

Chapter 1

The evolution of current practices

Conceptual frameworks are easy to ignore. Like the air we breathe, their presence is everywhere, once they are looked for. Yet, they are often taken for granted, under-estimated and under-examined. One way to reveal the influence of frameworks today is to study their use in the unfamiliar contexts. For example, an examination of past practices of speech therapists raises questions about what practitioners did then as well as how and why they did it. Such an investigation creates the distance needed for clinicians to apprehend aspects of their own practice that are ordinarily taken for granted.

(Duchan, 2006a)

Judith Felson Duchan, one of our profession's few historians, believes there has been too little work on the evolution of current practices. She observes that most histories of the origins of speech pathology in the United States focus on organisational matters and place the genesis of the profession in about 1925, when workers in the field of speech disorders and speech correction established their own professional association. The chronology by Margaret Eldridge, recording the development of speech therapy in Australia (Eldridge, 1965) and

the Commonwealth of Nations (Eldridge, 1968a, 1968b), has this same institutional focus. By contrast, over a decade Duchan (2001–2011) produced a lively web-based history and several articles (e.g., Duchan, 2009, 2010) broader in scope than their predecessors and distinctive because they include systematic records of the science and ideas underlying practice.

Unlike Duchan's rich histories, the timeline in Table 1.1 provides just a glimpse of the notable SLP/SLT and linguistics influences on contemporary child speech practice, from the 1930s to the beginning of this century. Dodging the trap of presentism (i.e., the practice of evaluating past events, people and motivations by present-day ideas), in the subsequent sections connections are made between our histories of practice and practice today.

Early understandings of 'normal' and 'deviant' speech

The book, *Normal Speech and Speech Deviations* (Travis, 1931) contained just one paragraph on articulation therapy and an appendix containing a

22 *Children's Speech Sound Disorders***Table 1.1** Timeline: Milestones in the history of children's speech sound disorders

Pioneers	William Holder (1616–1698) John Thelwall (1764–1834) Alexander Melville Bell (1819–1905)	See Holder (1669) and Duchan (2001) for information about William Holder See Duchan (2006a, 2009) for information about John Thelwall See Duchan (2006b) for information on Alexander Melville Bell
1931	Lee Edward Travis	'The Travis Handbook' contained one paragraph on articulation, and a word list. See also Travis (1957)
1934	Irene Poole	Produced a developmental schedule for 'normal' articulatory proficiency
1937	Robert West	Published <i>The Rehabilitation of Speech</i>
1937	Samuel T. Orton	Published <i>Reading, Writing and Speech Problems in Children</i>
1938	Sara Stinchfield and Edna Hill-Young	Treated delayed/defective speech with a motor-kinesthetic therapy
1939	Charles Van Riper	Developed a social theory of speech acquisition coupled with an auditory-phonetic therapy
1940	Grant Fairbanks	Published a voice/articulation drill book with listening lists and minimal pairs
1940 -	Theory–Therapy Gap–Research–Practice Gap	The principles of practice were often at odds with theory and research
1941	Roman Jakobson	Developed a linguistics theory of phonological universals
1943	Mildred Berry and Jon Eisonson	Linked a linguistic-mentalist acquisition theory with articulatory-motor therapy
1945	World War II ended	SLP/SLT informed by physiology, psychology and psychiatry (not linguistics)
1948	Kurt Goldstein	Discussed symbol formation and this sort of thinking lead to the novel idea of 'underlying representation' and 'psycholinguistic processing' in phonology
1952	Helmur Myklebust	Used the same term: symbol formation
1957	Charles Osgood	Talked about mediation/ psycho-linguistic processing
1957	Mildred Templin	Published <i>certain language skills in children</i>
1959	College of Speech Therapists	Formulated a definition of dyslalia
1959	Margaret Hall Powers	Definition of functional articulation disorder
1968	Noam Chomsky and Morris Halle	Wrote SPE presenting distinctive features theory and generative phonology
1968	Jon Eisonson	Symbol formation
1968	Charles Ferguson	Developed contrastive analysis
1970s	American behaviourism	3-position testing and traditional articulation therapy dominated
1972	Muriel Morley	Implied that 'functional articulation disorder' did not have a neuromotor basis
1973	David Stampe	Explicated natural phonology and phonological processes
1975	Pamela Grunwell	Showed the relevance to SLP/SLT of clinical linguistics
1976	David Ingram	His <i>Phonological Disability in Children</i> changed the SLT/SLP view of SSDs
1979	Frederick Weiner	Published <i>Phonological Process Analysis</i> (Test)
1980	Lawrence Shriberg and Joan Kwiatkowski	Published <i>Natural Process Analysis</i> (Test)
1980	Barbara Hodson	Published <i>Assessment of Phonological Processes</i> AAP (Test)
1981	Frederick Weiner	Presented an account of conventional minimal pairs therapy
1982	Stephen E. Blache	Applied distinctive features theory to phonological assessment and therapy
1983	Barbara Hodson and Elaine Paden	Published <i>Targeting Intelligible Speech: Patterns therapy/cycles</i> approach
1984	Dana Monahan	Published (perhaps the first) assessment and therapy package
1985	Pamela Grunwell	Published <i>Phonological Assessment of Child Speech: PACS</i> (Test)
1985	Marc Fey	Published the 'Inextricable constructs' article, making everybody think!

