repairs she noticed. Her phonological development between the ages of 4;5 and 5;3 is shown in Table 33.

**TABLE 33**  
**12T's Phonological Development between 4;5 and 5;3**

Phonological Deviation	% Occurrence Age 4;5	% Occurrence Age 4;8	% Occurrence Age 4;10	% Occurrence Age 5;0	% Occurrence Age 5;3
Velar Fronting	100	0	0	0	0
Palato-alveolar Fronting SFWF	100	33	0	0	0
Gliding of Fricatives SIWI	87	100	87	0	0
Gliding of Liquids	50	0	25	0	0
Cluster Reduction SIWI	100	64	35	0	0
Cluster Reduction SFWF	66	33	33	0	0
Stopping of Fricatives SFWF	33	83	83	50	0

### Therapy Block 3 (12T)

When 12T returned for review at 5;3 there were no phonological deviations present in her speech. She made occasional /θ/ → [f] and /r/ → [w] replacements, which she usually self corrected. Her progress in therapy is shown in Table 34.

**TABLE 34**  
**12T's Progress in Therapy**

Age	Incidence Category 5 80-100%	Incidence Category 4 60-79%	Incidence Category 3 40-59%	Incidence Category 2 20-39%	Incidence Category 1 ≤ 19%	Sum of Devs	Severity Index Score	Descriptive Incidence Category	Severity Rating
4;5	4	1	1	1	-	7	29	Moderate	3.75
4;8	2	1	-	2	-	5	18	Moderate	3.25
4;10	2	-	-	3	-	5	16	Mild	3.25
5;0	-	-	1	-	-	1	03	Mild	1.75
5;3	-	-	-	-	-	0	0	Normal	1.00

### Follow-up at 5;11 (12T)

When followed up in her first year at school it was found that 12T was one of the more able students in her class, and that reading acquisition was well advanced. At 6;1, when she was tested using a Neale Analysis of Reading - Revised, her results (in years) were as follows: Rate 7.6; Accuracy 8.2; Comprehension 8.0.

### Discussion (12T)

Having said that 12T provided an example of "pure" phonological disability in relation to her linguistic skills overall, it is necessary to point out that while there were no complicating linguistic factors in her presentation and therapeutic management, there were many emotional factors constantly in play. In this sense, she was representative of the entire treatment group. As illustrated by the case studies, in each of the 14 cases, there was *something* going on in the child's linguistic, social, emotional or "developmental" environment which impinged upon management and progress.

12T's literacy skills acquisition was particularly fascinating. Because of her extreme difficulty in the early stages of therapy in reliably telling two phonemes apart, it seemed logical to expect that she might have difficulties with early reading acquisition. However, she learned to read early, and without difficulty and was regarded by her teacher as a superior reader and speller, exemplifying findings in the reading research literature that children with developmental phonological disorders often went on to become good readers and spellers (Levi, Capozzi, Fabrizi & Sechi, 1982; Bishop & Adams, 1990). It would be very interesting to know why.

## **6.5 Subject 9T - Illustrative Example of Aspects of Target Selection**

As described in section 3.0, and exemplified in the preceding case examples, target selection in the current therapy approach was based upon linguistic criteria, taking motivational factors into account. In the current efficacy study, the difference made by having a matched group design, instead of using the control process approach, was that an unambiguous basic goal to facilitate normal phonological patterns was possible. Therapy could proceed in the research setting as it was normally intended in the routine clinical setting. It did not have to be modified to accommodate the experimental design.

By contrast, in the (first) *Metaphon* efficacy study (Hill, Howell & Waters, 1988), the experimenters were constrained by their decision to choose processes occurring at or near the 100% level for both intervention and control. Thus target selection was based on neither linguistic nor psychological criteria, but on the nature of the experimental design employed. Unfortunately the *Metaphon* team did not indicate the incidence of occurrence of processes at or near 100% for each of the children in their study.

Preliminary findings of a second *Metaphon* study were reported by Waters, Reid, Dean and Howell (1995). The study, which is proceeding at the time of writing, involves approximately 100 children with phonological disability in the 3;6 to 5;6 age range, in an independent subjects

design with subjects allocated randomly to one of four conditions: Experimental Group (1) will receive 6 sessions of Phase 1 *Metaphon* therapy; Experimental Group (2) will receive 10 sessions, including Phase 1 and Phase 2 work; Control Group (3) will remain untreated for 6 weeks, controlling for Group (1); and, Control Group (4) - will remain untreated for 10 weeks, controlling for Group (2). In both experimental groups only one process is being targeted and groups (3) and (4) will have therapy as soon as their 6 or 10 weeks control period has elapsed.

Returning to the current study, the author could follow each child's lead in implementing the approach, without having to constantly "work around" a phonological contrast that was meant to be left untreated for the purpose of experimental control. Further, there was no restriction upon which contrasts to target. 9T's therapy (see Table 35 for a history summary, and Table 36 for his progress in therapy in terms of his Incidence Category scores) provides an example of this flexibility, and a rationale for an approach that takes into consideration psychological (i.e., motivational) criteria, as well as linguistic criteria.

9T presented at 4;1 as a very willing participant in therapy with an Initial Severity Index Score of 30 (Moderate Phonological Disability). Initially he had five phonological deviations in Category 5: 80-100%, all at the 100% level, and including Stopping of Fricative SIWI, one in Category 3: 40-59% and one in Category 2: 20-39%, which was Stopping of Fricatives SFWF (see Table 37). At the outset, 9T's phonetic inventory lacked /v/, /j/, /z/, /θ/, and /ð/ (as well as /tʃ/, /dʒ/, /l/, and /r/).

In order to take advantage of his high level of enthusiasm, and to encourage 9T, by facilitating early success, his initial therapy goal was inventory expansion for the absent fricatives, and establishing /j/ SFWF (noting again that Stopping of Fricatives was 33% present). Probably as a consequence of this manoeuvre, 8 weeks later, at 4;3, Stopping of Fricatives was no longer present, and the stop:fricative contrast, which had only been targeted word-finally, had generalised to all word positions. His production of /j/ and /z/ matched the adult targets.

**TABLE 35**  
**History Summary: Subject 9T**

<b>HISTORY SUMMARY</b>	<b>Details 9T (MALE) Initial Severity Rating 3.50</b>	<b>Comment</b>
Initial Consultation Age	49 months (4;1)	Moderate Phonological Disability.  9T enjoyed therapy and the 1 to 1 attention of homework.
Initial Severity Index Score	30	
Initial PPVT-R SS	91	
Initial MLU <sub>m</sub>	4.30	
Consultations	22	Number of Treatments after Probe = 0
Treatments	18	
Assessments	4	
Duration of Therapy	9 months	
Initial Incidence Category Scores and Specific Phonological Deviations	<p><u>Category 5: 80 - 100% 5 Phonological Deviations</u></p> <p>Velar Fronting SIWI; Stopping of Fricatives SIWI; Stopping of Affricates; Cluster Redaction SIWI; Cluster Reduction SFWF</p> <p><u>Category 3: 40 - 59% 1 Phonological Deviation</u></p> <p>Glding of Liquids</p> <p><u>Category 2: 20 - 39% 1 Phonological Deviation</u></p> <p>Stopping of Fricatives SFWF</p>	<p>Sum of Deviations = 7</p> <p>Phonetic Inventory:</p> <p>/m/, /n/, /ŋ/, /p/, /b/, /t/, /d/, /k/, /g/, /f/, /s/, /z/, /h/, /w/, /j/</p> <p>Not stimuable for:</p> <p>/v/, /ʃ/, /ʒ/, /θ/, /ð/, /tʃ/, /dʒ/, /r/, /r/.</p>
Accompanying Family Members	Mother accompanied 9T to all consultations. Siblings were present at 21/22.	
Homework	All homework was with mother. 1 to 1 with teacher once per week. Speech book to preschool once per week.	12 homework sessions per week.
Therapy Blocks and Breaks	<p>Block 1: 11 Consultations. Break 1: 10 weeks.</p> <p>Block 2: 9 Consultations. Break 2: 10 weeks.</p> <p>Block 3: 2 Consultations.</p>	

**TABLE 36**  
**9T's Progress in Therapy**

<b>Age</b>	<b>Incidence Category 6 80-100%</b>	<b>Incidence Category 4 60-79%</b>	<b>Incidence Category 3 40-59%</b>	<b>Incidence Category 2 20-39%</b>	<b>Incidence Category 1 ≤ 19%</b>	<b>Sum of Dev's</b>	<b>Severity Index Score</b>	<b>Descriptive Category</b>	<b>Severity Rating</b>
4;1	5	-	1	1	-	7	30	Moderate	3.50
4;3	1	2	-	4	-	7	21	Moderate	2.50
4;6	1	-	-	5	1	7	16	Mild	2.25
4;8	-	2	-	1	-	3	10	Mild	2.00
4;10	-	-	-	1	-	1	02	Very Mild	1.00



Characteristically of many phonologically disordered children, 9T's phonological improvement happened via sequences of apparent progress followed by apparent regressions (shades of little Hildegard [Leopold, 1947] see 1.3.6.1.4). His production of /ʃ/ and /ʒ/ apparently regressed, and a new deviation Palato-alveolar Fronting SIWI 100%, SFWF 66% appeared (see also Stopping of Affricates in Table 37).

TABLE 37  
9T's Phonological Progress

Age Phonological Deviation	4;1 %	4;3 %	4;6 %	4;8 %	4;10 Probe %
Velar Fronting SIWI	100	0	33	0	0
Stopping of Fricatives SIWI	100	0	33	0	0
Stopping of Fricatives SFWF	33	0	0	0	0
Stopping of Affricates	100	25	100	0	0
Liquid Simplification	50	25	25	25	25
Cluster Reduction SIWI	100	28	14	0	0
Cluster Reduction SFWF	100	33	0	0	0
Palato-Alveolar Fronting SIWI		100	33	66	0
Palato-Alveolar Fronting SFWF		66	33	66	0

It is interesting to speculate what might have occurred phonologically if two of 9T's five 100% deviations had been chosen as the basis for intervention at 4;1, with one of the other 100% deviations being left untreated for the purpose of control, as in the first *Metaphon* efficacy study. On the other hand, if he was included, say in Group (2) in the second *Metaphon* study, and affricates were targeted and reduced to 25% after 10 weeks, would it be assumed that because his incidence score had dropped below 50% (the *Metaphon* cut-off point for targeting a contrast) that stop:affricate contrasts required no further intervention?

It seems doubtful that the 6 or 10 weeks proposed in the second *Metaphon* study (Waters, Reid, Dean & Howell, 1995) will be a long enough period to be certain that apparent improvements are stable. It is suggested that the children's progress in the second *Metaphon* study (and their further therapy), may need to be tracked longitudinally to see what happens to apparently successfully treated contrasts beyond 6 or 10 weeks.

## **CHAPTER 7**

### **GENERAL DISCUSSION AND CONCLUSIONS**

#### **7.0 Recapitulation**

In this study, 14 randomly selected pre-schoolers, aged 2;10 to 4;9 at the outset, with phonological development significantly below age expectations, were treated with a phonological therapy, and their progress in acquiring the target system compared with that of a matched control group of 8 children who did not receive treatment. Diagnoses of developmental phonological disorder were confirmed for each of the children, and the severity of their disorders rated, at intervals, by four independent and experienced speech-language pathologists. A Severity Index (with 5 descriptive categories: Normal Phonology, and Very Mild, Mild, Moderate and Severe Phonological Disability), which correlated highly with the four clinicians' severity ratings, was developed, and used in displaying the results of the therapy efficacy study.

The therapy model comprised: family education; metalinguistic tasks involving aspects of linguistic awareness and phonological processing; traditional phonetic production procedures; multiple exemplar techniques including minimal contrast and auditory bombardment activities; and homework. Recognising the gradual nature of phonological acquisition in normal development, and allowing the children to progress at a comfortable rate, the therapy was administered in an attendance schedule of alternating therapy blocks and breaks from therapy, each of approximately 10 weeks duration. The active, cognitive participation of the children in the therapy, and the importance of the role of parents in administering it, were emphasised throughout.

One of the 13 treatment group children who completed therapy presented originally with a Mild phonological disability (in the Index Score range 7 to 16), and the other 12 were in the Moderate range (Index Score range 17 to 34). 10T, whose therapy continues at the time of writing was the only child in the treatment group whose phonological disability was in the Severe category (Index Score range 35+). His data were excluded from most of the statistical analysis because his therapy participation, after probe, did not meet the required attendance criteria, rendering them unsuitable for comparison. Initially in the control group, one child's phonological disability was in the Mild range, six were in the Moderate range, and one was in the Severe range. The interval between the initial and probe assessments for the treated children ranged from 3 to 12 months ( $\bar{x}$  = 9 months). The interval between the control children's initial assessment and final re-assessment (i.e., probe) ranged from 5 to 11 months ( $\bar{x}$  = 8.6 months).

The parents of 13 of the 14 treated children complied with all aspects of the therapy protocol, and these thirteen children achieved age-appropriate phonology. The phonological patterns of seven of the 13 were normal within 3 to 10 months of initial assessment ( $\bar{x}$  = 7.4 months). The remaining five children had normal phonology within 12 to 19 months ( $\bar{x}$  = 15.8 months). In the "faster" group, the number of 50 minute consultations the children had ranged from 10 to 23 ( $\bar{x}$  = 16 consultations). In the "slower" group, the children had from 22 to 36 consultations before their phonology was age-appropriate ( $\bar{x}$  = 33 consultations). Overall, the thirteen children averaged 10.6 months of therapy, and 21 consultations.

At the probe assessment, the fourteen treated children showed accelerated improvement in their phonological patterns, compared with the untreated eight, who did not. Analysis of Variance of the initial and probe Severity Ratings of the groups showed highly significant selective progress in the treated children only ( $F(1,20) = 21.22$ ,  $p < .01$ ). Receptive vocabulary and MLUm showed non-significant between group changes, reflecting the specific effect of the therapy. The initial severity of the children's phonological disabilities was the sole predictor of the frequency and duration of consultations required for their speech patterns to fall within the normal range.

## **7.1 The Main Findings in Relation to Previous Research**

Previous individual case studies and efficacy studies involving group designs have made an important contribution to our understanding of the clinical management of developmental phonological disorders. Individual case examples, and detailed case studies (e.g., Blache, Parsons & Humphreys, 1981; Gibbon, Shockey & Reid, 1992; Grunwell, 1989; Grunwell, March & Russell, 1990; Grunwell & Russell, 1990; Grunwell, Yavas, Russell & LeMaistre, 1988; Jarvis, 1988; Leahy & Dodd, 1995; McLeod & Isaac, 1995; Penney, Fee & Dowdle, 1994; Stone & Stoel-Gammon, 1990; Weiner, 1981a; and Williams, 1993) have provided practising clinicians with theoretically principled guidance.

### ***7.1.1 Issues in Comparing Phonological Therapy Approaches***

There were no examples of phonological intervention efficacy studies using a control group found in the literature, except for the second *Metaphon* study which is proceeding currently (Waters, Reid, Dean & Howell, 1995). There were a few studies involving groups of two or more children. Four of them, outlined in Chapter 2 (Hill, Howell, Waters & Dean, 1989; Hodson & Paden, 1983; Monahan, 1984a; and Young, 1987) were varied in terms of their theoretical bases to assessment and therapy; and methodologically, including in terms of experimental design (or lack of), so that it was not possible to make direct comparisons.

It was clear from the four representative studies that, as had occurred with the term 'traditional therapy', 'phonological therapy' meant different things to different practitioners. Consequently, it was difficult to evaluate the relative merits of previous intervention approaches incorporating phonological principles. To reduce the probability of adding to this (possibly unavoidable) difficulty, care was taken, in Chapter 3, to explain the theoretical basis and rationale for each aspect of the model, to define in detail what was meant by the current interpretation of the term phonological therapy, and to delineate which aspects of the model could be considered phonological and which could not.

Briefly, the theoretical position adopted here was that a phonological therapy approach aims to facilitate age-appropriate phonological patterns through activities that encourage and nurture the development of the appropriate cognitive organisation of the child's underlying phonological system. The phonological procedures and activities were: minimal contrasts therapy, certain metalinguistic tasks (e.g., phoneme segmentation, awareness of rhymes, lexical knowledge, awareness of phoneme-grapheme correspondences, homophony confrontation, lexical and grammatical innovations), and auditory bombardment. The procedures and activities related to phonological development, and integral to the model, but not in themselves phonological, were phonetic production training (e.g., phonemic placement techniques), the blocks-and-breaks scheduling of consultations, parent participation, and homework.

### ***7.1.2 Issues in Comparing Phonological Therapy Studies***

In the few phonological intervention studies involving groups of *treated* children, the researchers either did not endeavour to achieve experimental control (Hodson & Paden, 1983; Monahan, 1986), or attempted it by using single subject designs, and having an untreated "control process" (Howell & Dean, 1991; Young, 1987). A lack of progress in the untreated process would indicate the specificity of the treatment effect upon the process being targeted. Reporting their results, and expressing similar scruples to those of Hodson and Paden (1983, see 2.4.1), Howell and Dean (1991) justified their choice of a single case design in which each child acted as his or her own control, as follows:

*As the children involved in the study had all been judged to require speech therapy the design of our investigation was constrained to some extent. We felt we could not, for example, deliberately withhold treatment from any of the children in order to compare the progress of a treated and an untreated group. (p. 97)*

Young (1987) had adopted the same experimental approach, conducting single case studies using a multiple baseline across behaviours design (Kazdin, 1982) to study the progress of two children (see 2.4.3).

There were thirteen children in the *Metaphon* efficacy study (Howell & Dean, 1991, see 2.4.4), out of an original sample of 15 (whose progress was reported in Hill, Howell & Waters, 1988; and also in Hill, Howell, Waters & Dean, 1989). Why two children's data were excluded from the final reporting of the efficacy study (Howell & Dean, 1991) was not apparent from the *Metaphon* team's published work. The treated children in the *Metaphon* study attended on average 22.5 weeks (range 11 to 34), and progress was determined by measuring "*the number of processes operating in the child's speech*" (p. 100, this author's underlining here and in the following paragraph) pre- and post-treatment (see Table 38, which comprises the current author's summary of the subject data and results reported by Howell and Dean, 1991).

**TABLE 38**  
Summary of the *Metaphon* Efficacy Study Results

(1) Subject	(2) CA	(3) Gender	(4) Weeks of Treatment	(5) Number of 30 minute Sessions	(6) Pre- treatment Sum of Processes	(7) Post Treatment Sum of Processes
1	3;7	F	18	16	6	1
2	3;8	M	21	15	8	3
3	3;8	M	31	20	6	5
4	3;8	M	18	14	7	1
5	3;8	M	19	18	5	2
6	4;0	F	19	13	8	0
7	4;1	F	19	17	4	2
8	4;1	M	24	20	10	5
9	4;2	M	25	19	8	4
10	4;4	M	25	18	4	1
11	4;4	M	25	19	6	2
12	4;5	M	34	25	8	4
13	4;7	M	11	13	6	2
<b>MEAN</b>	<b>4;1</b>		<b>22.5</b>	<b>17.4</b>	<b>6.7</b>	<b>2.5</b>
<b>RANGE</b>	<b>3;7 to 4;7</b>		<b>11 to 34</b>	<b>13 to 25</b>	<b>4 to 10</b>	<b>0 to 5</b>

For each child, two processes were targeted, and one process served as a control (Howell & Dean, 1991). Operational criteria for treatment and control processes were not specified, except that they were "*normally those operating at 100% occurrence levels*" (p. 98). In a later explanation of the study (Dean, Howell, Waters & Reid, 1995), it was reported that the three processes selected "*were at, or near 100%*" (p. 7), and that "*Decisions about the allocation of the processes to different conditions (first/second treated and control) were made on clinical grounds*" (p. 7). These clinical grounds were not defined or elaborated.

In neither the Young (1987) study nor the *Metaphon* study (Hill, Howell, Waters & Dean, 1989) was the control process treated. In commenting on the *Metaphon* research methodology, Miccio (1995) pointed out flaws in the *Metaphon* efficacy study design, one of which related to the failure to treat the control process. In a multiple baseline across behaviours design (which the *Metaphon* team claimed they were using) each behaviour is treated in sequence to show that treating one behaviour does not influence untreated (control) behaviours. The same treatment is then applied to the control behaviour in order to demonstrate that it will evoke the same changes in a behaviour that remained at baseline during earlier training. This replication of treatment effects indicates that the changes observed are attributable to the treatment (Kazdin, 1982; McReynolds & Keams, 1983).

In the *Metaphon* study of the original 15 children (Hill, Howell, Waters & Dean, 1989) two processes were treated, but the third (control) process was not, so that it is not known whether the treatment would have been effective on that behaviour also. Discussing the same study, Howell and Dean (1991) reported phonological change in each of their (13) subjects pre-and post therapy, but the clinical outcomes were such that the performance of only five of the thirteen subjects lent support to their hypothesis that *Metaphon* would effect therapy specific changes. Young (1981) reported therapy specific changes for her 2 subjects in the two processes targetted, but did not report treatment of the third (control) process, which remained at baseline level throughout treatment. Hodson and Paden (1983) and Monahan (1986) claimed therapy specific changes, but as discussed in section 2.4, did not attempt to provide empirical support for such claims.

### **7.1.3 The Unique Contribution the Control Group**

Engaging a control group distinguished the current study from previous ones in two crucial respects. The first issue involved the effect of intervening clinically in phonological disorders in general, and the second issue was related to the specific nature of the intervention.



### 7.1.3.1 The General Effect of Intervention

As we have seen in the current study, comparison of the phonological progress of the treated and untreated children indicated that the therapy accelerated phonological development beyond the progress expected with age, thus providing a much needed answer to a frequently posed question about the validity of intervening at all.

Having a clear-cut answer to the question of whether phonological intervention makes a positive difference to developing phonological patterns is of abiding interest to the parents of phonologically disabled children, the clinical practitioners working with them, and linguistics theorists. Quite simply, the study showed that phonological therapy was better than no therapy. This was the first way in which the experimental design with an untreated control group differentiated the efficacy study from previous ones.

### 7.1.3.2 Facilitating Age-Appropriate Phonology

The design also differentiated the study from its predecessors with respect to the treatment goals set for the period of the experiment. The *between* group study had addressed the important question of whether the therapy was effecting selective changes in the children's phonology. The research design provided an opportunity in the *within* group study of the treated children, to discover under what conditions the overall therapy approach was successful in achieving *age-appropriate output phonology*. This aim of facilitating normal speech output corresponds with the optimal basic goal in therapy in the routine clinical context. By contrast, the aim of the Hodson and Paden (1983) therapy project, was, as the title of their book conveyed, targeting *intelligible speech*, not necessarily age-appropriate output phonology. Meanwhile, the aim of the other three group studies (Hill, Howell, Waters & Dean, 1989; Monahan, 1986; Young, 1987), was to see if the therapy was effective in facilitating *phonological change* (again, not age-appropriate phonological function).

The experimenters conducting the control process studies (Hill, Howell, Waters & Dean 1989; Young, 1987) did not, and *could* not, determine the time-frame or conditions under which therapy facilitated normal output phonology. They were constrained by their experimental design, which caused them to leave pre-determined aspects of their subjects' phonology untreated. Lacking the usual freedom to let their therapy progress flexibly and naturally along the route that each child's progress took them (as in the single case studies referred to in 7.1), these clinical researchers were unable to fully examine the way their approaches worked as total treatment packages. In this respect, they were testing modified versions of their therapies, and probably not the therapies that would be applied in regular clinical situations.

### 7.1.3.3 Issues in Target Selection

As discussed in section 6.5, the *Metaphon* team (Hill, Howell, Dean & Waters, 1988) were further constrained in terms of the selection of treatment targets by their decision to choose processes occurring at or near the 100% level for both intervention and control. It would have been interesting to know the incidence of processes at or near 100% for each of the *Metaphon* children, in order to compare them with the children in the current study. Unfortunately, percentage of occurrence of phonological deviations information was only reported in the context of two case examples, Tom and Michael (Hill, Howell and Waters, 1988). Hill, Howell, Waters and Dean (1989) noted that the mean number of processes occurring in the children's speech samples prior to *Metaphon* therapy was 5.9, with a range of 3 to 9. Thus at least one subject had three processes at or close to 100%, only. The term "close to" was not explained. However, Howell and Dean's (1991) report implies that it could mean 80-100% in general, but 65-100% for Patient 8, and 75-100% for Patient 13.

Subject selection criteria for both the current study (see 4.2.4) and the *Metaphon* study (Hill, Howell, Dean & Waters, 1988) specified that the children should have at least three phonological deviations/processes occurring greater than or equal to 50% of the time (see Howell & Dean, 1991, p. 96). It appears, however, that in practice all the *Metaphon* study

subjects had at least three deviations at or close to the 100% level, suggesting that they may have been a more homogeneous group than the two groups in the current study, and perhaps not as representative of the phonologically disabled cross-section of children seen in the routine clinical context.

In terms of the Incidence Category scores applied in the current study, most deviations in the *Metaphon* study "at or close to 100%" would have been included in Category 5 (80-100%). In the current study, the children's phonological deviations in Incidence Category 5 (80-100%) ranged from 1 to 5 phonological deviations in the treatment group, and from 1 to 9 phonological deviations in the control group (see Table 4, which displays the phonological deviations by incidence category at the initial assessment). Table 4 also shows that, in the treatment group, one subject (1T) had 3 deviations in Category 5, and six subjects (4T, 8T, 9T, 10T, 12T and 14T) had more than 3 deviations in Category 5. Thus 7 treatment subjects (2T, 3T, 5T, 6T, 7T, 11T and 13T) had only one or two deviations in Category 5. The problem of using this criterion of Category 5 deviations (i.e., comparable with the "at or close to 100%" criterion) for intervention and control was that seven of the treatment subjects in the current study would not have had sufficient deviations in Category 5 to make such target selection possible.

Subject 9T (see section 6.5) provided a case example in which the initial therapy target related to a phonological deviation whose percentage of occurrence was only 33%, in the presence of five deviations at the 100% incidence level and one at 50%. As explained in section 6.5, the rationale for choosing 9T's "mildest" deviation was based on motivational and linguistic grounds. This choice would have been unavailable if the author had been constrained by the experimental design to base his initial therapy target on one of his Category 5 deviations.

#### **7.1.3.4 The Specific Effect of the Therapy**

As well as allowing observations of phonological changes, the current between groups study also afforded an opportunity to examine differences and similarities between the two groups in receptive vocabulary and MLU<sub>m</sub>. Neither receptive vocabulary (as determined by the

PPVT-R), nor MLUm, showed a selective improvement in the treated children. The PPVT-R result indicated that the therapy was treating what it set out to treat. It was evoking a specific improvement in phonology, and not a more general improvement in linguistic performance, associated with improved phonological patterns.

In the current study, PPVT-R scores were compared in both the within group and between group analyses. By contrast, in the Hill, Howell, Waters and Dean (1989) *Metaphon* study, the researchers used the British Picture Vocabulary Scale - BPVS (Dunn, Dunn, Whetton & Pintilie, 1982), a measure of *expressive* vocabulary, in which they discovered (in their *within* group analysis) a non-significant improvement in scores following treatment, supporting the specificity of the *Metaphon* therapy approach.

A probable explanation for the unequivocal nature of the MLUm and PPVT-R findings in the current study, and the BPVS finding in the *Metaphon* study was, that as an artefact of the subject selection criteria, the subjects' skills evaluated by these measures were developing normally. It is probable also, therefore, that all the subjects in both studies provided "pure" examples of phonological disability, conforming to the "Phonological Production Involvement" category in Shriberg's (1993) 5-level classification (see 2.0).

#### **7.1.4 The Severity Index**

The study prompted the need to measure, compare and display the phonological progress of the two groups in a readily understandable form. Thus arose the question of the feasibility of producing a clinically applicable Severity Index for developmental phonological disorders, more relevant and practical than those currently available (see 2.1). Currently available scales included the Percentage of Consonants Correct (PCC) (Shriberg & Kwiatkowski, 1982), the Composite Phonological Deviancy Score (Hodson & Paden, 1983), or the Process Density Index (Edwards, 1992). The Severity Index was successfully devised and submitted to statistical analysis.

The Severity Index, which incorporated developmental expectations and the incidence of phonological deviations in a simply applied procedure, had a high correlation with the clinical judgements of the four experienced speech-language pathology Raters. The advantages of the Severity Index procedure in clinical settings would clearly be its ease and speed of application, and its simplicity in demonstrating to non-speech-language pathologists (*particularly* administrators, and funding agencies), the degree of severity of a child's involvement. The justification for using it would be its high correlation with ratings by experienced clinicians. In treatment planning, it would have only a minor role, sometimes supplementing, but not replacing, such measures as the phonological process analysis, contrastive assessment and phonological performance indicators (in the *PACS*, Grunwell, 1992b) for evaluating phonological status and phonological change.

#### **7.1.5 Implications Age of Diagnosis and Initial Severity**

Leahy and Dodd (1995) stated that "*most children who are diagnosed as phonologically disordered are at least 3 years of age*" (p. 167). Similarly Grunwell (1989) said

*Although it is rather late, 4;0 is the age at which a conclusive diagnosis can be made. That is not to say that intervention prior to that age is contra-indicated. It is just as appropriate to be preventative as to be curative.* (p. 310)

Four is indeed late, but the difficulty is that there is no clear-cut boundary between normal and disordered phonology in children under four years of age. When treating 2 year olds and 3 year olds it is not usually possible for the clinician to know for certain which of the following they *are* doing: preventing, curing or observing changes attributable to the normal developmental process. In practice, however, this issue is not of concern. If parents seek assessment and therapy for thoroughly frustrated unintelligible, and otherwise linguistically normal 2 to 4 year old children, therapy will usually be offered as soon as possible, irrespective of age. Furthermore, in the day to day clinical context, particularly those in which 2 to 4 year olds with stuttering or vocal

nodules are seen urgently, it would seem unethical to defer therapy for unintelligible and/or distressed phonologically disabled children in the same age-range.

The first few weeks of therapy with very young, highly unintelligible, phonologically disabled children can sometimes be difficult for the clinician in terms of accountability issues. In this early period therapists may sometimes feel that they are not doing enough. Therapists may perceive that the main therapeutic effect of their intervention is anxiety reduction for the parents, emotional support for the child, and perhaps also linguistic support for the child in providing a communicative partner who is more skilled than most people in comprehending what they are saying. Despite such concerns and observations, the difficult early weeks of therapy with many young highly unintelligible children is a necessary period in which the clinician becomes attuned to what is happening in the child's phonology, and forms a working relationship with child and family. The outcome is usually either :

- (1) a decision to see the child on a review-assessment basis, if early therapy is not indicated; or,
- (2) a decision to see the child regularly for ongoing differential diagnosis (e.g., of development articulatory dyspraxia (Milloy & Morgan-Barry, 1990)); or,
- (3) a decision to treat the child's problems, based on overt indications of readiness, or clinical intuition.

It will be remembered that, when they were initially assessed, the children in the current study were aged between 2;10 and 4;8, and that four independent and experienced speech-language pathologists were in agreement when they confirmed their diagnoses of developmental phonological disorder, in each and every case. There was no suggestion, with these particular 22 children, that any of them formed part of the normal phonological continuum, and had therefore been misclassified.

When the progress of the treated children was analysed, a number of interesting findings emerged, one of which was that the initial severity of the children's phonological disabilities was

the one and only predictor of how much therapy they would require. In effect, children whose phonological disabilities were at the severe end of the range required more therapy, and took longer to achieve normal speech patterns.

Recent research has indicated that children who have severe phonological disabilities when they start school are at particular risk for literacy acquisition difficulties, irrespective of other language involvement (Bird, Bishop & Freeman, 1995). Coupling the initial severity finding with Bird, Bishop and Freeman's (1995) findings, an application for the Severity Index was seen in relation to early identification of this sub-set of severely affected children. Since the children in the severe category took longer to treat, and age of commencing therapy was not a predictor of progress (i.e., the *younger* children treated made similar gains to the older ones), there were strong arguments in favour of trying to identify the severe group early, and intervene with them as soon as possible.

In Australia, there is a very strong tendency for parents to wait until the year before their children are due to commence school before seeking intervention for phonological disability, with the expectation that the speech-language pathologist will be able to make the child's speech "right" *before* they begin school. The implication usually is that they want to forestall the child requiring therapy once have started school (i.e., so that they will not miss out on their lessons). Although some children's phonological disabilities may resolve within the 12 months thus "allocated", the expected time span, according to the findings for this small sample is 3 to 19 months (and 10 to 36 consultations in that time).

Treating phonologically disabled children only in the year before they begin school (i.e., between 4 and 5 years of age) is unlikely to be long enough for many of them, especially those with more severe problems. These are often the very children at risk for literacy problems, who, according to Torgesen, Wagner and Rashotte (1994) are least able to take advantage of efforts to teach them phonological analysis skills once they reach school. All the more reason then, to make sure that children with phonological disorders start school with the best possible

phonological patterns, through early intervention, since the potential implications of literacy learning problems are serious (Lewis & Freebairn, 1992).

It was noteworthy that the age at which therapy was instigated was not a significant variable in predicting how quickly the children would progress, nor how many consultations they would require. It was hypothesised, originally, that the age of the child at the commencement of therapy might predict rate of progress. It was considered that older children might progress faster than children who commenced therapy at a younger age, because the older ones might be more mature, have better underlying linguistic and metalinguistic abilities, have better attending skills and hence have the cognitive and emotional "edge". An alternative hypothesis was that younger children might be more flexible cognitively, and therefore more responsive to the therapy, progressing faster. Possibly also, the younger the child, the more likely (s)he was to have been misclassified as phonologically disabled. It was postulated that younger children might be on the verge of sorting out their phonological systems for themselves, operating at the extreme end of the normal continuum, and needing only a little therapeutic "push" to set them further down the right path. Finally, it was thought that stable phonological deviations might not have been as entrenched and habituated in younger children, making their response to therapy more rapid.

The non-significance of age of commencement of therapy was a very positive finding, indicating that early intervention with phonological disability may be worthwhile (i.e., an early start in phonological therapy did not appear to disadvantage the children). A reliable screening measure of the linguistic signs in children under the age of four, of incipient developmental phonological disorder, especially in its severe form, would be an essential adjunct to pursuing such a goal.

## **7.2 Political and Administrative Ramifications of the Results**

Long waiting lists for assessment and treatment are a regrettable feature of many areas of health, education and welfare service delivery in Australia, speech-language pathology



services included. This is exemplified by the fact that the control sample children were drawn from lengthy waiting lists for assessment, and that most of the children subsequently left the study to be treated in therapy regimes based more on the availability of sketchy clinical resources than on the specific intervention needs of each child.

Experienced and inexperienced professional personnel are in short supply, especially in economically depressed and/or remote areas of the continent. One response to personnel shortages has been the administrative trend to allocate therapy services to clients on a first-come-first-served basis, irrespective of severity. Policy has been influenced by appreciable concerns that delineating high and low priority categories violates state and federal Anti-Discrimination legislation: for instance, the Anti-Discrimination Act 1977 (NSW); the Disability Discrimination Act 1992 (Commonwealth); and the Human Rights and Equal Opportunity Commission Act 1987 (Commonwealth) (Goulding, 1995).

Administrative policies, and the legislation upon which they rest, can, and frequently do, conflict with clinicians' views that early identification and intervention should be paramount. Such institutionalised conflict is stressful for all parties, unconstructive, and seemingly insoluble. What the efficacy study findings suggest is that identifying the children at the severe end of the continuum, and providing them with appropriate intervention as a matter of priority, irrespective of age, can be justified empirically in terms of the eventual (fiscal, individual and social) cost to the community of their probable later difficulties with literacy skills if they do not receive appropriate treatment.

### **7.3 From Clinic to Classroom**

Those of the treated children (11) who had been at school for a year or more, and who had been exposed to formal reading instruction, were followed longitudinally, and assessed in terms of their reading acquisition. When the reading acquisition data were gathered for the Literacy Study, all except 10T, who was still having difficulty with phonology and fluency,

continued to have normal phonological skills in the context of otherwise normal linguistic function. The finding that language skills other than phonology were normal in all 14 was not surprising in light of the initial selection criteria of subjects for the study: receptive and expressive language development were to be within six months of age expectations.

Other factors which might impede reading progress (e.g., hearing impairment, bilingualism) had also been excluded. Children with non-linguistic communication impairments such as vocal nodules and stuttering were excluded initially, but if other communication difficulties arose while the children were in the study, they were to be retained in their respective groups. The only additional communication disorder to emerge was 6 instances of stuttering: three in the treatment group and three in the control group. When these children were followed up for the Literacy Study, neither of the treated children who had completed therapy and had been dysfluent had experienced a recurrence of stuttering symptoms.

In terms of the children's speech output, the therapy was effective, but well over half the treatment group went on to be assessed by their teachers as being below grade expectations and in need of special help, for learning to read. This finding raised a plethora of unanswered questions. The high proportion of children with literacy scores lower than their classmates was consistent with the Bird, Bishop and Feeleman (1995) findings, providing another example of the link between developmental phonological disorders, poor phonological awareness, and difficulties with reading acquisition. Eight of the 11 children who had started school had either received extra help at school with reading, or had been identified by their teachers as needing extra help in the near future, while only three had learned to read with no apparent difficulty (in fact, 5T and 12T were superior readers).

A factor in common between the three competent readers, 3T, 5T and 12T, was that they were not among the three out of 14 in the treatment group to have episodes of stuttering. Whether treating 3T, 5T and 12T had the effect of pre-empting potential literacy acquisition difficulties cannot be ascertained. Neither can it be determined whether the parents, or the teachers, having been alerted to the possibility that the phonologically disordered children might

have later trouble learning to read, put in extra effort in the early stages of teaching reading to these three children, thereby dealing effectively with the problem.

As far as the two children who had successful remedial help (1T and 2T) were concerned, it is not possible to say whether their reading difficulties might have been more severe and harder to remediate had they not received the therapy as younger children. The same applied to the child (4T) who had help, but remained a very slow reader. It is possible to say, however, that providing appropriate treatment for developmental phonological disorders does not necessarily prevent or ameliorate reading disability in all children, though it may do in some.

There needs to be clear and explicit communication between parents, speech-language pathologists, teachers and school counsellors (school psychologists), particularly when the child is discharged from therapy and when they begin school. Accurate information about phonological disability and the children affected by it from speech-language pathologists to school teachers is imperative. The New South Wales experience is that many Infants' teachers have extensive knowledge of phonological awareness. Indeed, 'phonological processing' has lately achieved 'buzz-word' status in many Infants' School settings (i.e., for children aged 4;9 to 7;8 in Kindergarten, Year 1 and Year 2). In such a climate, Infants' teachers generally welcome practical input from speech-language pathologists, especially when it relates directly to children with phonological problems that they are currently teaching.

There often appears to be a discrepancy between what speech-language pathologist and teachers mean when using the terms phonological process, phonological disability, phonological disorder, and phonological processing disorder. Stackhouse (1993) and Kamhi (1992) discussed the difficulties that can emanate from the use of such linguistic terminology in discussions between teachers and speech-language pathologists regarding speech and literacy acquisition. When teachers and speech-language pathologists discuss children's needs, using terms such as 'phonological disability' and 'phonological intervention', the two frames of reference sometimes do not quite fit (e.g., if clinicians allude to phonological *processes* and teachers might think of

phonological *processing*). Parents rarely discern these subtle differences in the terminology and knowledge-base of teachers and speech-language clinicians. Just as they often think the two professions perceive "language" in the same way, they are frequently relieved to find that teachers appear to know exactly what they are talking about when they first mention that their child has been treated for a phonological disability.

Kamhi (1992a), possibly with tongue rather disrespectfully in cheek when he referred to teachers in the same breath as "other non-professionals" suggested:

*Use the term PHONOLOGICAL with colleagues and in professional correspondences whenever possible. Other terms (e.g., speech/articulation disorder) may have to be used if mandated by federal, state, or local service delivery guidelines. Use familiar terms and descriptive phrases (e.g., "speech problem/delay," "articulation problem/delay", when talking with parents, teachers, and other nonprofessionals. Some of these individuals may be interested in an explanation of our professional use of phonologically-based terms. Do not use newly proposed terms such as PHONOMOTOR; no one will understand what you are talking about, including many professionals in the field. (p. 267)*

In response to Kamhi's comments, surely it is part of speech-language pathologists' role as communication professionals to demystify what we mean by our jargon, and be sensitive to the way other professionals, particularly teachers, define and understand the terms they employ.

#### **7.4 Implications for Practice**

The model differed from previous approaches in the emphasis given to the role of parents in assessment and in intervention. Parental participation during therapy blocks, particularly in implementing homework, and reinforcing the gains made phonologically during the breaks between therapy blocks, was strongly encouraged, if not "required"!

### **7.4.1 The Role and Concerns of Parents**

It is usual for parents to worry about their child's communicative frustration when their speech is not understood. They often state that they are anxious for their child's speech to be intelligible by the time they begin school, so that they can cope with the curriculum, and not be teased or isolated socially. Certain questions constantly arise, which demonstrate clearly the awareness most parents have of the communicative function of phonology (see Appendix A). Typically, the parents' questions, such as those listed below, that are the very ones that can preoccupy clinicians:

1. What would happen if the child's phonological disorder was left untreated?
2. Would speech normalise over time, and, if so, would such normalisation be at a slower than normal rate?
3. What then, would be the repercussions, if any, for reading and spelling progress?
4. Are there long term consequences for personality and adjustment associated with (treated or untreated) developmental phonological disorders?

Because there have been no previous studies comparing the phonological progress of treated and untreated matched groups of children with phonological disability, speech-language pathologists have been unable to give unqualified answers to these parents' salient questions of the pros and cons of intervention.

Nonetheless, speech-language pathologists have long been in a position to discuss with and provide information for parents of the communicative (interpersonal), cognitive, linguistic, social and emotional implications of phonological disability for the child (Grunwell, 1985a). We can also discuss what is known empirically about the connections between spoken and written language, and the growing body of evidence implicating difficulties in spoken language as contributing factors to reading disorder (Bird, Bishop & Freeman, 1995; Dodd, 1995; Kamhi,

1992b; Stackhouse, 1990) in helping parents decide whether to proceed with phonological intervention.