Table 1.1 (Continued)

Pioneers	William Holder (1616–1698) John Thelwall (1764–1834) Alexander Melville Bell (1819–1905)	See Holder (1669) and Duchan (2001) for information about William Holder See Duchan (2006a, 2009) for information about John Thelwall See Duchan (2006b) for information on Alexander Melville Bell
1985	Carol Stoel-Gammon and Carla Dunn	Published the ground breaking <i>Normal and Disordered Phonology in Children</i>
1986	Elizabeth Dean and Janet Howell	Published the developing linguistic awareness article, heralding <i>Metaphon</i>
1986	Mary Elbert and Judith Gierut	Published the <i>Handbook of Clinical Phonology</i>
1989	Gwen Lancaster and Lesley Pope	Described auditory input therapy for under 3s, and ‘difficult’ young clients
1990	Elizabeth Dean, Janet Howell, Anne Hill and Daphne Waters	<i>Metaphon</i> published as an assessment and therapy resource pack
1992	Marc Fey	Headed up a challenging LSHSS clinical forum
1993	Lawrence Shriberg	Looked at development differently with the early, middle and late 8
1997	Martin Ball and Raymond Kent	Published <i>The new Phonologies</i> – A book for clinicians and linguists
1997	Joy Stackhouse and Bill Wells	Published the first volume of a book series on the psycholinguistic framework
1998-9	B. May Bernhardt and Joseph Stemberger	Developed clinical applications of non-linear phonology
2001	WHO – children and youth classification	International Classification of Functioning, Disability and Health ICF-CY

list of initial–medial–final-sound production practice words. Although ‘the Travis Handbook’, as it was affectionately or even reverently called, offered a minuscule contribution as far as articulation therapy was concerned, it was highly regarded as a standard text, providing outlines of the neurophysiological bases and clinical subtypes of fluency, articulation and voice problems and aphasia. Uninfluenced by linguistics theory of the day – the Linguistic Society of America was founded in 1924 – Travis presented a view of disorders that had the speech sound (or segment) as the basic unit of speech. There was a hopeful sign in the same year that more was to come when Wellman, Case, Mengert and Bradbury (1931) reported on the development of ‘speech sounds’ in young children. Publications by other American SLPs soon followed with such revealing titles as: *The Rehabilitation of Speech* (West, Kennedy, & Carr, 1937), *Reading, Writing and Speech Problems in Children* (Orton, 1937), and *Children with Delayed or Defective Speech: Motor-Kinesthetic Factors in Their Training* (Stinchfield & Young, 1938). Robert West (1892–1968) wrote the first section of West, Kennedy and Carr (1937) and

introduced information about articulation difficulties due to oral deformities and hearing impairment. Speech remediation suggestions in the second half of the book included muscle relaxation, non-speech oral motor exercises (NS-OME), phonetic placement strategies and drill.

Another flurry of influential ‘child speech’ speech pathology publishing activity between 1939 and 1943 started with the first of the nine editions of *Speech Correction: Principles and Methods* (Van Riper, 1939). Charles Van Riper (1905–1994), who had a doctorate in clinical psychology and no formal SLP qualification, emphasised the significance of social context on the day-to-day experience of speech-impaired individuals, with portents of the ICF-CY (McLeod, A1). His social perspective is revealed in his famous definition: ‘Speech is defective when it deviates so far from the speech of other people in the group that it calls attention to itself, interferes with communication, or causes its possessor to be mal-adjusted to his environment’ (Van Riper 1939, p. 51). Van Riper’s cultural sensitivity and inimitable insight into what he called the ‘penalties’ of communication impairment may have stemmed

from his intrapersonal and interpersonal experiences of stuttering. Discussing what people with communication 'differences' might make of their social situations, and what they might perceive others to read into their symptoms, he wrote, 'The difference in itself was not so important as its interpretation by the speech defective's associates' (p. 66). He reflected sourly on the likely reactions of the said associates, writing: 'Personality is not merely individuality but evaluated individuality' (p. 67). So intensely important was the social level for Van Riper that he recommend trainee speech correctionists undertake assignments, such as lisping for a day, to develop empathy for individuals with speech difficulties and a deeper appreciation of their emotional landscapes. The social aspect was present in his intervention advice, too, when he suggested that correctionists should work with *teachers and parents* in pursuing therapy goals.

Paradoxically, although Van Riper espoused and sustained a sincerely held social view of speech impairment and of disability, his speech intervention approach—classically referred to as 'Traditional Articulation Therapy' or, slightly tongue-in-cheek, 'Van Riper Therapy'—could never have been regarded as communication focused. He incorporated many disparate elements in an atomistic array of peripheral procedures that included stimulus–response routines; sensory training that he called auditory stimulation comprising auditory discrimination, 'ear training' and auditory sequencing; and production drill. These all became part of an auditory–phonetic (or sensory–motor) therapy that is still implemented (Hegde & Peña-Brooks, 2007). In the same productive period, practical manuals, books of exercises, source books and workbooks for the speech correctionist began to appear, replete with word and sentence lists for production practice, listening lists, rhymes, stories, therapy tips, advice and ideas and techniques and activities to be used in speech lessons (Fairbanks 1940; Nemoy & Davis, 1937; Robbins & Robbins, 1937; Twitmeyer & Nathanson, 1932).

Among the techniques that Van Riper did not incorporate into his intervention, but which

were gaining in popularity, were the motor-kinesthetic (or motokinesthetic) tactile manoeuvres. Van Riper (1939, pp. 198–201) describes them with heavy sarcasm.

We have previously mentioned the Motokinesthetic Method invented by Edna Hill Young as one of the approaches used in teaching a child with delayed speech to talk. It has also been used in the elimination of misarticulations. Essentially, this method is based upon intensive stimulation; however, the stimulation is not confined to sound alone but to tactile and kinesthetic sensations as well. The therapist, by manipulation and stroking and pressing the child's face and body as she utters the stimulus syllable, helps him recognize the place of articulation, the direction of movements, the amount of air pressure, and so on. Watching an expert motokinesthetic therapist at work on a lisper is like attending a show put on by a magician. The case lies on a table with the therapist bending over him. First she presses on his abdomen to initiate breathing as she strongly makes the s sound; then to produce a syllable from the patient, her fingers fly swiftly to close his jaws, spread the lips, and tap a front tooth, thereby signaling a narrow groove of the tongue or the focus of the airstream. Then her magical fingers squeeze together to draw out the sibilant hiss as a continuant.

One therapist, when working with a child, used to "draw out" the s, wind it around the child's head three times then insert it into her ear, thus insuring that it would be prolonged enough to be felt. Each sound has its own unique set of deft manipulations, and considerable skill is required to administer motokinesthetic therapy effectively.

Viewed by the cold eye of the modern speech scientist, many of the motokinesthetic cues seem inappropriate; and a therapist would need sixty fingers and thirty arms to provide sufficient cues to take care of the necessary integration and coarticulation. Moreover, much of our research has indicated that standard sounds are produced in different ways by different people, and that their positioning vary widely with differing phonetic contexts. We

suspect that much of the effectiveness of this method is due to its powerful suggestion (the laying on of hands), to its accompanying auditory stimulation, or to the novelty to the situation, which may free the case to try new articulatory patterns. We have used it successfully with some very refractory cases, but we always have felt a bit uncomfortable when doing so, as though we were the Magical Monarch of Mo in the Land of Hocus Pocus.

Disparities between theory, therapy and practice

The release in 1943 of *The Defective in Speech* (Berry & Eisonson, 1942, 1956) provided an alternative interpretation of what might improve children's speech production. They guided a swing away from Van Riperian auditory perceptual and ear training, refocusing on auditory memory span and the motor execution component of speech output, in treatment that saw the therapist administering general bodily relaxation procedures and speech musculature exercises. Today, these are generally referred to synonymously as non-speech oral motor exercises (NS-OME), oral motor therapy, oral motor treatment or oro-motor exercises (the more prominent UK term) sometimes called oro-motor work. Apparently ignoring the social context of and consequences for the client of his or her communication impairment, Berry and Eisonson wrote about the mechanism of first-language learning for the first time in the speech pathology literature. They embraced the associative-imitative model (Allport, 1924) from psychology theory, conceptualising speech in linguistic-mental terms. But again, these insights were not reflected in their intervention suggestions. Like Van Riper's, their therapy belied any appreciation of language, and they proceeded from bottom up, starting with tongue, lip and jaw exercises, with stimulation of individual phones, and using phonetic placement techniques and repetitive motor drill.