Knowing about these issues is usually sufficient to prompt parents to choose intervention, if it is available, in preference to waiting to see if the child successfully solves his or her own intelligibility problems. Understandably, not intervening is a choice most parents are reluctant to make. The strong trend for parents to avail themselves of therapy for phonological disability, when it is recommended, is of course one of the reasons why controlled efficacy studies have hitherto been difficult to conduct.

#### **7.4.2 Case Management**

It would have been impossible to demonstrate the effectiveness of the therapy if the children and their parents had not engaged in therapy according to comparable attendance criteria. Agreement between therapist and parents about time management was most important. For the research, an attendance schedule of 50 minutes once a week, approximately 10-weeks-on-10-weeks-off, until phonology was close to or within normal limits, was instated. Over the course of the research none of the treatment subjects withdrew. The exception to the pattern of compliance from most families was 10T's parents who found they were unable to adhere to the 10 week blocks and breaks attendance requirements necessary to ensure that all the treatment children had approximately the same frequency of treatment. When his parents twice opted for longer breaks between therapy blocks, his participation in therapy became too different from the rest of the group's to include his data in the statistical analysis.

Although non-compliance with the attendance schedule was unfortunate for 10T, the difficulties encountered in his management, in this regard and in other respects, discussed in Chapter 6, typified the unwelcome factors that regularly occur in case management in the day to day running of a speech and language clinic. There was, therefore, much to be learned from his experience. In hindsight, it may even have been theoretically defensible, considering the gradualness factor, to spread 10T's phonological therapy over a longer time frame than the other

subjects, since his was the most severe phonological disability. However, a complicating element in 10T's phonological management was the persistent presence of stuttering. It was impossible to justify deferring or lengthening the duration of his stuttering management, and, in retrospect, it was regrettable that he had not been seen more intensively. What was most positive was that, despite his associated problems, 10T's phonology was gradually improving, apparently in response to the therapy, and the therapy was to continue after the family's long break. Cases such as 10T's are never clear cut, but are quite common, and they do underline the need for flexibility (and tolerance) in case management.

#### **7.4.3 Attendance Schedules and Commitment**

There are three general points concerning case management that need to be made in relation to compliance with the recommended attendance protocol, related to:

1. the constraints imposed by the research method, contrasted with what might reasonably occur in normal day to day clinical case management;
2. the theoretical perspective that phonological development is a gradual and individual process, and that case management has to be sensitive to this gradualness and individuality; and,
3. the demand placed upon parents when they are actively engaged in therapy, as part of case management.

Thinking first of the constraints imposed by the research methodology, and using 10T as an example again, if he had *not* been involved in therapy as a research subject, adjusting the frequency of therapy consultations to suit his family's preferences and needs better might have been less of an issue. In this particular instance, his mother was overwrought, needed a break and wished to avoid therapy attendance in hot weather. In typical clinical settings, these might be some of many reasons why parent(s) might choose to vary or re-arrange the temporal aspects of therapy attendance. For some families, bringing a child to therapy is grossly inconvenient.

Personal, social and emotional factors such as other commitments, financial considerations, health and individual differences (including emotional resources) operate singly or collectively to influence people's decisions about how involved they can become in therapy. In a multi-cultural society, cultural, religious or political influences will result in people having individual views of how much outside (the family or culture) intervention or professional help they see as appropriate for their child, and modify attendance accordingly. Case management of children with developmental phonological disorders must be conducted taking such factors as individual freedom of choice, and the cultural biases of both the service delivery system and the clinician into account (Crago and Cole, 1991; Crago, 1992; Nettelbladt, 1995).

The second general point related to attendance is that the study did not necessarily demonstrate that the system of 10-weeks-on-10-weeks-off was optimal or necessary for every child to progress adequately phonologically. The 10-weeks-on-10-weeks-off scheduling of consultations, like therapy cycles (Hodson & Paden, 1983), was not strictly a phonological aspect of the approach, but it did take into account and accommodate to the gradual nature of the process of developing phonological patterns in both normal and abnormal phonologies. The system of blocks and breaks allowed the children to progress phonologically at a comfortable rate, without feeling that they were being rushed. A side-benefit of the breaks was that the children who needed to return for more therapy usually came back to the task with renewed enthusiasm, often motivated by the progress they had made during the breaks.

As it happened, the children in the study progressed well in the blocks and breaks system of 10-on-10-off. However, in normal clinical situations a more flexible approach, to accommodate individual requirements, would be more desirable. Part of the success of the 10-weeks-on-10-weeks-off arrangement was probably due to the parents of the 13 children being comfortable with it: and they unquestionably gave that impression. The reasons for the blocks and breaks had been explained to them in detail, and they accepted the arrangements well. Had they not been happy with the system (e.g., if the reasons for it had not been portrayed adequately to them), it is quite possible that morale, attendance and punctuality at scheduled



appointments, compliance with homework, and hence overall progress might have been adversely affected.

If we agree that phonological development is gradual and individual, then it follows that therapy should be flexible and broad based enough take account of these two characteristics. The notion of gradualness has implications for time management and scheduling of consultations (or when the therapy takes place), while the concept of individuality is implicated in having an approach that suits individual families, and which can be geared to the specific requirements of the child (or how the therapy is implemented).

The third aspect of time management and compliance which needs highlighting relates to the amount of parental participation involved. After signing the consent forms, some parents remained more aware than others of the research project. Those who were more conscious of it tended to enter into the therapy in a slightly competitive spirit, sometimes asking how the "others" (children and parents) were doing. All the mothers commented at some point that they liked the idea that their child's therapy was potentially contributing to knowledge and hence helping other children. Some liked the idea that their experience was helping other parents. All the parents wanted to help in the therapy, and all performed at least adequately. The mothers saw themselves as having an indispensable role in intervention, as indicated by the following quotations:

*It's wonderful to be so involved: we feel we are really doing something constructive here, but more to the point, at home too (TT's parents, in a letter at the author at the end of his first therapy block); Having a positive way of helping makes up for the times I have been angry with her when I haven't understood (2T's mother, in conversation with the author).*

Thus the parents, particularly the mothers, valued the opportunity to contribute in a practical sense to facilitating phonological progress in their children. In so doing, they were being asked to understand and manipulate novel concepts and strategies, needing the clinician's continual encouragement and support. Most were impressive in their capacity to accommodate

new concepts and learn new skills. It would be unfortunate ever to underestimate the contribution parents can make to phonological intervention with a minimum of clinical guidance (cf. Grunwell, March & Russell, 1990).

Probably because they took such an active part in therapy, some of the parents felt the need of breaks themselves. They would comment on being "ready" for a break in the same way parents note that children are "ready" for a school holiday. Similarly, when they returned after a break, they generally commented enthusiastically on being "ready" to come back for another block. Thus, as well as the breaks accommodating to the gradualness of phonological acquisition, allowing for a consolidation of progress, and giving an opportunity for the child to make some less supervised progress, they fitted well with families' varying needs to work in bursts and then relax for a while.

#### ***7.4.4 The Model and its Components: Explanation and Discussion***

The rationale for the intervention model involved two aspects. The first aspect was a theoretically based view of phonological acquisition as a complex developmental interaction between motoric, perceptual, conceptual, and cognitive-linguistic capacities and capabilities at the intra-personal level. The second aspect was that the development of such capacities and capabilities is facilitated by interpersonal communication experiences in the child's particular and immediate linguistic surroundings.

Phonological acquisition was seen to have four basic, interacting components: auditory perceptual, cognitive, phonological and neuromotor (Stoel-Gammon & Dunn, 1985). It depended upon the child's developmental readiness, as well as facilitative psycho-social factors in the communicative milieu. Congruent with this perspective was a theory of phonological disorders as an interruption to normal phonological acquisition, which could have its origins in one or more of the four components or their environments, thereby adversely affecting the cognitive processes involved in phonological organisation and learning. The goals in phonological therapy, therefore, were to encourage, stimulate, and recognise developmental readiness, and activate cognitive

reorganisation of the child's phonological system. This process would thereby facilitate the emergence of new pronunciation patterns, hence improve intelligibility and ultimately foster the emergence of age-appropriate phonology.

The therapy model emphasised the importance of the child's active cognitive involvement, and family communicative participation. The model's components included metalinguistic, phonological and phonetic procedures and activities. Since the efficacy study indicated that the treatment approach was successful, empirically supported guidelines for treating developmental phonological disorders, based on this approach, can be stated as follows:

1. Base therapy upon detailed and ongoing phonological assessment in order to target cognitive reorganisation of the underlying system for phoneme use as efficiently and as relevantly as possible for the child at any given time.
2. Administer therapy in the form of planned therapy blocks and breaks to allow for the gradual emergence of new phonological patterns.
3. Structure therapy sessions so that *at least* 50% of procedures and activities involve cognitive (auditory processing) skills, thereby acknowledging the important role of listening and thinking in linguistic learning, with less emphasis given to production procedures and activities.
4. Engage parents and significant others (family and pre-school teachers) in an active and informed way in the therapeutic process, thus tapping into the resources and capabilities of the most influential people in any child's early linguistic environment: i.e., his or her family.
5. Involve the child as an active participant in therapy, on the basis that language learning is dynamic, interactive and interpersonal, and that the function of phonology is communication.
6. Include in the therapy regime components tested here, and listed again as follows: (a) family education; (b) metalinguistic tasks, including aspects of linguistic awareness and

phonological processing; (c) traditional phonetic production procedures; (d) multiple exemplar techniques, including minimal contrast and auditory bombardment activities; and, (e) homework activities, incorporating (a) to (d) above.

## **7.5 Limitations of the Study**

If they are in a position to intervene, clinicians cannot legitimately withhold therapy when they believe it is indicated, and of course parents do not wish to deny their children therapy when it is advised by an appropriate professional person. The onus is on both parent and clinician to do what they see is best for the child. In the current study, mindful of all the ethical standards and constraints, an untreated group was included, and in Chapter 3 we saw the arduous process involved in establishing this control sample drawn from speech-language pathology waiting lists.

One reason for the process being so difficult was that, as soon as most of the parents were accurately informed about the nature of their child's speech problem and told that therapy was indicated, they somehow found a means of getting therapy. In fact the majority of them were very resourceful in obtaining intervention, despite extraordinarily limited clinical facilities, geographical isolation, and enormous distances from appropriate service providers.

Just 11% of the original metropolitan control subjects, and 5.5% of the country control subjects, were retained in the study: that is, only 7.4% of the total sample, or 8 out of the 108 children assessed. Importantly, they were closely matched for socio-economic status and family structure. Four of the children were from the country, but it is improbable that this factor could possibly have affected their phonological progress. Having located a small group of eight well matched control subjects, and included them in the study respecting strict ethical guidelines, there still remained a number of practical difficulties related to time limitations.

The long term time limitations related to the duration of the control subjects' participation in the study. The control subjects could only be retained in the study for a limited period. As soon as they were eligible for therapy they were dismissed from the project. The period ranged from 5 to 11 months, with a mean of 8.6 months. This meant that the control subjects' progress could

not be plotted for as long as the treatment subjects. The short term time limitations were to do with the duration of the assessment consultations, especially those for the initial and probe assessments. Because four of the control group children lived in remote areas, they had to travel considerable distances to attend the assessments. This meant that the assessment process had to be as brief as possible, while still being comprehensive.

In practice, the whole process had to take place within two hours (usually with an additional half-hour break mid-way through) so that the children performed at their best and did not become tired, bored or unhappy. Care had to be taken not to attempt too many procedures in the available time, thereby negatively affecting their performance. A further consideration in deciding how much time to allocate for the assessments, and how much assessment to do, was the ease with which the study could be replicated. The requirement to assess the children fairly quickly affected the type and amount of useful assessment data gathered from either group that could be used for direct comparisons between the two groups. The aspect of the research most negatively affected by the short term time limitations was data collection relating to the metalinguistic tasks. Because time was short, only four tasks were included in the initial and probe assessments. Thus insufficient data to determine the children's performance of the range of tasks listed in section 3.3.2, and their individual or collective relationship to the children's progress, were available for analysis.

Being short of time had a fortuitous side-benefit of compelling the development of a time-efficient data gathering procedure that did not over-extended child, parent, nor clinician! If more assessment-time *had* been available (which it never was), a moral dilemma would no doubt have arisen as to whether it was appropriate to continue testing, essentially out of interest, or whether to initiate some therapeutic management in the form of detailed guidance for the parents. Despite a genuine spirit of academic inquiry, the situation, of diagnosing children with phonological disorder and advising therapy, but not proceeding to initiate it, was uncomfortable enough in itself for a long-time interventionist, without this added dimension.

What was noticeable and thought provoking, considering the author's view that assessment is inextricable from therapy, and very often "therapeutic" in itself, was that all the control group children's parents claimed to gain something positive from the assessment process. Once they were involved in the study, none of the control families dropped out for any reason other than that their child was now eligible for therapy. They were particularly pleased to have the assessment reports, and relieved to discover that their children had a readily diagnosed, treatable communication disorder that was comparatively common.

When the current study was in the planning stage, two options concerning following the control children's progress were considered. The first option was to follow their phonological progress in therapy, and the second was to track their literacy acquisition in the first two years of school. It was eventually decided not to pursue these lines of inquiry when it was realised that each of the control children was being managed clinically in widely disparate ways:

1. in brief series of up to 6 individual therapy consultations (4 children);
2. via a consultative model in which the speech-language pathologist advised a preschool teacher how to intervene on the basis of the author's report to the parents (2 children);
3. group therapy (1 child); and,
4. periodic review assessments only: i.e., no therapy *per se* (1 child).

On a predictable and depressing note, once the control children entered therapy, none were seen in a typical once a week therapy format for any longer than six weeks. The parents' interpretation of this, which was doubtless accurate, was that more therapy was not on offer due to policies determined by shortages of professional personnel and long waiting lists (cf. Dodd, 1995).

## **7.6 Suggestions for Further Research**

In a review of the prominent theories of normal and disordered phonological development in Chapter 1, and in accounts in Chapter 2 of classification, measurement, assessment and therapy for children's speech sound disorders, a recurring theme was found.

This common thread was the often stated need for both a theoretically informed phonological therapy that had some explanatory value, and the necessity for further clinical research into the nature and treatment of developmental phonological disorders.

The direction and form of further research suggested by the current study have been touched upon already in this chapter and in Chapter 5. At the risk of some repetition, it is necessary, however, to summarise and discuss briefly, here, the main suggestions for further research raised by this work.

### **7.6.1 Are Some Approaches to Treatment More Effective than Others?**

Whether the current phonological therapy is more, less, or as effective as traditional therapy (Van Riper, 1978), the Hodson and Paden therapy (Hodson & Paden, 1983), *Metaphon* therapy (Dean, Howell, Hill & Waters, 1990), or therapy based on non-linear phonology (Bernhardt & Stoel-Gammon, 1994), was, regrettably, beyond the scope of the project. There are echoes here of Fey's opinion (1992b):

*My own and others' experience with phonological assessment and treatment protocols and that of others also has led me to believe that these approaches are effective. But the question that sceptical clinicians and researchers must continue to ask is: 'Has it been demonstrated empirically that phonological approaches (along with their underlying theoretical principles) are more effective and/or more efficient than existing procedures?' The response to this humbling question is still 'no', in my view. I am hopeful that in another 7 years, a group of investigators can fill the pages of a forum...with the results of experiments designed to address this nagging, but important question. (p. 281)*

The present author, like many who consider phonological therapy to be the most desirable currently available approach for children with all but the very mildest of phonological disabilities, has ethical reservations regarding a longitudinal between groups study comparing a phonological therapy with traditional therapy. These reservations would preclude a research design in which the progress of a group receiving traditional therapy was compared with a group

receiving phonological therapy, with the author or any like-minded clinician administering all the therapy.

In some clinics, traditional therapy has not been superseded, and is the only therapy offered for children with developmental phonological disorders. In other clinics, phonological therapy is the only approach considered appropriate. In order to execute a comparative study, it would be necessary to match the groups and then follow them longitudinally in different treatment settings. A similar approach could be employed to compare different phonological therapy methodologies. Alternatively, single case designs (McReynolds & Kearns, 1983) could be employed.

While it would be challenging to conduct such group and single case studies, there is a continuing need for more detailed individual case reports, with children with various phonological disabilities, and using various approaches based upon phonological principles. There are very few case studies in the literature that provide sufficient detail as to be truly informative and instructive for the practising clinician. Unfortunately, the current study shares in this inadequacy in terms of the limited case history information included in the studies in Chapter 6.

Factors such as developmental and family history are potentially important in the management of developmental phonological disorders (Macken & Ferguson, 1983; Shriberg & Kwiatkowski, 1982). Information such as developmental history, family history (e.g., of speech disorder, reading disability, etc.) parents' socio-economic status and educational level, and so on, was gathered but not included here, because it would have resulted in easy identification of the subjects.

### ***7.6.2 Testing the Model with a More Representative Sample***

In further testing of the therapy approach, it is planned to compare the progress of groups of children with and without additional communication problems, specifically, language impairment and stuttering.



### **7.6.3 Studying the Severe Population in Greater Depth**

The current study raised a number of questions regarding the relationships between phonological development and other aspects of language development, phonological development and fluency, and phonological development and literacy skills acquisition.

Only one child in the treatment group had a developmental phonological disorder in the severe range, and his therapy was atypical and incomplete. An important direction for future work would include treating a group of children in the severe category, and following them longitudinally, particularly through the early years of school. We have seen that the more severely involved children are more likely to have literacy problems (Bishop, Bird & Freeman, 1995). In the light of this information, it seems essential to determine whether the sub-group of children in the severe range who do *not* develop reading problems have distinguishing phonological, or indeed other linguistic, characteristics.

Issues to explore in relation to phonology and fluency would include determining whether severely phonologically disabled children are more, less, or as likely as other children with developmental phonological disability to have persistent problems with fluency. This begs the question as to whether phonological therapy influences the probability of the emergence of stuttering symptoms. Is it possible that by attempting to hasten the phonological patterning of slow and disordered phonological learners clinicians unwittingly disrupt a vulnerable underlying system of fluency control? Finally, a pertinent direction for research to take might be to examine the probable inter-connections between severe developmental phonological disorder, stuttering and reading and spelling disorders.

### **7.6.4 Attendance Schedules and Alternatives**

There is little information available to clinicians in planning attendance schedules relative to the time taken for new phonological learning to consolidate. Further research into what might constitute an optimal balance between therapy attendance and breaks from therapy, in a

conventional clinical setting where open-ended weekly therapy is an option, is indicated. For example, it would be clinically useful to discover whether (and with whom) the therapy could be as effective with longer periods between therapy blocks. A study in which children were seen weekly for 10 weeks, using the approach, then given a break of 20 weeks, reviewed and given 10 more treatments, might be germane. The scope for doing this is available in some Australian settings, in which families are routinely offered 10 treatments per calendar year (maximum) for their communicatively impaired children.

A testable hypothesis might be that having disrupted stable disordered phonological patterns (via one phonological therapy block) all that the child would then require to incorporate new learning and go on to develop age-appropriate phonological patterns is more time. The theoretical rationale for such an hypothesis would be a view of the phonologically disabled child not only as a disordered phonology-learner, but also as an abnormally gradual phonology-learner.

#### ***7.6.5 Development of the Severity Index***

The Severity Index was based upon the phonological deviations that occurred in the children's 81 assessments. It required the development of more precise guidelines for counting the phonological deviations that did not occur in this limited sample, and standardisation on a larger, more representative population.

The Index has the potential to become a useful measure of the severity of a phonological disability, with particular administrative and political applications. With the development of reliable age-norms for the younger age-range, it might also provide a component of a mechanism for earlier (i.e., younger than 4;0) screening and identification of children with developmental phonological disorders in the Severe category.

### ***7.6.6 Screening Measures for Early Identification***

Predictably enough, the Efficacy Study had several implications for screening and assessment. The need for a means of early identification of children with severe phonological disabilities (see 7.6.3 and 7.6.5, above) was particularly apparent. Such a screening measure would be especially valuable if it included means of determining which sub-group(s) of phonologically disabled children are at risk for stuttering and literacy acquisition difficulties. In order to develop such measures, more detailed studies of the characteristics of disordered phonologies are required. For example, are there any structural, systemic or prosodic features associated with the disordered phonologies of children who also have episodes of stuttering?

### ***7.6.7 Research Implications of the Literacy Study***

A large proportion of the sample went on to have significant reading difficulties, which may have been phonologically based, given the original criteria by which the children were selected for the study. That is, they did not have language delays, hearing impairments, difficulties with bilingualism, or other factors that might partly account for slow progress with literacy acquisition (Cataldo & Ellis, 1988). Further research would be necessary to confirm or disprove the phonological basis for the children's reading difficulties (see Bishop, Bird & Freeman, 1995 for a discussion).