In her analysis of these inconsistencies, Duchan (2001) highlights the genesis of 'a famil-

iar trait in our professional development, the theory-therapy gap', also commenting that 'a second identifiable gap was between research findings and therapy practices', pointing to an evident interdisciplinary gap that saw speech pathologists failing to take much advantage of the developmental psychology research that flourished from the 1920s to the 1950s.

Dyslalia and functional articulation disorder

SLP/SLT was a young profession when speech sound disorders in children were called 'dyslalia' or 'functional articulation disorders'. In its *Terminology for Speech Pathology*, the College of Speech Therapists (1959) defined dyslalia as: 'Defects of articulation, or slow development of articulatory *patterns*, including: substitutions, distortions, omissions and transpositions of the sounds of speech.' Almost simultaneously in the United States, Powers (1959, p. 711) defined it, with a different name, using the word 'functional' in its medical pathology connotation 'of currently unknown origin' or 'involving functions rather than a physiological or structural cause'. The acronym 'SODA' may have been far from Powers' thoughts when she said, '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.'

How interesting it is to find that as early as 1959 SLPs/SLTs in Britain and the United States had an agreed definition and terminology and included the notion of speech *patterns* when they described speech development and disorders. Nonetheless, it must be remembered that they did so without taking into account speech sounds' organisation and representation, cognitively. The 'phoneme' and constructs like it were the domain of clinical linguistics, and it would not be until 20 years or more after the formulation of the British and

American definitions that the beginnings of a practical assessment and 'therapy connection' (Grunwell, 1975; Ingram, 1976) would be forged between phonological theory and SLP/SLT practice.

In the United Kingdom and Australia, the name 'dyslalia' remained in vogue until the 1960s when the preferred US term, functional articulation disorder, gained currency. The preoccupation of therapists, in the 1960s through to the mid-1970s, with individual sounds in the so-called 'three positions' (initial, medial and final), still constituted a strictly phonetic approach to the problem, somehow isolating the linguistic function of speech from the mechanics or motoric aspects of speech. It is enlightening to return to Grunwell's 1975 critique of contemporary practice and her proposal for a more linguistically principled approach to assessment and remediation than the ones that had evolved from practice in the 1930s.

Functional articulation disorders were graded in severity as mild, moderate or severe. In the severe category were the children with 'multiple dyslalia' or 'multiple misarticulations' whose speech was generally unintelligible to people outside of their immediate families. 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). In other words, the supposed motor execution problem or 'articulation' disorder appeared to reside in the children's difficulty in employing speech sounds for word production, which they *could* produce in isolation. Intervention concentrated on the mechanical aspects of establishing the production of individual phonemes, one at a time, context by context.

By defining the problem in articulatory terms and focussing in therapy on speech and accuracy of production, SLPs/SLTs failed to take into account something that they already knew: 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 acquiring the agreed pronunciation patterns of a language and learning the correspondences between articulatory *movements* and sounds, they

are also discovering relationships between *meanings* and sounds.

Linguistic theory and sound patterns

In the 1940s and beyond, linguistics theory blossomed in the hands of scholars like Jakobson (1941/1968), who studied child language, aphasia and phonological universals; Velten (1943), who investigated in the growth of phonemic and lexical patterns in infants; and Leopold (1947), who explored sound learning in the first two years of life. These linguistics developments eventually proved highly relevant to practice, but, in and around the World War II period, the profession tended towards physiology, psychology and psychiatry for elucidation, and not linguistics or education. By the 1950s, however, the literature revealed that thinkers knew something more was going on in speech besides auditory, visual and tactile perception and motor execution of sounds. The idea of an inner process or underlying representation as a clinical construct was imminent. Eisenson (1968) talked about symbol formation; Goldstein (1948) and Myklebust (1952) alluded to inner language; and Osgood (1957) used two terms: mediation and psycholinguistic processing.