The phonological therapy was clearly very effective in helping the children to achieve normal speech for their ages. Speculatively, improving the children's phonological awareness may also have had the effect of ameliorating potential reading difficulties in some or even all of the children (Bradley & Bryant, 1985; Torgesen, Wagner & Rashotte, 1994). In this regard, it would be interesting to follow longitudinally the literacy development of children treated for their phonological disabilities with different approaches. For example, do children who have had phonological therapies have comparable difficulties to children treated with traditional articulation therapy? Are they more or less responsive to special reading help once it is instated?

### **7.6.8 MLUm: More Talking, More Listening, or More Confidence?**

Initial and Probe assessment measures of MLUm were taken for both groups in the expectation that the treated children might have elevated MLUm's in comparison to the untreated children. What prompted the MLUm inquiry was the frequent observation of families of phonologically disabled children that as their children's intelligibility improved, there appeared to be a corresponding increase in the amount they were saying. Their comments would be couched as "better vocabulary", "longer sentences", "talking more", and the like, explained in terms of "being happier and more confident". The study of MLUm did not yield the anticipated result. In retrospect, it could have been more productive to take initial and probe measures of expressive vocabulary (cf. Hill, Howell, Waters & Dean, 1989).

The parents' comments about "more talking" were very prevalent, and excited curiosity about exactly what it was so many of them were observing and responding to in their children. Was it that the parents were understanding more of what the children said, and this gave the illusion of talking more? Were the parents being more attentive? Subjectively, the children were enjoying talking more, initiating more conversations and taking more conversational turns within the clinical setting, as their therapy proceeded. The adults around them were comprehending more of what the children were saying, and hence finding it easier to converse with them. Was this increase in communicative interaction implicated in producing phonological change, or was it an effect of phonological improvement?

Further research into the relationship between phonological development and other aspects of language development is relevant here (see Ingram, 1989b for an account of first language acquisition highlighting the constructionist perspective). The use of parental diaries (Ingram, 1989b) in conjunction with audiotaped language samples of the children in conversation with their families, during periods of phonological intervention, might help provide the answer to the questions raised by the MLUm finding.

### **7.6.9 Evaluating and Developing Components and Aspects of the Model**

Having tested the therapy as a total package, the next direction research could take would be to test the individual components of it, in an attempt to see whether it was the combination of procedures and activities that were effective, or whether certain procedures and activities were evoking the desired effect.

#### **7.6.9.1 Family Education**

As previously described, the parents of the treated children were skilled and resource-rich when it came to seeking out and helping with therapy. It therefore seems unfortunate that many parents in this country place their phonologically disabled children's names on waiting lists, and then wait, anything up to 2 years for treatment! Surely this is a missed opportunity for the speech-language pathology profession to tap into parents' abilities (Blosser, 1996). Appropriate guidance could be provided to parents in the written form (e.g., the *"Notes for Families and Teachers"* booklet) or on audio or videotape. Where distance is problematic, it could be given over the telephone, or through the facilities used in distance education (television or radio by landline, and satellite transmission).

There are obvious ethical restrictions upon speech-language pathologists disseminating written management guidelines, telephone or tele-conference advice, to the parents of children who have not been assessed. Therefore it would be necessary to re-think waiting list policy in some clinical settings. A practical direction for research to take would be to explore the option of assessing phonologically disabled children and developing programmes and materials for parents to use to help them, based on each individual child's assessment. A system in which a small group of parents attended tutorials to learn the relevant concepts and skills, with periodic re-assessment and re-development of the children's home-intervention programmes, might prove worthwhile (cf. Dodd, McCormack, & Woodyatt, 1995).

It will be recalled that, in trying to establish a control sample, once the children were diagnosed, 92.6% of the parents found speech-language pathology intervention for their children. Previously, the children's names had been on waiting lists for assessment, and it appeared that the majority of the parents accepted this situation as inevitable. As soon as their children were assessed, for the vast majority, there was an attitude change, and they were no longer content to wait. Perhaps an effect of providing assessment and the type of supervised home-management described above, especially if it was presented as a stop-gap measure, might be to provide a comparable spur, encouraging parents to be more active in lobbying governments to provide better coverage in the form of adequate provision for speech-language pathology services.

#### **7.6.9.2 Metalinguistic Tasks**

The roles of the four representative metaphonological procedures and activities contained in the therapy model were examined. Rhyme matching (Task 1) and word structure sorting abilities (Task 3) appeared to be related to improvements in phonology. The treated children showed significant improvements in their ability to perform these tasks, while the untreated children did not. This finding suggested that the ability to perform rhyme matching and word structure sorting, or phonological processing tasks, was linked with the significant improvements observed in the treatment subjects' output phonologies. Conversely, phonemic onset matching (Task 2: sorting words by initial phoneme), and lexical knowledge tasks predicated on the child's ability to discriminate meaningfully between the terms "sound" and "word" (Task 4) did not appear to be causally related to accelerated phonological acquisition. Non-significant changes were evident when the two groups were compared.

The children's performance of the four metalinguistic tasks pointed to the need for detailed examination of the metalinguistic training component of the therapy model beyond the scope of the current study. It was clear that some of the tasks performed a key role in facilitating phonological change, especially those concerned with rhyme matching and word structure sorting. This finding supported the importance of identifying, developing and using interesting (to

children) procedures and activities designed to foster rhyme matching and word structure sorting abilities.

The treated children did not improve any more than the control children in their ability to perform lexical knowledge and phonemic onset matching tasks. Perhaps this finding meant that the theoretical justifications for including the tasks in the therapeutic battery were sound, but the tasks themselves were too difficult for the children to perform independently in a strict assessment format, without adult prompting or corrective feedback. On the other hand, it may have been the case that performing comparable tasks, with continual adult assistance, was integral to the success of the therapy. Alternatively, the children might have progressed more quickly if the tasks had been simplified to the extent that they required either no, or minimal, adult help.

Onset matching and metalinguistic processing (lexical knowledge) tasks manipulating the concepts of "sound" and "word" often assume prominence as the basis for intervention procedures and activities in phonological therapy approaches (e.g., Dean, Howell, Hill & Waters, 1990, pp. 31-35). Indeed, Dean, Howell, Hill and Waters (1990) found significant changes in their 13 subjects' scores on phoneme segmentation task designed for the study ( $p = < .01$  on the nonparametric *Wilcoxon Matched Pairs Signed Rank Test* (Siegel, 1956). Why did the 13 *Metaphon* children improve in their phoneme segmentation abilities, while all 22 in the current study did not? The nature of the phoneme segmentation task was unspecified in Dean, Howell, Hill and Waters (1990) and Howell and Dean (1991), but it is assumed that it was the one described as follows for the original 15 children in Hill, Howell, Waters and Dean's (1989) paper:

*A Phoneme Segmentation Task. This task required the subject to segment the initial phoneme from a given word. A set of 10 mono- or bi- syllabic words were presented in the context of a story. The task allowed for two levels of prompting to be employed if the subject was unable to segment the initial phoneme at first attempt - the first level involved prolongation and emphasis of the initial phoneme, and the second level isolation and repetition of the phoneme" p. 17*

Judging from this account, the *Metaphon* study children were trained first to anticipate assistance (cf. 4T in the current study asking "Why don't you help me?" when performing Task 3, see 5.2), and second to anticipate and then recognise two forms of distorted phonetic production (prolongation and emphasis, and isolation and repetition). Thus the *Metaphon* "tests" were not formal tests in the accepted sense. Having first determined that the tests were ones that most preschoolers could perform easily, Bird, Bishop and Freeman (1995) included in their study three tests of phonological awareness:

1. a rhyme matching task, similar to the one in the current study;
2. an onset matching task, also similar to the one in the current study, in which the children had to select words starting with /p/ and /tʃ/; and,
3. an onset segmentation and matching test, requiring the children to find words that "began with the same sound" as a puppet, "Sam", in the first test, and "Tom", in the second test.

After the Bird, Bishop and Freeman (1995) children had been shown how to do the three tests, as in the Tasks Study (see 5.2) in the current project, no prompting or corrective feedback was given during the test phase. By contrast, as indicated above, the *Metaphon* children were given two levels of assistance during the assessment phase (see above quotation), probably explaining why their children appeared to show significant improvement.

Comparing children in the 5;0 to 7;4 age range, comprising a linguistically normal control group, and two experimental groups of phonologically impaired children (with and without additional language impairments), Bird, Bishop and Freeman (1995) found that the experimental children scored well below their controls on all three tasks, irrespective of whether or not they had other language problems. Their finding for onset matching accords with the poor outcome for Task 2 at the probe assessment in the current study for both the treatment group and the control group. However, their findings conflict with the success the treated children in the current study, who were younger than the Bird, Bishop and Freeman children, had in performing Task 1 and 3 at probe. This issue of course warrants further investigation.



### 7.6.9.3 Phonetic Production

Not all would agree that the stimulus methods applied in traditional approaches, which predated the application of phonological principles to intervention, may form theoretically congruent components of phonological therapy regimes (e.g., Schwartz, 1992). In the current model, phonetic production training was not counted as a phonological component *per se*, but it was considered theoretically defensible and coherent to include it in the model. Phonological therapy is, by definition, directed at activating the child's underlying system for phoneme use, but somewhere along the line the child has to learn *how* to produce the phonemes (Saben & Costello Ingham, 1991).

Phonetic procedures must of course be used advisedly with children with phonological problems (Bleile & Hand, 1995; Grundy, 1995; Miccio, 1995), or they become counter-productive. For some phonologically disabled children, many of whom are at the severe end of the phonological disability spectrum, inventory expansion is their most pressing need, and traditional methods suffice. Phonetic production training is essential (usually only in the early stages of therapy) to teach them to produce the full range of phonemes and also to achieve a degree of familiarity and automaticity as they learn to incorporate their new sounds into their speech patterns. At the other end of the spectrum, some children's phonological disabilities are so mild, and their developmental readiness so ripe, that the phonetic production training component of the model is all that is necessary to trigger the final step or two necessary for their phonological patterns to conform to the norm.

All the phonological therapies cited here had a phonetic component, sometimes de-emphasised, almost as an embarrassing necessity. We still do not know how to determine how much intervention can be directed at the phonetic level before it begins to interfere with phonological processing.

#### **7.6.9.4 Multiple Exemplar Techniques**

Minimal contrast and auditory bombardment activities take a variety of forms. In the current study auditory bombardment was included using minimal meaningful contrasts. There is no research to support the use of amplified auditory bombardment, although Hodson and Paden (1983) believed it might increase the perceptual saliency of phonemes. No amplification was used in the current therapy because it was felt that the input should be as close (acoustically) to normal conversational speech as possible. It was also considered that for some children the headphones could be too distracting (e.g., either because the children liked them, or because they found them objectionable). In further research, the effects of the current approach could be compared with those of Hodson and Paden (1983) who administered auditory bombardment, in the form of word lists containing target phonemes (not minimal meaningful contrasts) using low levels of amplification. It might also be of interest to compare progress of children treated with the current method, with and without auditory bombardment.

### **7.7 Conclusions**

The process of the development and successful testing of a theoretically based, multifaceted phonological therapy approach was the focus of the current investigation. The therapy comprised five interacting, overlapping and dynamic components, incorporating phonological principles, approaches, procedures and activities alongside traditional procedures and activities. The therapy proved effective in facilitating normal phonological patterns in a group of children with development phonological disorders. Such encouraging results suggest that the skill in designing and implementing an effective phonological therapy approach dwells both in the timing and scheduling of therapy, and in finding the right balance between old and new for each individual phonologically disabled child. Most importantly, for the child's optimal linguistic progress, therapeutic practice must be based upon a theoretically principled understanding of the ways in which all the factors involved fit congruently together.

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## **APPENDIX A**

### **Evaluation of a Phonological Therapy**

#### **Notes for Families and Teachers**

This booklet has been prepared for families and teachers of children who are involved in

the Phonological Therapy Research Project to borrow.

You are requested not to copy or distribute it in any way.

## NOTES FOR FAMILIES AND TEACHERS

### *Phonological Disability*

Phonological disability (or developmental phonological disorder) is a language disorder which affects children's ability to develop easily understood speech by the time they are four years old. Even though the cause or causes of phonological disability remain unknown, it has been successfully treated by speech-language pathologists since the 1930's. Children with unintelligible, or difficult-to-understand speech, due to phonological disability, are usually developing quite normally in every other respect, and do not have serious physical problems. They understand what is said to them, have adequate vocabularies, and can string sentences together at least as well as other children of the same age.

Grammatical development and use may sometimes be slower in children with phonological disability. Sometimes it is difficult for adults to decide whether phonologically disabled children are applying grammatical rules such as 's' plurals (two dogs, two cats), 's' possessive markers (dog's bone, cat's whiskers) and regular past tense verbs (dog jumped, cat purred), because of the way their words are pronounced. For instance, some children with phonological disability never use the sounds 's' and 'd' at the ends of words, so it may not be possible to tell whether they know about grammatical word endings or not.

Research into the nature, causes and management of phonological disability has, until recently, taken a 'back seat' while more pervasive, handicapping communication disorders have been studied. However, in the last decade, speech-language pathology practice in the area of *children's speech sound disorders* have been increasingly influenced by the interest that Linguists have been taking in Clinical Phonology. Clinical Phonology is the application of linguistic principles and theory to language disorders affecting speech sound systems.

## **Aspects of Normal Speech Development**

From the research done so far, it is clear that more needs to be known about normal speech development, and the mechanism that underlies the failure of some four year olds to develop clear intelligible speech.

It is important to remember that a child learning to talk has to conquer the complexities of language comprehension, vocabulary, grammar, syntax and so on, as well as learning how to speak intelligibly. Additionally, the child has to devote time and energy to other important areas of development, such as acquiring motor and social skills. All of this learning usually takes place gradually, with the emphasis constantly shifting from one developmental area to another. If certain areas are difficult for a particular child, progress will be even more gradual, or even non-existent after a certain point is reached.

Children with phonological disabilities need skilled help to master the sound system of their native language. This help, or therapy, is designed to accelerate their phonological development. However, even with special help, it would be unreasonable to expect a child with a phonological disability to learn to speak clearly any faster than a child without such a disability.

What phonological therapy aims to do is provide systematic help to the child in learning the sounds of the language and how they are organised for speech. It aims to help the child become an active 'problem solver' in untangling their disordered speech patterns, and replacing them with correctly organised ones, and it guides parents as helpers in this process. The ultimate aim in therapy is for the child to 'catch up' phonologically, and proceed with language development without the need of further special help.

Family education is the first and key component of the therapy regime, and starts with an understanding of the normal stages of speech development. The following notes provide a summary which can be used as a basis for discussion with the therapist, a stimulus for further reading, or both. Some of the terminology and jargon may be daunting and confusing at first, but is included in the interests of accuracy.

## **Expressive Language Development**

<b>By 6 months</b>	variety of cries, sounds and intonations
<b>By 12 months</b>	babbles VOWEL + CONSONANT (e.g. babababa) says 1 or 2 words combines sounds with gestures (e.g. points and says "uhuh")
<b>By 18 months</b>	says 3 to 10 words or more uses words to communicate
<b>By 24 months</b>	uses 50 or more words combines two words (e.g. "car go", "more juice")
<b>By 30 months</b>	uses "my", "me", and "mine" recites or sings bits of rhymes, songs or commercials
<b>By 36 months</b>	uses 1000 or more words asks and answers simple questions carries on a simple conversation

**How well words can be understood by parents**

By 18 months	25% intelligible
By 24 months	50 -75% intelligible
By 36 months	70-100% intelligible

Not all sounds are said correctly, but the child can nonetheless be understood.

Their speech sounds child-like, not adult-like.

## **Phonetic Development ('Articulation' Development)**

When children learn to speak they have to learn how to make the individual speech sounds (that is, phonetic features) and they have to learn how the sounds must be organised in order to form words (that is, phonological features). Like other aspects of development, phonetic development or 'articulation development' as it is sometimes called, occurs in stages. The sequence of speech sound development, and the approximate ages that each sound becomes 'correct' 75% of the time, were studied by an Australian speech-language pathologist, Meredith Kilminster and colleagues in Queensland in 1978. The 'norms' they worked out are listed below.

<b><u>AGE</u></b>	<b><u>SPEECH SOUND (Phonetic Symbols)</u></b>
-------------------	---

<b>3;0</b>	<b>h      ʒ</b>
------------	-----------------

	<b>j      w</b>
--	-----------------

	<b>ŋ      m      n</b>
--	------------------------

	<b>p      b      t      d      k      g</b>
--	---

<b>3;6</b>	<b>f</b>
------------	----------

<b>4;0</b>	<b>l</b>
------------	----------

	<b>ʃ</b>
--	----------

	<b>tʃ</b>
--	-----------

<b>4;6</b>	<b>dʒ</b>
------------	-----------

	<b>s      z</b>
--	-----------------

<b>5;0</b>	<b>r</b>
------------	----------

<b>6;0</b>	<b>v</b>
------------	----------

<b>8;0</b>	<b>ð</b>
------------	----------

<b>8;6</b>	<b>θ</b>
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### **KEY TO PHONETIC SYMBOLS**

j = you    ʒ = measure    ŋ = sing    ʃ = she    tʃ = chair    dʒ = jump    ð = this    θ = think



## **Phonological Development (Development of the system of sound contrasts)**

The presence of phonological processes, or regular non-adult speech patterns in the speech of very young children, and older children with phonological disability was not recognised by linguists until the late 1960's. Their 'discovery' made quite a remarkable change to the way speech-language pathologists assessed phonological disability. Children were no longer viewed as making 'mistakes' with individual sounds. Rather they were seen as making predictable simplifications within their sound systems. A Canadian Linguist, David Ingram, proposed that the organisation of the sound system involved three aspects:

1. how the sounds are stored in the mind;
2. how the sounds are articulated, and
3. phonological rules or processes that 'map' between the two above.

An example may serve to clarify this somewhat abstract set of ideas. The phonological process of **velar fronting** involves production of the velar consonants k, g and ng as t, d, and n. Accordingly, 'key' is pronounced as 'tea', 'gone' is pronounced as 'don', and 'thing' is pronounced as 'thin'. One theory has it that although the child makes these simplifications when they talk, they know the correct sound in their mind. Therefore the process of velar fronting could be demonstrated as follows, using the word 'car' as an example:

### **UNDERLYING REPRESENTATION**

correctly stored adult version of the word e.g., "car"



### **PHONOLOGICAL PROCESS**

In this example, velar fronting, so "car" becomes "tar"



### **CHILD'S PRODUCTION**

Reflecting the process applied to the adult word,  
so that the child says, "tar" for "car"

## **When is a phonological process considered to be normal?**

Just as crawling is a normal behaviour, so too are “processes”. It is normal for a 10 month old baby to get from place to place by crawling. However, it is considered abnormal if the child is still crawling everywhere (not walking) at the age of three. Similarly, processes occur normally at certain young ages, but their presence is considered to be abnormal if they persist past certain ages.

To use a familiar example: A child under 3 years 3 months who leaves most of the final consonants off words (who says, for example, ‘bow’ instead of ‘boat’) is considered to be behaving normally. If this process of **final consonant deletion** persists past 3 years 3 months then the child’s final consonant deletion may be part of a phonological disability.

Another example would be a child under four who evidenced the normal process of **cluster reduction**, saying, for instance, ‘boon’ instead of ‘spoon’, ‘loud’ instead of ‘cloud’ and ‘guy’ instead of ‘sky’. Before four years of age, this speech behaviour would be developmentally appropriate. After four years most children will no longer have the process, and will no longer be reducing clusters. Such children may still not say all of the consonant clusters perfectly, though. Some will continue to replace the sounds l and r with w or y, so that they say things like ‘bwoo’ instead of ‘blue’ and ‘byack’ instead of ‘black’.

The following *Chronology of Processes* table, based on the research of another Linguist, Pamela Grunwell in the north of England, provides examples of some of the most familiar phonological processes that occur in normal children’s speech, and the ages beyond which they are no longer considered normal.

## Chronology of Phonological Processes in Normal Speech Sound Development

PHONOLOGICAL PROCESS	EXAMPLE		GONE BY APPROXIMATELY	
Context Sensitive Voicing and word-final de-voicing	pig pig car	= pick = big = gar	3 years	
Final Consonant Deletion	boat up soon	= bow = uh = soo	3 years 3 months	
Fronting	car go ship	= tar = doe = sip	3 years 6 months	
Consonant Harmony	mine kittycat	= mime = tittytat	3 years 9 months	
Weak Syllable Deletion	elephant potato television banana	= efant = tato = tevision = nana	4 years	
Cluster Reduction	spoon train clean	= poon = chain = keen	4 years	
Gliding of Liquids	run leg leg	= one = weg = yeg	5 years	
Stopping	/ f / / s / / v / / z / sh j ch th th	fish soap very zoo shop jump chair thing that	= tish = dope = berry = doo = dop = dump = tear = ting = dat	3 years 3 years 3 years 6 months 3 years 6 months 4 years 6 months 4 years 6 months 4 years 6 months 5 years 5 years

ALL PHONOLOGICAL PROCESSES ARE NORMALLY GONE BY 5 YEARS OF AGE

(This table is based on the work of Pamela Grunwell, 1981)

## **Speech Pathology Intervention**

Treatment of phonological disability by a speech-language pathologist may take a number of forms, depending on the theoretical orientation of the therapist. The type of therapy outlined here is usually termed *Phonological Therapy*.

Phonological therapy is based on the view that the organisation of the sound system involves the three aspects previously described:

- (1) how the sounds are stored in the mind;
- (2) how they are articulated by the child; and,
- (3) the phonological processes or "rules" that map between the mind and the mouth.

This perspective leads to the belief that therapy approaches which attempt to deal with the problem of phonological disability at all three levels will be the most efficient and effective, provided that the child shows sufficient readiness.

## **Readiness**

'Readiness' is a term which refers to a person's developmental and cognitive preparedness to learn something, or profit from some experience. So, for example, 'reading readiness' implies that a person has acquired certain skills which will make teaching them to read a successful undertaking. The term is applied in speech in relation to a child's gradual learning of the complex skill of talking like an adult.

Speech sounds are learned by children in a fairly predictable order and at certain ages. Among the earliest sounds to emerge in speech are p, b, m, w, and h; later come sounds such as f, s, sh, and ch, and later still l and r, with th usually emerging last of all. If someone told a speech-language pathologist that they were concerned that their three year old was saying f instead of th (e.g., 'fick' for 'thick'), they would probably be told that this was normal for a child of that age. It would be explained that a three year old is not usually *developmentally ready* to use the th sound in ordinary talking or to correct the way they made the sound.

A researcher in the United Kingdom, Nigel Hewlett (1990), summarised the four conditions that had to be present before a child could be considered ready to 'revise' or correct the way they made a speech sound. He believed that:

1. the child had to be aware that they were making the particular mistake (for example replacing sounds made with the back of the tongue with sounds made at the front);
2. the child must have the desire to change their current way of talking;
3. the child must have knowledge of the required 'targets', that is, the correct sounds; and,
4. the child's 'vocal apparatus' (larynx, tongue, lips etc.) must have sufficient dexterity to use the newly learned sounds at speed, and in a variety of phonetic contexts.

## **Assessment**

Assessment of communication skills is the first stage in managing phonological disability. With three and four year olds it is customary for a care giver (usually the child's mother) to observe testing. This provides support for the child and saves a great deal of explanation. Most importantly it means that the parent/s are involved meaningfully in therapy from the outset. The tests and other assessment procedures used by the speech-language pathologist in the initial assessment are administered with the aim of determining how the child is developing generally in the areas of voice, speech, language and fluency. Once this is done, more detailed assessment and analysis of the child's particular system of speech sounds, that is, the *Phonological Assessment*, is made.

Assessment is an ongoing aspect of the management of phonological disability. The speech-language pathologist continually assesses progress throughout therapy, in order to plan the next step. Phonological assessment involves writing down phonetically the way the child pronounces all the speech sounds in English in words. This involves taking a sample of the way child says individual words, and then the way they pronounce words during normal conversation. The speech sample, or *phonological sample*, is then analysed. The analysis entails establishing the developmental level of the child's speech, the sounds present in and absent from the sample, and the *regular patterns of non-adult speech sounds*. The sound patterns are then examined in detail for signs of whether the child is 'improving', or whether the phonological patterns are stable, and the child seems 'stuck' at a particular level.

The regular sound patterns are called **phonological processes**. Phonological processes include the normal speech 'errors' that very young children make, such as leaving sounds out of words or simplifying them in some way. For example, a two year old with normal speech will say 'wor' for 'water' or 'oon' for 'spoon'; and a normal three year old will say 'sip' and 'ship' 'lellow' for 'yellow' or 'aminal' for 'animal'. In children with phonological disability, these normal developmental 'errors' seem to persist for longer.

## **The questions families often ask about phonological therapy**

### **1. What does the therapy approach involve?**

Every *phonological therapy programme* is individually geared to the needs of each child. Every programme comprises the following interacting components:

1. Parent education, which involves parents learning, as therapy progresses, a set of skills and techniques to use at home to help their child's speech.
2. Metalinguistic training (or learning to talk and think about language), which involves child, parents and therapist, talking and thinking about speech sounds and the way they are organised to convey meaning. This is done mainly through games and activities during therapy sessions, and at home.
3. Phonetic production training, which involves the therapist teaching the child how to make the sounds they have difficulty with, and parents working with the child at home with listening and talking games and activities.
4. Multiple exemplar training, which involves parent and therapist reading word-lists to the child, and the child learning to sort words (pictured on playing cards) according to their sound properties.
5. Homework.

These components are introduced gradually, in simple language that children can understand.

### **2. Can you tell how long therapy is likely to take?**

As a general rule, children with phonological disability receiving this therapy attend in therapy blocks of 10 once weekly 40 to 45 minute sessions. Most of the children require two or three therapy blocks, 10 weeks apart (i.e., 10 weeks on / 10 weeks off / 10 weeks on again / 10 weeks off .....). Sometimes the blocks and breaks vary a little in length. Children who are progressing slowly or who have severe problems may require more therapy.

### **3. Why not attend continuously until the phonological problem resolves?**

There are several reasons for breaking the therapy regime into blocks. First, it is believed that children learn new skills more efficiently if they are taught intensively for a period, and then given “space” for the new learning to consolidate, before going on to the next thing. Second, planned breaks allow for natural “plateaus” that occur when new skills are being learned. Third, the breaks make way for other types of learning, in other areas of development, to take place. Fourth, it helps prevent the child and the adults involved from becoming unmotivated through going on too long without a “holiday”. And, fifth, and perhaps most importantly, it allows space for the child to generate new phonological learning independently.

### **4. Will my child's speech eventually be normal?**

Almost certainly, yes. Phonological Disability is regarded as a temporary delay or deviation in an essentially normal speech processing and production mechanism. It is a problem which has been successfully treated by speech-language pathologists since the 1930's.

### **5. What would happen if we let nature take its course?**

This is one of the most frequent questions parents ask, and the truth is, we don't really know the answer. What we *think* is, that children with phonological disability would slowly develop reasonably clear speech, if they didn't have therapy, but would continue to have difficulty pronouncing certain sounds, perhaps even for a lifetime. One concern is, that having to interact with others at preschool and school, and in other social settings, with poorly intelligible speech, carries with it various social penalties and frustrations. A second concern is that there is experimental evidence to show that children with phonological disabilities are likely to exhibit later learning disabilities, especially in the areas of reading and spelling. Both of these concerns have implications for self esteem and adjustment.



## **6. What causes phonological disability?**

Once again, the answer is that we don't know precisely. Research to date suggests five possible causes, which may occur singly or in combination. You will notice that each of these five causes relates to factors within the child (not to the way they are being raised).

1. the child is overwhelmed by the complexity of the sound patterns of the language they are learning, and is unable to abstract new information from the speech environment;
2. the child's speech maturation (readiness) may be severely delayed;
3. the restricted speech system becomes "habit", suppressing further speech maturation;
4. the child has poor perception and awareness of how their speech sounds, and the difficulty other people have understanding them when they talk;
5. the child has a specific difficulty initiating changes in their sound system, and knowing how to organise their sound system in a consistent way.

## **7. Could I be responsible for causing this speech problem? Or is it laziness or attention seeking?**

We do not think that phonological disability is produced by factors such as the way the child is talked to, whether he or she has stories read to them or not, imitating the speech of another child or particular parenting styles. It is not seen as a sign that the child might be lazy or attention seeking.

**8. Will s/he get lazy if others interpret?**

No. It is hard work trying to communicate when you have a phonological disability. It is helpful and supportive of siblings to interpret for adults what the child with unclear speech is saying. Although they don't realise it, every time they "clarify" a word, they are providing a correct model (see notes on modelling corrections).

**9. Should we insist on speech all the time?**

No, if his/her gestures, sound effects, and other ingenious ways of getting around the problem are effective communicatively, and are not disruptive, put up with them. Every time the child succeeds in letting you know what he/she means, he or she is having a communicative success, and that is very important.

**10. Is there a genetic connection?**

There is clinical evidence to indicate that phonological disability may "run in families". Children with phonological disability are quite likely to have a close relative who had a speech or language delay, a developmental communication disorder, a language based learning disability, or stuttering. However, it is also common to find that the phonologically disabled child has siblings with perfectly normal speech for their ages.

### **11. Should we have waited longer before having an assessment?**

Probably the best time to address any problem is as soon as it starts to bother you. speech-language pathologists are usually keen to assess children's speech and language development, and advise about the need for help, as soon as their parents voice concern (caseload pressures permitting). By three years of age a child's speech should be 75 to 100% intelligible to parents. Parents are consistently accurate in identifying developmental difference in their own children. Remember that speech-language pathologists are the only professionals uniquely qualified to assess speech and language. As parents, trust your own judgment, and don't be guided by the advice of a professional who is not qualified to give an expert opinion!

### **12. Should we be setting a better example?**

Providing a good "model" for speech development is helpful to the child's progress. It is well recognised that children learn by example. If you talk rapidly and allow little opportunity for interruption, or for the child to take a conversational turn, it is quite likely that they will speak fast too. Although it can be a bit wearing for the listener, speaking fast is not a problem in itself. However, a child with a phonological disability who also talks too quickly, will be more difficult to understand, and probably more difficult to correct. They will certainly have more problems noticing their own speech errors. In effect, rapid speech complicates the situation. Slowing your own speech down, if it is too fast, helps the child to hear in better detail how the sounds in language are organised, and where the boundaries between words occur.

### **13. Can correcting speech errors have a negative effect too?**

This is an important point that is sometimes overlooked. Consider this: most children with phonological disability must have something done about their speech in order to get them communicating effectively without struggling, and to reduce their communicative frustration. The potential for “hang-ups” about failure to communicate seems rather more of a problem, than not liking to be corrected.

Having our speech errors corrected by a caregiver while we are children provides the basis for learning to self-correct, just as being controlled in terms of behaviour generally provides the basis for learning self-control. No-one likes the idea of correcting and controlling children, unless it is done by example, with sensitivity and good humour. If the right balance can be struck between correcting errors, praising success, and letting some errors “pass”, the child’s self esteem will not suffer. Correcting and praising lets the child know you are listening, that you care how they are doing, and that you are there to help.

## **Constituents of the Therapy Model**

The particular therapy regime being tested in the Phonological Therapy Research Project involves five interacting components: (1) parent education and training, (2) metalinguistic training, (3) phonetic production training, (4) multiple exemplar training, and (5) homework. The first four components are described below.

### **1. Parent Education and Training**

As well as involving a general grasp of the normal process of speech development, already outlined, the “parent information” component of the therapy approach incorporates the learning of a series of simple strategies and concepts to apply at home in ordinary conversation, and during “homework” sessions. These strategies and concepts are explained in the following sections.

### **2. Metalinguistic Training (Talking and Thinking ABOUT Talking)**

When a child asks, “What does that word mean?”, or says, “I can’t say that word. It’s too hard”, or comments, “That’s a funny name”, they are using their metalinguistic skills. They are using language to talk about language. When we, as parents, say things like, “Say that again clearly for me”, or “Do you know what that’s called?”, we are not only using metalanguage, but also modelling its use for the child. Usually without realising it, caregivers constantly employ metalanguage in talking with children (and other adults).

In phonological therapy, the child is helped to learn about various properties of sounds and words, and to actively explore the way language is organised. They are helped to think about sounds and words, discover rhymes, and other sound patterns, to understand the idea of a word “making sense” or not, and to understand what is needed if speech is going to be used adequately to communicate. The child makes discoveries about language through games, activities and discussion with therapist and parents.

### **3. Phonetic Production Training (learning to say sounds in words)**

This component of the therapy regime is more of a feature for some children than it is for others. Some children with phonological disability can already say all the speech sounds during connected speech, but in a disorganised way. They need relatively little phonetic production training, and therapy tends to focus on the re-organisation of their sound system, and getting all the sounds into the "right spot". Other children can make all the sounds, but not when they are conversing. They need help to learn how to incorporate sounds that they can already produce, into their ordinary speech. Still others have a very limited number and range of sound-types that they can actually produce. They must be taught to make the sounds before they can begin working them into their sound system for normal speech. Phonetic production training involves learning and practising with the therapist, and a certain amount of formal, supervised (by a parent) home practice.

### **4. Multiple Exemplar Training (Listening to sounds in words)**

Multiple Exemplar Training involves two techniques - auditory bombardment and minimal contrasts therapy

#### **4a. Auditory Bombardment**

Auditory bombardment provides concentrated exposure to a particular sound, sound pattern or word type. All it involves is the therapist or parent reading a word list to the child, while they listen quietly. The word list might comprise 10 to 15 words with common phonetic features (e.g. all starting with 's' or all ending with a particular class of consonants such as the voiceless plosives /p/, /t/ and /k/, see below).

e.g., "Listen while I say these words to you: sea, soap, circle, sew, sign, seed, soak, seat, save, sack, sit, sun". or "Listen, back, bite, lip, like, fat, cup, soak, let, sip, tick, sit, soap".

Alternatively, an auditory bombardment list might comprise 6 to 10 contrasting pairs of words, as in the four examples listed below:

<b>List 1</b>		<b>List 2</b>		<b>List 3</b>		<b>List 4</b>	
lie	light	go	glow	car	tar	sip	ship
bow	boat	sew	slow	call	tall	see	she
high	hide	cap	clap	can	tan	sell	shell
tie	time	bow	blow	com	torn	sock	shock
row	road	pain	plane	cub	tub	sip	ship
moo	moon	back	black	key	tea	save	shave
way	wave	cub	club	cap	tap	sell	shell

Again, all the child has to do is listen while the adult says the words. Sometimes the child is shown pictures of the words, and sometimes not.

#### **4b. Minimal Contrasts Therapy**

Minimal contrasts therapy incorporates auditory bombardment using word pairs, and various other activities and games in which the child is made more aware of small differences between words.

## **Special Techniques**

The following notes relate to therapy techniques and ways of encouraging speech development in children with phonological disability. They do not necessarily apply generally to all children learning language.

### **1. Modelling (Setting an example)**

“Modelling” is a term that speech-language pathologists use to refer to the process of saying a sound, word, phrase or sentence for someone to imitate. Modelling is something that is done deliberately during therapy when the therapist says to the child “Say this the way I do”, and then gives an example of what they want the child to say. Parents do it constantly also, formally, when they ask their child to pay attention and then imitate, and informally all the time they are talking to the child. In a way, parents are their children’s primary “speech models”.

### **2. Modelling Corrections**

Modelling corrections are the preferred way of guiding correct speech while the child still has significant problems making themselves understood to people outside the immediate family. A modelling correction is one in which a parent, teacher or therapist hears an error, and then repeats what the child should have said, once or twice or three times after them, sometimes giving the relevant sounds or words a little extra emphasis, without expecting them to repeat the word or sentence again.

Child: When can I ride in the bow?

Adult: When can you ride in the boat?  
Boat.  
In a minute when it's your turn.  
It's a good boat isn't it? ..... and continue with the  
conversation in the normal way .....

Child: Tan I use your tea?

Adult: Can you use my key?  
You sure can.  
Don't forget it's my key though! ..... and go on with the  
conversation without asking the child to imitate the way  
you said the words .....



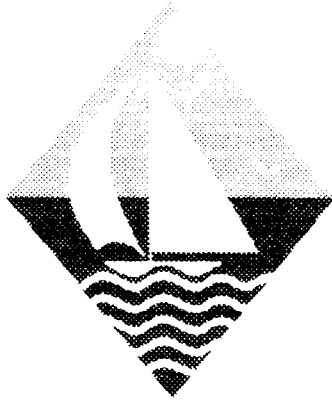
If you stop the conversation and ask the child to “repeat” it not only interrupts your conversation, but also interrupts the child’s opportunity to listen to and gradually “file” the correct version of the word. Also, continual requests for “repeats” eventually frustrate both the phonologically disabled child, and the adult who is attempting to guide them.

There *may* sometimes be a place for the “say that again properly so that I can understand you” approach - but not during the period when the child still has a lot of sorting out to do with their sound system. In fact, most children don’t require much of this style of correction, as they quickly catch on to the idea of making self-corrections, especially if they are praised for doing them (see revisions and repairs below).

### **3. Revisions and Repairs (Self-corrections, or fixed-up-ones)**

As adult speakers, we continually make little mistakes when we speak. We barely notice these mistakes at a conscious level, but quickly correct ourselves, on-line, and go on with what we are saying. The process of doing this is called making revisions and repairs, and it is made possible because we have the ability to monitor our speech (i.e., listen to ourselves critically). Children with phonological disability are generally not very good self-monitors or self-correcters. This is probably partly because they don’t know where to start.

When your child is *ready* (remember, “developmental readiness”) the idea of a “fixed-up-one” will be introduced by *talking about* (using metalinguistic skills) the process of noticing speech mistakes, saying the word again more clearly. Here is an example of the way the ideas might be introduced, using pictures to help the child follow the discussion.



"Listen to this! If I accidentally said bow, when I wanted to say boat it wouldn't sound right. I would have to fix it up and say boat, wouldn't I?". Did you hear that fixed-up-one? First I said 'bow', then I fixed it up and said 'boat'."



"Listen, if I said 'tat' it wouldn't sound right. I would have to fix it up and say 'cat'."



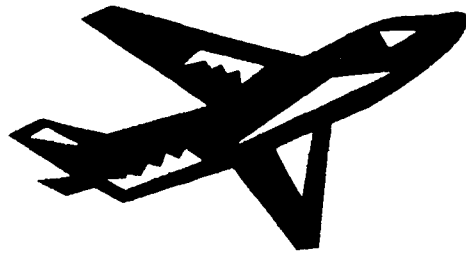
"If I said 'buff-eye', instead of 'butterfly', I would have to do a fixed-up-one again. I would have to think to myself not 'buff-eye', it's '*butterfly*'. Did you hear that fixed-up-one?".



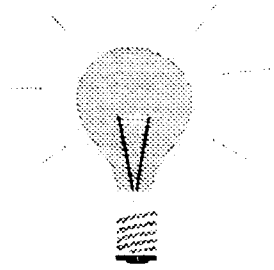
"'Tup of toffee' isn't right is it. I need to do a fixed-up-one and say, 'cup of coffee'."



"Uh oh! I had better not say 'hort'! I have to fix it up and say 'horse' very carefully."



"What would I have to do if I accidentally said 'aero-pane'? I would have to do a ....." (fixed-up- one).

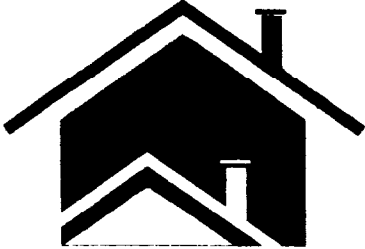
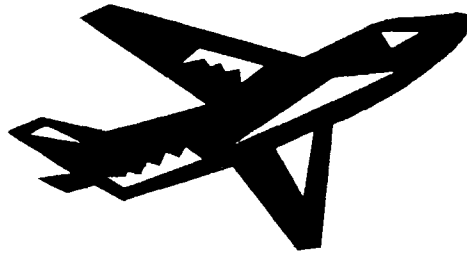


"Would I have to do a fixed-up-one if I said 'wite' for this one?"

#### 4. Judgement of Correctness

Before a child can perform a revision and repair, they must, of course, be able to recognise various types of speech 'errors', or the differences between their own sounds and the adult target sounds. One way of enhancing the ability to notice these speech differences, which is often poorly developed in phonologically disabled children, is by playing "judgement of correctness" games. This involves the child taking the role of "teacher" and listening for your (i.e., the adult's) errors. Here is an example of this technique applied to the process of final consonant deletion. Note that all the child is expected to do is judge whether the words are said correctly or incorrectly. They do not have to say the words at all.

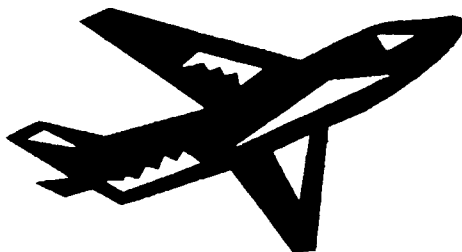
"Here are some pictures of words that all have a sound at the beginning and a sound at the end. Listen: cat, cup, plane, roof. Now you be the teacher, and tell me if I say the words the right way or the wrong way ca-, cu-, plane, roo-". Note that the child does not have to tell you what you *should* have said. All they have to do is *judge* whether you were right or wrong.



Another way of playing the judgement of correctness game is to play a game of "silly sentences". This time the child has to judge whether a sentence makes sense or not. For example, the following sentences might be used when working on the process of cluster reduction:



"You be the teacher, and tell me if this is a good sentence or a silly sentence. The racing driver saw the flags/pwags".



"Be the teacher again, and tell me how this sounds. The pane can fly in the sky". (or "The plane can fie in the sky" or "The plane can fly in the sigh").

## 5. Reinforcement

A learned behaviour is encouraged, strengthened or reinforced whenever a "reward" such as praise, or special acknowledgment of the behaviour occurs. For example, saying, "That's nice and tidy" when a child puts their things away is a verbal and social reward and reinforces tidy behaviour. Most parents use this technique for fostering desirable behaviour, constantly. Parents seem to do this very naturally, without special training over and above the "training" or modelling they received, themselves, as children.

If a child is told, "You can watch TV when you have tidied your toys", a contingent reinforcement is being proposed. The child knows that the reward of watching TV is contingent upon tidying. In phonological therapy, reinforcement and contingent reinforcement are in continual use during formal therapy sessions, and informally at home. Here are some examples:

### 5a. Labelled Praise

Specific praise, or "labelled praise" as it is sometimes called, is a powerful means of reinforcement. The more specific the praise, the more effective it is likely to be. For instance, "You said that nicely" would be less powerful than, for example, "You said 'car' well that time, with a good 'k' at the beginning of it. I heard you say car". In the latter example the behaviour being admired is nominated specifically (hence '*labelled*' praise).

As well as being used to reinforce correct pronunciation, labelled praise can be used to encourage the process of self-correction, or making revisions and repairs. Again, it will work best if it is made specific, for example, "That was good! First you said "drive in the tar", and then you remembered, and said, "Drive in the car".

Children's use of metalanguage can also be reinforced, by commenting favourably, and specifically when they talk and muse about language, for example, "You are good at thinking up words that rhyme with each other".

## **5b. Tokens**

The speech-language pathologist may introduce a system of giving the child small rewards, such as ticks on a page, or 'points' for getting something right. These ticks or points or other tokens may then accrue to a level where the child receives a larger reward. For example, 20 ticks, or, 20 points, might equal a smiley stamp or an achievement sticker.

## **5c. Rewarding Homework**

After the novelty of having a speech book, new games to play at home, and special one-to-one homework time with a parent (or parents) wears off - and it certainly doesn't wear off in every case - the child may need a reward for doing the homework. Children will do a certain amount of work for the pleasure of it, and because they enjoy adult attention. However, they can become bored and resentful. It is pointless trying to tell a three or four or five year old that the homework is for their own good! They usually seem to understand that at a simple level anyway, but that doesn't make it any easier for them to tolerate daily practice unless there is a good reward to look forward to. It is simply not fair to expect them to love doing something related to what is probably their most difficult and frustrating developmental area. Ways of making homework time enjoyable that people have said were successful for them include:

1. finding ways of enjoying it yourself, really letting your child know that you take pleasure in the special time with them;
2. sandwiching the speech homework between two favourite story books;
3. doing the speech homework first thing, in bed with parents;
4. combining the homework with creating something with Lego™ - do some words - do some Lego™ - and so on;
5. take the homework to a favourite place sometimes, and do it there (e.g. to a park);
6. promise a special treat if the homework is done without grumbling a certain number of times (e.g. cut a picture of a hamburger, or other favourite, into six. Give the child a section after each practice. When they have collected all six - they get the real thing!)

## Some Important Points

Constantly model correct speech, praise self-corrections and reinforce your child's own efforts to speak more clearly by being encouraging. Ask the therapist for clarification if there is any aspect of the homework that you do not understand.

Be as positive as you can be about coming to therapy appointments and doing homework. Remember that the therapist understands that neither you nor your child would be coming unless *you* felt it was necessary. If you are feeling ambivalent about coming, or concerned about management or progress, the child will detect it. Talk about it with the therapist. Discuss any difficulties concerning the child's co-operation or reluctance to come to therapy, with the therapist - but discreetly. Sometimes it is better to telephone than to talk about the child's unwillingness in front of them. Most children coming to therapy will go through a "reluctant" stage, which parents usually negotiate quite quickly. Parents too, can go through a "slump" when they feel overloaded by the practical aspects of coming, on top of other responsibilities, or worried about progress.

Show your child's pre-school teacher the speech book, and encourage them to have a discussion with the therapist about follow-up at pre-school. Good pre-school liaison is invaluable. Share the responsibility for therapy and homework with your spouse, and other family members (e.g., grandparents) if that is possible. Children usually love both parents being involved with homework. It can also be a thrill (and a boost to motivation and progress) to be brought to therapy occasionally by the parent who doesn't usually come. Every now and then make the therapy day special - come by train instead of by car - have a special treat after therapy - or some other little reward.

Make it a golden rule never pretend you don't understand what your child is saying, when you *do*, and never pretend you do understand, when you *don't*.

*Language learning is a gradual process. Expect progress to be gradual.*



## **‘Notes for Families and Teachers’**

### **References**

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## **APPENDIX B**

### **CONSENT FORMS**

**NOTE:**

1. THE AUTHOR, CAROLINE BOWEN, PRACTICES AS CAROLINE WALSH SPEECH-LANGUAGE PATHOLOGIST.
2. THE ATTACHMENT REFERRED TO IN THE CONSENT FORMS WAS PAGE 281 OF APPENDIX A.



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IN REPLY PLEASE QUOTE

### **PHONOLOGICAL THERAPY STUDY**

Thank you for agreeing to take part in the Phonological Therapy Study which forms part of my research for a PhD degree at Macquarie University.

The aim of the study is to assess the effectiveness of a particular therapy approach with children whose speech is unintelligible or very difficult to understand for people outside the immediate family. Also, as part of the study, I will be comparing the changes, if any, that occur in the speech of a group of children who are not receiving therapy, with the changes that happen in the speech of the children who are having therapy. All the children participating in the study have what is termed a Phonological Disability (see attached).

The therapy approach being studied is one that has been used successfully by myself, and which is known to result in intelligible speech. The approach involves some six to eight therapy procedures. What has not been previously investigated is which procedures work best with which children, and why.

From the point of view of you, as parent/s, and your child receiving therapy, the intervention programme will not be any different from the therapy programmes for other phonologically disabled children attending my clinic. From my point of view as therapist/researcher, the procedures will be different in that I will have to keep more detailed records of your child's participation and progress, in order to complete my research in a proper and scientific manner.

Confidential records will be kept at the 2 St John's Avenue, Gordon, clinic in the usual way. However, all research notes will be kept separately from any identifying information, ensuring confidentiality.

If you begin to take part in the study, and then change your minds, you may withdraw at any time, without prejudicing your child's continued therapy.

Caroline Walsh  
Speech Pathologist  
Principal Investigator

Telephone 498 8200

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### **INFORMED CONSENT FORM**

I/WE HAVE READ THE ABOVE AND GIVE MY/OUR CONSENT TO PARTICIPATE IN THE STUDY

CHILD'S NAME.....

MOTHER'S NAME.....

SIGNATURE.....DATE.....

FATHER'S NAME.....

SIGNATURE.....DATE.....

DO YOU WISH TO RECEIVE A COPY OF THE SPEECH EVALUATION? YES NO

DO YOU WISH TO RECEIVE A COPY OF THE FINDINGS OF THE STUDY? YES NO



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IN REPLY PLEASE QUOTE

## 3 AND 4 YEAR OLD CHILDREN ON SPEECH THERAPY WAITING LISTS STUDY

Thank you for agreeing to take part in the 3 and 4 Year Old Children on Speech Therapy Waiting Lists Study which forms part of my research for a PhD degree at Macquarie University.

The groups of children I am interested in studying all have what is termed a Phonological Disability (see attached). One aim of the study is to compare the changes, if any, that occur in the speech of a group of children who are not receiving therapy, with the changes that happen in the speech of children receiving therapy.

It is known that some children whose speech is unintelligible or very difficult to understand when they are three or four years old, go on to develop easily understood speech by the time they reach school age, without professional Speech Pathology help. However, we have no way of knowing which children will outgrow their problems with speech clarity, and which will not. Accordingly, another aim of the study will be to look for ways of predicting who will be the "improvers" and who will require therapy in order to improve.

Each child in the Waiting Lists Study will be assessed to determine whether they have a Phonological Disability. Those who do will be reassessed no less than 10 weeks and no more than 30 weeks later, provided that they have not had more than 6 hours speech therapy in that period. The results of each assessment will be provided to parents and, with your permission, to the relevant Speech Pathology Department the child is waiting to attend. As part of the second assessment you will be asked questions about the solutions you have attempted to improve your child's speech intelligibility.

If you begin to take part in the study, and then change your minds, you may withdraw at any time, without prejudice. The study is concerned with group trends, and your names and other identifying material will not be used, ensuring confidentiality.

Caroline Walsh  
Speech Pathologist  
Principal Investigator

Telephone 498 8200

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### INFORMED CONSENT FORM

To be completed by one or both parents

I/WE HAVE READ THE ABOVE AND GIVE MY/OUR CONSENT TO PARTICIPATE IN THE STUDY

CHILD'S NAME.....

MOTHER'S NAME.....

SIGNATURE.....DATE.....

FATHER'S NAME.....

SIGNATURE.....DATE.....

## APPENDIX C

### RELIABILITY

TABLE 39

Reliability of Phonetic Transcription

Phoneme by Phoneme Comparison of Phonetic Transcription of 10% of each Initial Speech Sample

(41% of the Sample = Vowels & 59% of the Sample = Consonants)

Treatment Subjects	Inter-observer Agreement	Control Subjects	Inter-observer Agreement
	%		%
1T	90	15C	85
2T	92	16C	89
3T	89	17C	88
4T	91	18C	84
5T	90	19C	81
6T	82	20C	76
7T	75	21C	78
8T	89	22C	75
9T	88		
10T	86		
11T	75		
12T	79		
13T	75		
14T	76		
Mean	84		82

TABLE 40

Reliability of the Identification of Phonological Deviations

Treatment Subjects	Inter-observer Agreement	Control Subjects	Inter-observer Agreement
	%		%
1T	100	15C	100
2T	100	16C	100
3T	100	17C	100
4T	100	18C	91
5T	100	19C	100
6T	100	20C	85
7T	100	21C	80
8T	85	22C	100
9T	85		
10T	100		
11T	100		
12T	100		
13T	100		
14T	100		
Mean	97.8		94.5

TABLE 41

Reliability of Percentages of Occurrence of Phonological Deviations

Treatment Subjects	Inter-observer Agreement	Control Subjects	Inter-observer Agreement
	%		%
1T	91	15C	82
2T	99	16C	89
3T	87	17C	88
4T	88	18C	91
5T	88	19C	95
6T	91	20C	80
7T	88	21C	99
8T	96	22C	83
9T	92		
10T	88		
11T	99		
12T	99		
13T	89		
14T	95		
Mean	92		88

## APPENDIX D

### Scores from the Task Study

**TABLE 42**  
**Results of the Four Tasks of Metalinguistic Awareness and Phonological Processing**

Subject	Task 1 Initial # correct	Task 1 Probe # correct	Task 2 Initial # correct	Task 2 Probe # correct	Task 3 Initial # correct	Task 3 Probe # correct	Task 4 Initial # correct	Task 4 Probe # correct
1T	3	9	3	3	0	2	9	9
2T	3	9	2	3	0	2	10	12
3T	3	9	1	5	0	3	2	8
4T	1	9	0	0	0	2	0	10
5T	2	9	0	0	0	2	12	12
6T	4	9	0	12	0	3	12	12
7T	2	9	1	3	0	2	0	10
8T	1	9	0	0	0	0	0	4
9T	2	9	0	0	2	3	4	12
10T	2	9	0	0	0	1	0	6
11T	0	9	0	0	0	0	0	0
12T	3	9	3	12	0	3	12	12
13T	2	9	0	6	0	3	0	0
14T	2	9	0	0	0	2	0	0
15C	4	4	0	3	1	1	12	12
16C	2	3	0	0	0	0	0	0
17C	2	2	0	0	0	0	4	6
18C	4	3	3	12	0	3	12	12
19C	2	3	0	0	0	0	0	4
20C	2	4	0	0	0	0	0	0
21C	0	0	0	0	0	0	0	0
22C	3	4	4	4	0	0	4	6



### Results of Task 1

## RHYME MATCHING

[illegible]

TABLE 44  
Results of Task 2

[+ denotes correct response]

# PHONEMIC ONSET MATCHING

Subject	jelly	giraffe	jumper	hat	horse	nose	sun	sock	soup	boat	ball	bike	Total
1T I	+				+		+						3
1T P	+	+									+		3
2T I				+	+								2
2T P										+	+	+	3
3T I	+												1
3T P	+						+	+			+	+	5
4T I													0
4T P													0
5T I													0
5T P													0
6T I													0
6T P	+	+	+	+	+	+	+	+	+	+	+	+	12
7T I													0
7T P							+	+	+				3
8T I													0
8T P													0
9T I													0
9T P													0
10T I													0
10T P													0
11T I													0
11T P													0
12T I						+	+	+					3
12T P	+	+	+	+	+	+	+	+	+	+	+	+	12
13T I													0
13T P	+	+	+							+	+	+	6
14T I													0
14T P													0
15C I													0
15C P							+	+	+				3
16C I													0
16C P													0
17C I													0
17C P													0
18C I	+	+	+										3
18C P	+	+	+	+	+	+	+	+	+	+	+	+	12
19C I													0
19C P													0
20C I													0
20C P													0
21C I													0
21C P													0
22C I							+	+	+			+	4
22C P							+	+	+			+	4

**TABLE 46**  
**Results of Task 3**

[+ denotes correct response]

# **WORD STRUCTURE SORTING**

SUBJECT	go pie	goat pile	pea sew	peep soap	cow four	couch fork	TOTAL CORRECT
1T I							0
1T P		+				+	2
2T I							0
2T P		+				+	2
3T I							0
3T P		+		+		+	3
4T I							0
4T P				+		+	2
5T I							0
5T P				+		+	2
6T I							0
6T P		+		+		+	3
7T I							0
7T P		+				+	2
8T I							0
8T P							0
9T I				+		+	2
9T P		+		+		+	3
10T I							0
10T P				+			1
11T I							0
11T P							0
12T I							0
12T P		+		+		+	3
13T I							0
13T P		+		+		+	3
14T I							0
14T P				+		+	2
15C I				+			1
15C P				+			1
16C I							0
16C P							0
17C I							0
17C P							0
18C I							0
18C P		+		+		+	3
19C I							0
19C P							0
20C I							0
20C P							0
21C I							0
21C P							0
22C I							0
22C P							0

**TABLE 46**  
**Results of Task 4**

**LEXICAL KNOWLEDGE ("sound" and "word")**

<b>SUBJECT</b> <b>I = Initial</b> <b>P = Probe</b>	<b>snake</b> <b># correct</b>	<b>/s/</b> <b># correct</b>	<b>baby</b> <b># correct</b>	<b>/j/</b> <b># correct</b>	<b>tap</b> <b># correct</b>	<b>/u/</b> <b># correct</b>	<b>TOTAL</b> <b>CORRECT</b>
1T I	2	2	2	2	1	0	9
1T P	2	2	2	2	1	0	9
2T I	2	2	2	1	2	1	10
2T P	2	2	2	2	2	2	12
3T I	2	0	0	0	0	0	2
3T P	2	2	2	2	0	0	8
4T I	0	0	0	0	0	0	0
4T P	2	2	2	1	2	1	10
5T I	2	2	2	2	2	2	12
5T P	2	2	2	2	2	2	12
6T I	2	2	2	2	2	2	12
6T P	2	2	2	2	2	2	12
7T I	0	0	0	0	0	0	0
7T P	2	2	2	2	2	0	10
8T I	0	0	0	0	0	0	0
8T P	2	2	0	0	0	0	4
9T I	1	1	1	1	0	0	4
9T P	2	2	2	2	2	2	12
10T I	0	0	0	0	0	0	0
10T P	1	2	1	2	0	0	6
11T I	0	0	0	0	0	0	0
11T P	0	0	0	0	0	0	0
12T I	2	2	2	2	2	2	12
12T P	2	2	2	2	2	2	12
13T I	0	0	0	0	0	0	0
13T P	0	0	0	0	0	0	0
14T I	0	0	0	0	0	0	0
14T P	0	0	0	0	0	0	0
15C I	2	2	2	2	2	2	12
15C P	2	2	2	2	2	2	12
16C I	0	0	0	0	0	0	0
16C P	0	0	0	0	0	0	0
17C I	2	2	0	0	0	0	4
17C P	2	2	0	0	0	2	6
18C I	2	2	2	2	2	2	12
18C P	2	2	2	2	2	2	12
19C I	0	0	0	0	0	0	0
19C P	0	0	0	0	2	2	4
20C I	0	0	0	0	0	0	0
20C P	0	0	0	0	0	0	0
21C I	0	0	0	0	0	0	0
21C P	0	0	0	0	0	0	0
22C I	2	2	0	0	0	0	4
22C P	2	2	2	0	0	0	6

## **APPENDIX E**

### **Border Points Selection for the Severity Index**

#### **Normal Phonology: Index Score 0 (Severity Rating 1.00)**

<b>Row</b>	<b>Rating</b>	<b>Index Score</b>
------------	---------------	--------------------

1	1.00	0
2	1.00	0
3	1.00	0
4	1.00	0
5	1.00	0
6	1.00	0
7	1.00	0
8	1.00	0

#### **Very Mild Phonological Disability: Index Score 1 to 6 (Severity Rating 1.25 to 1.75)**

<b>Row</b>	<b>Rating</b>	<b>Index Score</b>
------------	---------------	--------------------

9	1.25	4
10	1.50	1
11	1.50	1
12	1.50	5
13	1.50	2
14	1.50	7 Misclassified
15	1.50	1
16	1.75	3
17	1.75	5

### **Mild Phonological Disability: Index Score 7 to 16 (Severity Rating 2.00 to 2.75)**

<b>Row</b>	<b>Rating</b>	<b>Index Score</b>
18	2.00	4
19	2.00	7
20	2.00	7
21	2.00	10
22	2.00	9
23	2.00	11
24	2.25	9
25	2.25	10
26	2.25	8
27	2.25	16
28	2.25	7
29	2.50	22 Misclassified
30	2.50	12
31	2.50	14
32	2.50	20 Misclassified
33	2.50	13
34	2.50	21 Misclassified
35	2.50	15
36	2.50	13
37	2.50	19
38	2.50	22 Misclassified
39	2.75	24 Misclassified
40	2.75	16
41	2.75	18 Misclassified
42	2.75	25 Misclassified
43	2.75	18 Misclassified
44	2.75	12
45	2.75	10
46	2.75	17 Misclassified

### **Moderate Phonological Disability: Index Score 17 to 34 (Severity Rating 3.00 to 3.75)**

Row	Rating	Index Score
-----	--------	-------------

47	3.00	19
48	3.00	14 Misclassified
49	3.00	8 Misclassified
50	3.00	32
51	3.25	22
52	3.25	22
53	3.25	17
54	3.25	29
55	3.25	18
56	3.25	16 Misclassified
57	3.25	17
58	3.25	29
59	3.50	17
60	3.50	20
61	3.50	30
62	3.50	21
63	3.50	18
64	3.50	42
65	3.75	22
66	3.75	25
67	3.75	29
68	3.75	22
69	3.75	28
70	3.75	29
71	3.75	26
72	3.75	23
73	3.75	22
74	3.75	31
75	3.75	25
76	3.75	31
77	3.75	19

### **Severe Phonological Disability: Index Score 35+ (Severity Rating 4.00)**

Row	Rating	Index Score
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78	4.00	38
79	4.00	30 Misclassified
80	4.00	49
81	4.00	43

## **APPENDIX F**

**Summaries of Selected Case History Information**

**and**

**Progress Summaries**

**2T, 3T, 5T, 6T, 7T, 8T, 11T, 13T and 14T**



## F 1.0 Case Summary: 2T

TABLE 47  
HISTORY SUMMARY: Subject 2T

HISTORY SUMMARY	Details 2T (FEMALE) Initial Severity Rating 3.75	Comment
Initial Consultation Age	56 months (4;8)	Moderate Phonological Disability.  2T loved therapy. It was very exciting for her to come to a place outside her usual limits.
Initial Severity Index Score	25	
Initial PPVT-R SS	106	
Initial MLUm	5.20	
Consultations	32	Number of Treatments after Probe = 0. Probe Assessment was # 7. Interval between Initial Assessment and Probe was 11 months. Number of Months after Probe that no Deviations were present = 2.
Treatments	25	
Assessments	7	
Duration of Therapy	13 months	
Initial Incidence Category Scores and Phonological Deviations	<u>Category 5: 80 - 100% 2 Phonological Deviations</u> Velar Fronting; Cluster Reduction SIWL. <u>Category 4: 60 - 79% 2 Phonological Deviations</u> Stopping of Fricatives SIWL; Cluster Reduction SFWF. <u>Category 3: 40 - 59% 2 Phonological Deviations</u> Stopping of Affricates SFWF; Gliding of Liquids <u>Category 1: ≤ 19% 1 Phonological Deviation</u> Stopping of Fricatives SFWF 16%	Sum of Deviations = 7  Phonetic Inventory: /m/, /n/, /p/, /b/, /t/, /d/, /h/, /f/, /s/, /z/, /ʃ/, /dʒ/, /w/, /j/  Not stimutable for: /k/, /g/, /ŋ/, /v/, /θ/, /ð/, /ʒ/, /ʎ/, /r/, /ʁ/
Accompanying Family Members	Mother accompanied 2T to 26 consultations, father to 4, and grandmother 2. Siblings attended on 2/32 occasions.	
Homework	60% of homework was with mother and 40% with father. 1 to 1 with teacher: nil. Speech book to preschool < once per week.	12 homework sessions per week.
Therapy Blocks and Breaks	Block 1: 14 Consultations; Break 1: 10 weeks. Block 2: 11 Consultations; Break 2: 11 weeks. Block 3: 7 Consultations.	2T had 14 consultations in the first block because a close family member died, and the parents did no homework for about 5 weeks. They requested extra sessions to make up for the lack of homework.

TABLE 48  
2T's Progress in Therapy

Age	Incidence Category 5 80-100%	Incidence Category 4 60-79%	Incidence Category 3 40-59%	Incidence Category 2 20-39%	Incidence Category 1 ≤ 19%	Sum of Dev's	Severity Index Score	Descriptive Category	Severity Rating
4;8	2	2	2	-	1	7	25	Moderate	3.75
4;11	1	-	3	3	-	7	20	Moderate	3.50
5;1	1	1	3	2	-	7	19	Moderate	3.25
5;4	1	1	-	2	1	4	14	Mild	3.00
5;7	-	-	-	-	1	1	01	Very Mild	1.50

## F 2.0 Case Summary: 3T

**TABLE 49**  
**HISTORY SUMMARY: Subject 3T**

<b>HISTORY SUMMARY</b>	<b>Details 3T (MALE) Initial Severity Rating 2.50</b>	<b>Comment</b>
Initial Consultation Age	46 months (3;10)	Moderate Phonological Disability
Initial Severity Index Score	22	
Initial PPVT-R SS	22	
Initial MLUm	105	
	4.50	
Consultations	12	Number of Treatments after Probe = 0.  Mother was very active in "motivating" 3T to participate in therapy. He did not take much pleasure in therapy sessions or homework, always wanting to be outside playing.
Treatments	9	
Assessments	3	
Duration of Therapy	6 months	
Initial Incidence Category Scores and Phonological Deviations	<u>Category 5: 80 - 100% 2 Phonological Deviations</u> Velar Fronting; Cluster Reduction SFWF <u>Category 4: 60 - 79% 1 Phonological Deviation</u> Cluster Reduction SIWI <u>Category 3: 40 - 59% 1 Phonological Deviation</u> Stopping of Fricatives <u>Category 2: 20 - 39% 2 Phonological Deviations</u> Final Consonant Deletion; Gliding of Liquids <u>Category 1: ≤19% 1 Phonological Deviation</u> Word-Final Devoicing 16%	Sum of Deviations = 7 Phonetic Inventory: WNL
Accompanying Family Members	Mother came to 100% of consultations. Sibling attended all but the Initial Consultation.	
Homework	Half the homework was with mother, and half with father. 1 to 1 with teacher: nil. Speech book to preschool once per week.	Mother kept good records of homework participation. 24 homework sessions per week.
Therapy Blocks and Breaks	Block 1: 11 Consultations. Break 1: 10 weeks. Block 2: 1 Consultation.	

**TABLE 50**  
**3T's Progress in Therapy**

<b>Age</b>	<b>Incidence Category 5 80-100%</b>	<b>Incidence Category 4 60-79%</b>	<b>Incidence Category 3 40-59%</b>	<b>Incidence Category 2 20-39%</b>	<b>Incidence Category 1 ≤19%</b>	<b>Sum of Dev's</b>	<b>Severity Index Score</b>	<b>Descriptive Category</b>	<b>Severity Rating</b>
3;10	2	1	1	2	1	7	22	Moderate	2.50
4;4	-	-	-	-	-	7	0	Normal	1.00

## F 3.0 Case Summary: 5T

TABLE 51: Subject 5T

HISTORY SUMMARY	Details 5T (FEMALE) Initial Severity Rating 2.75	Comment
Initial Consultation Age	50 months (4;2)	Moderate Phonological Disability
Initial Severity Index Score	24	
Initial PPVT-R SS	106	
Initial MLUm	3.17	
Consultations	15	Number of Treatments after Probe = 0. 5T enjoyed therapy, but due to separation anxiety needed her mother to be present in treatment sessions throughout the first 6 sessions.
Treatments	11	
Assessments	4	
Duration of Therapy	7 months	
Initial Incidence Category Scores and Specific Phonological Deviations	<u>Category 5: 80 - 100% 2 Phonological Deviations</u> Stopping of Affricates; Palato-alveolar Fronting <u>Category 4: 60 - 79% 1 Phonological Deviation</u> Cluster Reduction SFWF <u>Category 3: 40 - 59% 2 Phonological Deviations</u> Velar Fronting SIWI; Cluster Reduction SIWI <u>Category 2: 20 - 39% 2 Phonological Deviations</u> Velar Fronting SFWF; Gliding of Liquids	Sum of Deviations = 7  Phonetic Inventory: WNL
Accompanying Family Members	Mother came to 100% of consultations. Sibling attended 14/15.	
Homework	100% of homework was with mother. 1 to 1 with teacher: nil. Speech book to preschool once per week.	Mother kept good records. 5T would volunteer to do homework in order to have 1 to 1 time with mother. 8 homework sessions per week.
Therapy Blocks and Breaks	Block 1: 10 Consultations. Break 1: 10 Weeks.  Block 2: 5 Consultations.	

TABLE 52  
5T's Progress in Therapy

Age	Incidence Category 5 80-100%	Incidence Category 4 60-79%	Incidence Category 3 40-59%	Incidence Category 2 20-39%	Incidence Category 1 ≤ 19%	Sum of Dev's	Severity Index Score	Descriptive Category	Severity Rating
4;2	2	1	2	2	-	7	24	Moderate	2.75
4;5	2	-	-	2	2	6	16	Mild	2.75
4;7	1	-	-	1	-	2	07	Mild	2.00
4;9	-	-	-	-	1	1	01	Very Mild	1.00

## F 4.0 Case Summary: 6T

TABLE 53 : Subject 6T

HISTORY SUMMARY	Details 6T (FEMALE) Initial Severity Rating 2.75	Comment
Initial Consultation Age	51 months (4;3)	Moderate Phonological Disability
Initial Severity Index Score	18	
Initial PPVT-R SS	105	
Initial MLUm	4.00	
Consultations	19	Number of Treatments after Probe = 0.
Treatments	15	
Assessments	4	
Duration of Therapy	10 months	
Initial Incidence Category Scores and Specific Phonological Deviations	<u>Category 5: 80 - 100% 1 Phonological Deviation</u> Velar Fronting <u>Category 4: 60 - 79% 1 Phonological Deviation</u> Palato-alveolar Fronting <u>Category 3: 40 - 59% 2 Phonological Deviations</u> Cluster Reduction; Gliding of Liquids <u>Category 2: 20 - 39% 1 Phonological Deviation</u> Final Consonant Deletion <u>Category 1: ≤19% 1 Phonological Deviation</u> Stopping of Fricatives 15%	Sum of Deviations = 6  Phonetic Inventory complete except for velars /k/, /g/, and /ŋ/; and /t/, for which she was not stimulable.
Accompanying Family Members	Mother came on 18/19 occasions. Grandmother brought 6T once. Sibling attended 17/19.	
Homework	80% of homework with mother and 20% with father. 1 to 1 with teacher once weekly. Speech book to preschool once weekly.	Mother kept good records. 24 homework sessions per week
Therapy Blocks and Breaks	Block 1: 9 Consultations. Break 1: 8 weeks.  Block 2: 9 Consultations. Break 2: 10 weeks.  Block 3: 1 Consultation.	

TABLE 54  
6T's Progress in Therapy

Age	Incidence Category 5 80-100%	Incidence Category 4 60-79%	Incidence Category 3 40-59%	Incidence Category 2 20-39%	Incidence Category 1 ≤ 19%	Sum of Dev's	Severity Index Score	Descriptive Category	Severity Rating
4;3	1	1	2	1	1	6	18	Moderate	2.75
4;7	-	1	-	2	2	5	10	Mild	2.25
4;9	1	-	-	1	-	2	07	Mild	2.00
5;1	-	-	-	-	-	0	0	Normal	1.00

## F 5.0 Case Summary: 7T

**TABLE 66**  
**HISTORY SUMMARY: Subject 7T**

HISTORY SUMMARY	Details 7T (MALE) Initial Severity Rating 3.25	Comment
Initial Consultation Age	57 months (4;9)	Moderate Phonological Disability
Initial Severity Index Score	22	
Initial PPVT-R SS	127	
Initial MLUm	4.00	
Consultations	24	Number of Treatments after Probe = 0
Treatments	20	
Assessments	4	
Duration of Therapy	12 months	
Initial Incidence Category Scores and Specific Phonological Deviations	<p><u>Category 5: 80 - 100% 2 Phonological Deviations</u> /s/ → /h/ SIWI; Weak Syllable Deletion</p> <p><u>Category 4: 60 - 79% 2 Phonological Deviations</u> Cluster Reduction SIWI; Gliding of Liquids</p> <p><u>Category 3: 40 - 59% 1 Phonological Deviation</u> Cluster Reduction SFWF</p> <p><u>Category 1: ≤19% 1 Phonological Deviation</u> Stopping of Fricatives 16%</p>	<p>Sum of Deviations = 6</p> <p>Phonetic Inventory:</p> <p>/m/, /n/, /ŋ/, /p/, /b/, /t/, /d/, /k/, /g/, /f/, /s/, /z/, /ʃ/, /ʒ/, /h/, /ŋ/, /dʒ/, /w/</p> <p>Not Stimulable for:</p> <p>/v/, /j/, /l/, /r/, /θ/, /ð/</p>
Accompanying Family Members	Both parents came to the Initial Consultation. Mother accompanied 7T to 21, and father to 2 consultations.	
Homework	20% of homework was with mother and 80% with father. 1 to 1 with teacher once per week. Speech book to preschool once per week.	12 homework sessions per week.
Therapy Blocks and Breaks	<p>Block 1: 14 Consultations. Break 1: 11 Weeks.</p> <p>Block 2: 9 Consultations. Break 2: 9 weeks</p> <p>Block 3: 1 Consultation.</p>	7T had 14 consultations in the first block. Having co-operated in the Initial one (which both parents attended) he refused to speak for the next 3! His father accompanied him to the following one, from which time 7T participated well.

**TABLE 66**  
**7T's Progress in Therapy**

Age	Incidence Category 5 80-100%	Incidence Category 4 60-79%	Incidence Category 3 40-59%	Incidence Category 2 20-39%	Incidence Category 1 ≤19%	Sum of Dev's	Severity Index Score	Descriptive Category	Severity Rating
4;9	2	2	1	-	1	6	22	Moderate	3.25
4;11	-	2	1	1	1	5	14	Mild	2.50
5;2	-	-	1	2	1	4	08	Mild	2.25
5;8	-	-	-	-	2	2	05	Very Mild	1.75

## F 6.0 Case Summary: 8T

TABLE 67  
HISTORY : Subject 8T

HISTORY SUMMARY	Details 8T (FEMALE) Initial Severity Rating 2.75	Comment
Initial Consultation Age	35 months (2;11)	Moderate Phonological Disability.  8T enjoyed therapy.
Initial Severity Rating	2.75	
Initial Severity Index Score	25	
Initial PPVT-R SS	94	
Initial MLUm	3.40	
Consultations	24	Number of Treatments after Probe = 4. Probe Assessment was # 4. Interval between Initial Assessment and Probe was 10 months. Number of Months after Probe that no Deviations were present = 7.
Treatments	19	
Assessments	5	
Duration of Therapy	17 months	
Initial Incidence Category Scores and Phonological Deviations	<u>Category 5: 80 - 100% 4 Phonological Deviations</u> Palato-alveolar Fronting SIWI; Palato-alveolar Fronting SFWF; Cluster Reduction SFWF; Final Consonant Deletion  <u>Category 3: 40 - 59% 1 Phonological Deviation</u> Cluster Reduction SIWI  <u>Category 2: 20 - 39% 1 Phonological Deviation</u> Stopping of Fricatives SIWI	Sum of Deviations = 6  <i>/m/, /n/, /ŋ/, /p/, /b/, /t/, /d/, /k/, /g/, /f/, /s/, /ʒ/, /h/, /w/, /l/, /j/</i>  Not stimulable for  <i>/v/, /z/, /ʃ/, /θ/, /ð/, /tʃ/, /dʒ/, /r/</i>
Accompanying Family Members	Both parents attended the initial consultation, after which mother accompanied 8T to 23/24. Siblings came 3/24 times.	
Homework	Half the homework was with mother and half with father. 1 to 1 with teacher: nil. Speech book to preschool < once per week.	12 homework sessions per week.
Therapy Blocks and Breaks	Block 1: 9 Consultations; Break 1: 13 weeks.  Block 2: 9 Consultations; Break 2: 10 weeks.  Block 3: 3 Consultations; Break 3: 10 weeks.  Block 4: 3 Consultations.	Break 1 was 13 weeks because 8T contracted chickenpox just before she was due to commence Block 2.

TABLE 68  
8T's Progress in Therapy

Age	Incidence Category 6 80-100%	Incidence Category 4 60-79%	Incidence Category 2 40-59%	Incidence Category 2 20-39%	Incidence Category 1 ≤ 19%	Sum of Dev's	Severity Index Score	Descriptive Category	Severity Rating
2;11	4	-	1	1	-	6	25	Moderate	2.75
3;6	2	1	-	2	2	7	20	Moderate	2.50
3;7	1	1	-	1	2	5	13	Mild	2.50
3;9	-	2	-	1	1	4	11	Mild	2.00
4;0	-	1	-	-	1	2	05	Very Mild	1.50
4;1	-	-	-	1	-	1	02	Very Mild	1.50

## F 8.0 Case Summary: 11T

TABLE 69  
HISTORY SUMMARY: Subject 11T

HISTORY SUMMARY	Details 11T (FEMALE) Initial Severity Rating 3.25	Comment
Initial Consultation Age	46 months (3;10)	Moderate Phonological Disability
Initial Severity Index Score	29	
Initial PPVT-R SS	99	
Initial MLUm	3.50	
Consultations	14	Number of Treatments after Probe = 0
Treatments	10	
Assessments	4	
Duration of Therapy	7 months	
Initial Incidence Category Scores and Phonological Deviations	<p><u>Category 5: 80 - 100% 2 Phonological deviations</u></p> <p>Cluster Reduction; Palato-alveolar Fronting SFWF</p> <p><u>Category 4: 60 - 79% 2 Phonological Deviations</u></p> <p>/Fricatives/ → /h/ SIWI; Cluster Reduction SFWF</p> <p><u>Category 3: 40 - 59% 3 Phonological Deviations</u></p> <p>Velar Fronting SIWI; Glottal Replacement; /t/ and /k/ → /h/ SIWI</p> <p><u>Category 2: 20 - 39% 1 Phonological Deviation</u></p> <p>Velar Fronting SFWF</p>	<p>Sum of Deviations = 8</p> <p>Phonetic Inventory:</p> <p>/m/, /n/, /p/, /b/, /t/, /d/, /k/, /g/,</p> <p>/f/, /v/, /s/, /z/, /h/, /w/, /l/, /j/</p> <p>Not Stimulable for:</p> <p>/θ/, /ʃ/, /ʒ/, /ð/, /ð/, /ŋ/, /dʒ/, /r/</p>
Accompanying Family Members	Both parents attended 4 consultations, including the initial consultation. Mother accompanied 11T to 6, father to 4 and grandmother to 2 consultations. Siblings were present on 13/14 occasions.	Therapy attendance was very much a 'family affair', and 11T loved coming.
Homework	All homework was with father. 1 to 1 with teacher: nil. Speech book to preschool < once per week.	6 homework sessions per week.
Therapy Blocks and Breaks	Block 1: 9 Consultations. Break 1: 10 weeks. Block 2: 5 Consultations.	

TABLE 60  
11T's Progress in Therapy

Age	Incidence Category 6 80-100%	Incidence Category 4 60-79%	Incidence Category 3 40-59%	Incidence Category 2 20-39%	Incidence Category 1 ≤ 19%	Sum of Dev's	Severity Index Score	Descriptive Category	Severity Rating
3;10	2	2	3	1	-	8	29	Moderate	3.25
4;0	-	2	2	2	-	6	18	Moderate	2.75
4;3	-	1	-	1	1	3	07	Mild	1.50
4;6	-	-	-	-	-	0	0	Normal	1.00

## F 9.0 Case Summary: 13T

**TABLE 61**  
**HISTORY SUMMARY: Subject 13T**

HISTORY SUMMARY	Details 13T (FEMALE) Initial Severity Rating 2.50	Comment
Initial Consultation Age	44 months (3;8)	Mild Phonological Disability
Initial Severity Index Score	15	
Initial PPVT-R SS	114	
Initial MLUm	4.00	
Consultations	10	Number of Treatments after Probe = 0
Treatments	8	
Assessments	2	
Duration of Therapy	3 months	
Initial Incidence Category Scores and Phonological Deviations	<p><u>Category 5: 80 - 100% 1 Phonological Deviation</u></p> <p>Stopping of Affricates</p> <p><u>Category 4: 60 - 79% 1 Phonological Deviation</u></p> <p>Cluster Reduction SFWF</p> <p><u>Category 3: 40 - 59% 2 Phonological Deviations</u></p> <p>Cluster Reduction SIWI; Stopping of Fricatives</p>	<p>Sum of Deviations = 4</p> <p>Phonetic Inventory:</p> <p>/m/, /n/, /ŋ/, /p/, /b/, /t/, /d/, /k/, /g/, /f/, /v/, /h/, /θ/, /ð/, /w/, /l/, /r/, /j/</p> <p>Not stimuable for:</p> <p>/s/, /z/, /ʃ/, /ʒ/, /tʃ/, /dʒ/</p>
Accompanying Family Members	6 with mother, 3 with father, and 1 with grandmother. Sibling attended 3/10.	
Homework	Half the homework was with mother, and half with father. 1 to 1 with teacher once per week. Speech book to preschool once per week.	Mother kept good records of homework participation. 24 homework sessions per week.
Therapy Blocks and Breaks	Block 1: 10 Consultations.	Phonology WNL by 10th visit.

**TABLE 62**  
**13T's Progress in Therapy**

Age	Incidence Category 5 80-100%	Incidence Category 4 60-79%	Incidence Category 3 40-59%	Incidence Category 2 20-39%	Incidence Category 1 ≤ 19%	Sum of Dev's	Severity Index Score	Descriptive Category	Severity Rating
3;8	1	1	2	-	-	4	15	Mild	2.50
3;10	-	-	-	2	-	2	04	Very Mild	1.25
3;11	-	-	-	-	-	0	0	Normal	1.00



## F 10.0 Case Summary: 14T

**TABLE 63**  
**HISTORY SUMMARY: Subject 14T**

<b>HISTORY SUMMARY</b>	<b>Details 14T (FEMALE) Initial Severity Rating 2.75</b>	<b>Comment</b>
Initial Consultation Age	47 months (3;11)	Moderate Phonological Disability
Initial Severity Index Score	22	
Initial PPVT-R SS	96	
Initial MLUm	3.50	
Consultations	21	Number of Treatments after Probe = 0
Treatments	17	
Assessments	4	
Duration of Therapy	9 months	
Initial Incidence Category Scores and Phonological Deviations	<u>Category 5: 80 - 100% 3 Phonological Deviations</u> Velar Fronting SIWI; Word-Final Devoicing; Stopping of Fricatives SIWI; Cluster Reduction SIWI <u>Category 2: 20 - 39% 1 Phonological Deviation</u> Velar Fronting SFWF	Sum of Deviations = 5 Phonetic Inventory: WNL
Accompanying Family Members	Mother accompanied 14T to all consultations. Sibling attended 2/21.	
Homework	All homework was with mother. 1 to 1 with teacher once per week. Speech book to preschool once per week.	12 homework sessions per week.
Therapy Blocks and Breaks	Block 1: 11 Consultations. Break 1: 9 weeks. Block 2: 9 Consultations. Break 2: 8 weeks. Block 3: 1 Consultation.	

**TABLE 64**  
**14T's Progress in Therapy**

<b>Age</b>	<b>Incidence Category 5 80-100%</b>	<b>Incidence Category 4 60-79%</b>	<b>Incidence Category 3 40-59%</b>	<b>Incidence Category 2 20-39%</b>	<b>Incidence Category 1 ≤ 19%</b>	<b>Sum of Dev's</b>	<b>Severity Index Score</b>	<b>Descriptive Category</b>	<b>Severity Rating</b>
3;11	4	0	0	1	-	5	22	Moderate	2.75
4;4	2	-	1	-	-	3	13	Mild	2.50
4;5	-	-	-	-	1	1	01	Very Mild	1.50
4;8	-	-	-	-	-	0	0	Normal	1.00

## Appendix G

### Statistical Analyses

#### One-Way Analysis of Variance on Initial Age of the Subjects (page 112)

Source	DF	SS	MS	F	p
Group	1	37.0	37.0	1.01	0.328
Error	20	734.8	36.7		
Total	21	771.8			

#### One-Way Analysis of Variance on the Age at the Probe Assessment (Age x Group) (p. 112)

Source	DF	SS	MS	F	p
Group	1	50.3	50.3	1.05	0.317
Error	20	955.7	47.8		
Total	21	1006.0			

#### One-Way Analysis of Variance on Initial PPVT-R Standard Scores (page 112)

Source	DF	SS	MS	F	p
Group	1	3	3	0.03	0.870
Error	20	2174	109		
Total	21	2177			

#### One-Way Analysis of Variance of Initial MLUm's (page 112)

Source	DF	SS	MS	F	p
Group	1	1.149	1.149	2.75	0.113
Error	20	8.339	0.417		
Total	21	9.487			

**One-Way Analysis of Variance on the time Interval between the Initial and Probe Assessment (Interval x Group) (p. 125)**

Source	DF	SS	MS	F	p
Group	1	1.01	1.01	0.19	0.665
Error	20	104.80	5.24		
Total	21	105.82			

**One-Way Analysis of Variance of the Initial Mean Severity Rating (page 145)**

Source	DF	SS	MS	F	p
Group	1	0.416	0.416	1.59	0.222
Error	20	5.232	0.262		
Total	21	5.648			

**One-Way Analysis of Variance of the Probe Mean Severity Ratings (page 145)**

Source	DF	SS	MS	F	p
Group	1	11.660	11.660	21.22	0.000
Error	20	10.988	0.549		
Total	21	22.648			

**Two-way Analysis of Variance on the Initial and Probe Mean Severity Ratings for both Groups, showing a significant group x time interaction (page 145)**

Source	DF	SS	MS	F	p
mean	1	330.0	330.0	260.5	0.00
s/g	20	10.6367	0.5318		
group	1	6.9826	6.9826	13.129	0.002
s/g	20	10.6367	0.5318		
time	1	19.7784	19.7784	80.070	0.00
ts/g	20	4.9403	0.2470		
gt	1	4.7813	4.7813	19.356	0.00
ts/g	20	4.9403	0.2470		

**One-Way Analysis of Variance on Initial Sum of Phonological Deviations ( page 151)**

Source	DF	SS	MS	F	p
Group	1	0.72	0.72	0.22	0.642
Error	20	64.38	3.22		
Total	21	65.09			

**One-Way Analysis of Variance on Probe Sum of Phonological Deviations (page 151)**

Source	DF	SS	MS	F	p
Group	1	99.84	99.84	17.30	0.000
Error	20	115.43	5.77		
Total	21	215.27			

**Two-Way Analysis of Variance on the Initial and Probe Sum of Deviations, showing a significant group x time interaction (page 151)**

Source	DF	SS	MS	F	p
mean	1	1050.5682	1050.5682	152.879	0.00
s/g	20	137.4375	6.8719		
group	1	60.4943	60.4943	8.803	0.008
s/g	20	137.4375	6.8719		
time	1	127.8409	127.8409	55.229	0.00
ts/g	20	46.2946	2.3147		
gt	1	40.3644	40.3644	17.438	0.00
ts/g	20	46.2946	2.3147		

**Three-way Analysis of Variance on the Incidence Category Scores, showing a significant group x time x incidence interaction (page 152)**

Source	DF	SS	MS	F	p
gt	1	8.3651	8.3651	19.054	0.00
ts/g	20	8.7804	0.4390		
gti	4	7.0529	1.7632	2.926	0.026
tis/g	80	48.2107	0.6026		

**One-Way Analysis of Variance on the Initial Severity Index Scores (page 154)**

Source	DF	SS	MS	F	p
Group	1	62.4	62.4	0.92	0.348
Error	20	1352.0	67.6		
Total	21	1414.4			

**One-Way Analysis of Variance on the Probe Severity Index Scores (page 154)**

Source	DF	SS	MS	F	p
Group	1	1374.0	1374.0	18.81	0.000
Error	20	1460.9	73.0		
Total	21	2835.0			

**Two-Way Analysis of Variance on the Initial and Probe Severity Index Scores for both Groups, showing a significant group x time interaction (page 154)**

Source	DF	SS	MS	F	p
mean	1	14509.1136	14509.1136	121.646	0.00
s/g	20	2385.4643	119.2732		
group	1	1010.9221	1010.9221	8.476	0.009
s/g	20	2385.4643	119.7232		
time	1	2896.5682	2896.5682	135.523	0.00
cs/g	20	427.4643	20.3732		
gc	1	425.4675	425.4675	19.907	0.00
cs/g	20	427.4643	21.3732		

**One-Way Analysis of Variance on Task 1 at the Initial Assessment (page 161)**

Source	DF	SS	MS	F	p
Group	1	0.27	0.27	0.21	0.648
Error	20	25.59	1.28		
Total	21	25.86			

**One-Way Analysis of Variance on Task 1 at the Probe Assessment (page 161)**

Source	DF	SS	MS	F	p
Group	1	190.989	190.989	296.68	0.000
Error	20	12.875	0.644		
Total	21	203.864			

**Two-Way Analysis of Variance on Task 1 at the Initial and Probe Assessments for both groups, showing a significant group x time interaction ( $F(1,20) = 208.72$ ) (page 161)**

Source	DF	SS	MS	F	p
mean	1	891.00	891.00	622.921	0.00
s/g	20	28.6071	1.4304		
group	1	88.3929	88.3929	61.798	0.00
s/g	20	28.6071	1.4304		
time	1	227.2727	227.2727	461.133	0.00
cs/g	20	9.8571	0.4929		
gc	1	102.8701	102.8701	208.722	0.00
cs/g	20	9.8571	0.4929		

**One-Way Analysis of Variance on Task 2 at the Initial Assessment (page 163)**

Source	DF	SS	MS	F	p
Group	1	0.13	0.13	0.07	0.789
Error	20	35.73	1.79		
Total	21	35.86			

**One-Way Analysis of Variance on Task 2 at the Probe Assessment (page 163)**

Source	DF	SS	MS	F	p
Group	1	3.0	3.0	0.17	0.688
Error	20	361.6	18.1		
Total	21	364.6			

**Two-Way Analysis of Variance for Task 2 (page 163)**

Source	DF	SS	MS	F	p
mean	1	145.4545	145.4545	11.120	0.003
s/g	20	261.6071	13.0804		
group	1	0.9383	0.9383	0.072	0.792
s/g	20	261.6071	13.0804		
time	1	48.0909	48.0909	7.087	0.015
cs/g	20	135.7143	6.7857		
gc	1	2.1948	2.1948	0.323	0.576
cs/g	20	135.7143	6.7857		

**One-Way Analysis of Variance on Task 3 at the Initial Assessment (page 164)**

Source	DF	SS	MS	F	p
Group	1	0.002	0.002	0.01	0.934
Error	20	4.589	0.229		
Total	21	4.591			

**One-Way Analysis of Variance on Task 3 at the Probe Assessment (page 164)**

Source	DF	SS	MS	F	p
Group	1	11.45	11.45	10.41	0.004
Error	20	22.00	1.10		
Total	21	33.45			



**Two-Way Analysis of Variance on Task 3 at the Initial and Probe assessments for both groups, showing a significant group x time interaction (page 164)**

Source	DF	SS	MS	F	p
mean	1	27.8409	27.8409	35.254	0.00
s/g	20	15.7946	0.7897		
group	1	5.8644	5.8644	7.426	0.013
s/g	20	15.7946	0.7897		
time	1	19.1136	19.1136	35.413	0.00
cs/g	20	10.7946	0.5397		
gc	1	5.5917	5.5917	10.360	0.004
cs/g	20	10.7946	0.5397		

**One-Way Analysis of Variance on Task 4 at the Initial Assessment (page 164)**

Source	DF	SS	MS	F	p
Group	1	0.6	0.6	0.02	0.880
Error	20	559.2	28.0		
Total	21	559.9			

**One-Way Analysis of Variance on Task 4 at the Probe Assessment (page 164)**

Source	DF	SS	MS	F	p
Group	1	35.6	35.6	1.50	0.235
Error	20	475.2	23.8		
Total	21	510.8			

**Two-Way Analysis of Variance on Task 4 at the Initial and Probe Assessments for both groups, showing no significant interaction, but a significant effect of time (Initial vs. Probe) (page 164)**

Source	DF	SS	MS	F	p
mean	1	1309.0909	1309.0909	28.335	0.00
s/g	20	924.0000	46.2000		
group	1	22.9091	22.9091	0.496	0.489
s/g	20	924.000	46.2000		
time	1	66.2727	66.2727	12.003	0.002
cs/g	20	110.4286	5.5214		
gc	1	13.2987	13.2987	2.409	0.136
cs/g	20	110.4286	5.5214		

**One-Way Analysis of Variance of Probe Assessment PPVT-R Standard Scores (p.165)**

Source	DF	SS	MS	F	p
Group	1	17	17	0.08	0.780
Error	20	4131	207		
Total	21	4148			

### Two-Way Analysis of Variance on PPVT-R (page 166)

Source	DF	SS	MS	F	p
mean	1	502259.1136	502259.1136	1795.833	0.00
s/g	20	5593.6071	279.6804		
group	1	17.7792	17.7792	0.64	0.84
s/g	20	5593.6071	279.6804		
time	1	172.0227	172.0227	4.850	0.040
cs/g	20	709.3571	35.4679		
gc	1	3.1201	3.1201	0.088	0.770
cs/g	20	709.3571	35.4679		

### One-Way Analysis of Variance on the Probe Assessment MLUm's (page 166)

Source	DF	SS	MS	F	p
Group	1	2.011	2.011	2.71	0.116
Error	20	14.867	0.743		
Total	21	16.879			

**Correlations (Pearson) of Initial Severity Rating ('meansev'); Duration of therapy in Months ('duration'), Number of Treatments ('treats'), Number of Assessment ('assmnts'), Number of Visits (Treatments + Assessments: 'visits'), Initial Age ('icage'), Initial Sum of Phonological Deviations ('icsum'), Gender, and Initial PPVT-R Standard Score ('icppvtr'). (Page 171)**

	meansev	duration	treats	assmnts	visits	icage	icsum	gender	icppvtr
duration	0.582								
treats	0.755	0.841							
assmnts	0.749	0.773	0.890						
visits	0.766	0.878	0.993	0.893					
icage	0.578	0.075	0.404	0.342	0.374				
icsum	0.354	0.041	0.113	0.385	0.140	0.176			
gender	0.080	0.200	0.140	0.325	0.160	-0.175	-0.184		
icppvtr	0.155	0.002	0.046	-0.093	0.026	0.584	-0.299	-0.110	
sevdif	0.442	-0.379	-0.046	0.110	-0.063	0.506	0.438	-0.067	-0.061

### 3 Stepwise Regression Analyses Predicting [1] Number of Treatments, [2] Number of Consultations, and [3] Duration of Treatment in Months, Using 5 Predictors (page 173)

'treats' = treatments

'visits' = total consultations (assessments + treatments)

'duration' = time in months from initial consultation to discharge

'meansev' = initial mean severity ratings

'icage' = age at initial consultation

'icsum' = Initial Sum of Phonological Deviations

'icppvtr' = Initial PPVT-R Standard Score

#### [1] Response is treats on 5 predictors, with N = 13

F-to-Enter: 4.00 F-to-Remove: 4.00

Step 1

Constant -15.50

meansev 10.4

T-Ratio 3.82

S 4.78

R-Sq 56.99

SUBC> Steps 2. No variables entered or removed

#### [2] Response is visits on 5 predictors, with N = 13

F-to-Enter: 4.00 F-to-Remove: 4.00

Step 1

Constant -14.86

meansev 11.5

T-Ratio 3.95

S 5.10

R-Sq 58.69

SUBC> steps 2. No variables entered or removed

#### [3] Response is duration on 5 predictors, with N = 13

F-to-Enter: 4.00 F-to-Remove: 4.00

Step 1

Constant -6.113

meansev 5.3

T-Ratio 2.37

S 3.92

R-Sq 33.83

SUBC> steps 2. No variables entered or removed

## APPENDIX H

### Data Display

#### KEY

Subject	Research Subject
Group	1 = Treatment Group, 2 = Control Group
Icage	Age of Entry to Study
Probeage	Time in months from Initial to Probe Assessment
Meansev	Mean Severity Rating of the Raters at Initial Assessment
Promsev	Mean Severity Rating of the Raters at the Probe Assessment
Sevdif	(Meansev) minus (Promsev)
I SOPD	Sum of Phonological Deviations at Initial Assessment
Pr SOPD	Sum of Phonological Deviations at the Probe Assessment
Icppvtr	PPVT-R Standard Score at Initial Assessment
Prppvtr	PPVT-R Standard Score at Probe Assessment
ICMLUm	MLUm at Initial Assessment
PRMLUm	MLUm at Probe Assessment
ICINDEX	Severity Index Score at Initial Assessment
PRINDEX	Severity Index Score at Probe Assessment
IC Five, IC Four, etc.	SOPD in Incidence Category 5 at Initial Assessment, and so on
Pr IC 5, Pr IC 4, etc.	SOPD in Incidence Category 5 at Probe Assessment, and so on
Rating	81 Observations of Mean Severity Rating
Index	81 Observations of Severity Index score
T1 Ini, T2 Ini, etc.	Score for Task 1 at the Initial Assessment, and so on
T1 Pro, T2 Pro, etc.	Score for Task 1 at the Probe Assessment, and so on

**STATISTICAL PROGRAMMES: SPSS for Windows and MINITAB 10.2 for Windows**

Worksheet size: 10000 cells

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Retrieving worksheet from file: C:\MTBWIN\PHON.MTW
Worksheet was saved on 11/ 1/1995
MTB > Print 'Subject' 'Group' 'Icage' 'Probeage' 'Interval' 'Meansev' &
CONT>      'Promsev' 'Sevdiff' 'I SOPD' 'Pr SOPD' 'Icppvtr' 'Prppvtr' &
CONT>      'ICMLUm' 'PRMLUm' 'ICINDEX' 'PRINDEX'.
```

## Data Display

Row	Subject	Group	Icage	Probeage	Interval	Meansev	Promsev	Sevdiff
1	1	1	52	63	11	3.75	2.25	1.50
2	2	1	56	67	11	3.75	1.50	2.25
3	3	1	46	52	6	2.50	1.00	1.50
4	4	1	50	62	12	3.75	2.50	1.25
5	5	1	50	57	7	2.75	1.00	1.75
6	6	1	51	61	10	2.75	1.00	1.75
7	7	1	57	68	11	3.25	1.75	1.50
8	8	1	35	45	10	2.75	2.00	0.75
9	9	1	49	58	9	3.50	1.00	2.50
10	10	1	51	62	11	4.00	3.25	1.25
11	11	1	46	53	7	3.25	1.00	2.25
12	12	1	53	63	10	3.75	1.00	2.75
13	13	1	44	47	3	2.50	1.00	1.50
14	14	1	47	56	9	2.75	1.00	1.75
15	15	2	51	61	10	3.75	2.25	1.50
16	16	2	43	54	11	3.75	2.00	1.75
17	17	2	50	60	10	3.50	3.75	-0.25
18	18	2	45	53	8	4.00	4.00	0.00
19	19	2	56	64	8	3.25	2.75	1.00
20	20	2	41	49	8	3.50	3.25	0.25
21	21	2	34	43	9	2.50	2.50	0.00
22	22	2	51	56	5	3.75	3.75	0.00

Row	I SOPD	Pr SOPD	Icppvtr	Prppvtr	ICMLUm	PRMLUm	ICINDEX	PRINDEX
1	5	4	115	116	5.30	6.60	22	9
2	7	1	106	106	5.20	6.20	25	1
3	7	0	105	103	4.50	5.00	22	0
4	7	4	104	108	4.37	4.60	29	12
5	7	0	106	104	3.17	4.00	24	0
6	6	0	105	128	4.00	6.20	18	0
7	6	2	127	127	4.00	6.30	22	5
8	6	4	94	94	3.40	5.30	25	11
9	7	1	91	99	4.30	5.00	30	2
10	9	6	97	97	3.64	4.75	38	17
11	8	0	99	99	3.50	4.00	29	0
12	7	0	113	133	4.80	6.00	29	0
13	4	0	114	124	4.00	6.00	15	0
14	5	0	96	94	3.50	5.00	22	0
15	7	3	126	129	4.00	6.00	26	7
16	5	3	101	92	3.04	4.00	23	9
17	5	8	94	94	3.10	4.00	21	25
18	12	11	117	130	4.80	4.80	49	43
19	5	3	94	97	4.10	5.90	17	10
20	8	8	105	97	3.17	4.30	42	29
21	5	6	103	118	3.45	5.00	19	22
22	8	6	95	104	3.50	3.80	31	19

```
MTB >
MTB >
MTB > Print 'IC Five' 'IC Four' 'IC Three' 'IC Two' 'IC One' 'Pr IC 5' &
```

CONT> 'Pr IC 4' 'Pr IC 3' 'Pr IC 2' 'Pr IC 1'.

## Data Display

Row	IC Five	IC Four	IC Three	IC Two	IC One	Pr IC 5	Pr IC 4	Pr IC 3
1	3	1	1	0	0	0	1	0
2	2	2	2	0	1	0	0	0
3	2	1	1	2	1	0	0	0
4	4	1	1	1	0	0	2	0
5	2	1	2	2	0	0	0	0
6	1	1	2	1	1	0	0	0
7	2	2	1	0	1	0	0	0
8	4	0	1	1	0	0	2	0
9	5	0	1	1	0	0	0	0
10	5	2	1	1	0	1	1	1
11	2	2	3	1	0	0	0	0
12	4	1	1	1	0	0	0	0
13	1	1	2	0	0	0	0	0
14	4	0	0	1	0	0	0	0
15	3	2	0	1	1	0	0	1
16	4	0	1	0	0	1	0	0
17	4	0	0	0	1	3	0	1
18	9	0	0	1	2	6	1	2
19	1	1	2	1	0	0	1	2
20	6	1	1	0	0	2	2	3
21	2	0	3	0	0	1	2	3
22	4	1	1	2	0	2	0	2

Row	Pr IC 2	Pr IC 1
1	2	1
2	0	1
3	0	0
4	2	0
5	0	0
6	0	0
7	0	2
8	0	1
9	1	0
10	2	1
11	0	0
12	0	0
13	0	0
14	0	0
15	2	0
16	2	0
17	3	1
18	1	1
19	0	0
20	1	0
21	0	0
22	1	1

MTB >



Worksheet size: 10000 cells

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Worksheet was saved on 11/ 1/1995

MTB > Print 'Rating' 'Index'.

## Data Display

Row	Rating	Index
1	1.00	0
2	1.00	0
3	1.00	0
4	1.00	0
5	1.00	0
6	1.00	0
7	1.00	0
8	1.00	0
9	1.25	4
10	1.50	1
11	1.50	1
12	1.50	5
13	1.50	2
14	1.50	7
15	1.50	1
16	1.75	3
17	1.75	5
18	2.00	4
19	2.00	7
20	2.00	7
21	2.00	10
22	2.00	9
23	2.00	11
24	2.25	9
25	2.25	10
26	2.25	8
27	2.25	16
28	2.25	7
29	2.50	22
30	2.50	12
31	2.50	14
32	2.50	20
33	2.50	13
34	2.50	21
35	2.50	15
36	2.50	13
37	2.50	19
38	2.50	22
39	2.75	24
40	2.75	16
41	2.75	18
42	2.75	25
43	2.75	18
44	2.75	12
45	2.75	10
46	2.75	17
47	3.00	19
48	3.00	14
49	3.00	8
50	3.00	32
51	3.25	22
52	3.25	22
53	3.25	17
54	3.25	29

55	3.25	18
56	3.25	16
57	3.25	17
58	3.25	29
59	3.50	17
60	3.50	20
61	3.50	30
62	3.50	21
63	3.50	18
64	3.50	42
65	3.75	22
66	3.75	25
67	3.75	29
68	3.75	22
69	3.75	28
70	3.75	29
71	3.75	26
72	3.75	23
73	3.75	22
74	3.75	31
75	3.75	25
76	3.75	31
77	3.75	19
78	4.00	38
79	4.00	30
80	4.00	49
81	4.00	43

MTB >

Worksheet size: 10000 cells

MTB > RETR 'C:\MTBWIN\PHON.MTW'.  
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Worksheet was saved on 11/ 1/1995  
MTB > Print 'T1 Ini' 'T1 Pro' 'T2 Ini' 'T2 Pro' 'T3 Ini' 'T3 Pro' 'T4 Ini' &  
CONT> 'T4 Pro'.

Data Display

Row	T1 Ini	T1 Pro	T2 Ini	T2 Pro	T3 Ini	T3 Pro	T4 Ini	T4 Pro
1	3	9	3	3	0	2	9	9
2	3	9	2	3	0	2	10	12
3	3	9	1	5	0	3	2	8
4	1	9	0	0	0	2	0	10
5	2	9	0	0	0	2	12	12
6	4	9	0	12	0	3	12	12
7	2	9	1	3	0	2	0	10
8	1	9	0	0	0	0	0	4
9	2	9	0	0	2	3	4	12
10	2	9	0	0	0	1	0	6
11	0	9	0	0	0	0	0	0
12	3	9	3	12	0	3	12	12
13	2	9	0	6	0	3	0	0
14	2	9	0	0	0	2	0	0
15	4	4	0	3	1	1	12	12
16	2	3	0	0	0	0	0	0
17	2	2	0	0	0	0	4	6
18	4	3	3	12	0	3	12	12
19	2	3	0	0	0	0	0	4
20	2	4	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0
22	3	4	4	4	0	0	4	6

MTB >