The linguistic linkage that enticed speech-language clinicians to consider speech disorders in terms of sound systems or patterns came about when researchers in the area of generative linguistics, Chomsky and Halle (1968), expounded distinctive features theory in *The Sound Patterns of English*, a book so famous and influential in linguistics circles that it is commonly referred to simply as SPE. Contemporaneously, Ferguson (1968) looked at contrastive speech analysis and phonological development (see also Ferguson, 1978; Ferguson & Farwell, 1975; Ferguson, Peizer, & Weeks, 1973). Then, Stampe (1973, 1979) forged another link, but this time in the area of natural phonology, leading most saliently for us to Ingram and his innovative work (Ingram, 1974; 1976) uniquely dedicated to the understanding of disordered speech, and to Grunwell (1975, 1981).

Clinical phonology

In the 1970s, linguists and SLPs/SLTs were talking to each other about language in general and clinical phonology in particular. Finally, what SLPs/SLTs had perceived as multiple individual errors came to be seen as sound class problems, involving multiple members of those classes.

For two phonologists, Pamela Grunwell and David Ingram, there was a clear mission to help the SLP/SLT profession in the practical application of phonological principles to the treatment of children with 'phonological disability'; and many clinicians, myself included, devoured every word they wrote! Clinical phonology, according to Grunwell (1987), a British linguist working in the United Kingdom, was the clinical application of linguistics at the phonological level. Ingram (1989a), an American located in Canada at the time, 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 mapping rules that connect the two). Around the same period in the United States, Stoel-Gammon and Dunn (1985) provided further theoretically principled guidance in a book about assessment and intervention, as did Elbert and Gierut (1986).

From a therapy point of view, the most radical aspect of the new principles was their focus on changing phonological patterns by stimulating children's underlying systems for phoneme use. There was an apprehensive feeling abroad in the clinical community that, because of the theoretical paradigm shift, therapeutic approaches, intervention goals and therapy procedures and activities should now be different, or at least revamped. Fey (1985, p. 255) answered these concerns and uncertainties in a reassuring 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, artic-

ulation 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.

In their response to Q3, Nicole Müller and Martin Ball, both linguists, explore the development of the application of linguistic sciences to speech SLP/SLT practice.

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Q3. Nicole Müller and Martin Ball: Application of linguistic sciences

Crystal (2001) defined clinical linguistics, which had its origins in the 1970s, as 'the application of the linguistic sciences to the study of language disability in all its forms'. It has become an independent discipline in its own right with its own professional association, as well as being a core curriculum subject in the preparation of SLPs/SLTs. On the one hand, it informs SLP/SLT assessment, target selection and intervention practices; and on the other, it provides a tool for critical evaluation of competing linguistic theories and methodologies (Perkins & Howard, 1995). In the process, each discipline impacts the other. How did these two-way influences evolve, what in your estimation are the contributions of clinical linguistics to SLP/SLT practice and vice versa?

A3. Nicole Müller and Martin J. Ball: Clinical linguistics (and phonetics)

On a fairly regular basis, students of speech language pathology/speech and language therapy (SLP/SLT) ask us, 'why do we need to study all that linguistics?' To clinical linguists (and phoneticians), the answer is blindingly obvious: To us, doing SLP/SLT without a solid basis in phonetics and linguistics is like trying to do engineering without physics: One (physics, or linguistics/phonetics) is the enabling science that provides the conceptual basis, and indeed the language, to be able to talk about problems arising in the other (engineering, or SLP/SLT). Having said that, we of course have to add that there are a lot of branches of physics that do not contribute directly to building safer bridges or improving the efficiency of the internal

combustion engine. Similarly, there is a lot in linguistics that does not precisely lend itself to clinical applications, such as the development of assessment procedures or of intervention programs. Still, we maintain that speech and language pathologists need a strong grounding in linguistics and phonetics, and we hope to show why in this brief essay.

The term 'clinical linguistics' gained currency in SLP/SLT and linguistics in the wake of David Crystal's publication of a book with that title in 1981. Crystal defined clinical linguistics as the 'application of linguistic science to the study of communication disability, as encountered in clinical situations' (Crystal, 1981, p. 1) and expanded on this definition later: '[C]linical linguistics is the application of the theories, methods, and findings of linguistics (including phonetics) to the study of those situations where language handicaps are diagnosed and treated' (Crystal, 1984, p. 31). For the purposes of this essay, we use the term clinical linguistics in Crystal's sense, that is, as the theoretical backbone providing tools for clinically applied analyses. Other linguists have expanded on Crystal's original definition and include, under the umbrella term of clinical linguistics, research that uses data gathered from participants with a variety of language disorders in order to test hypothesis formed on the basis of linguistic theories. In such studies, clinical data are used to test constructs about language systems, formed on the basis of normal language or, more often, on the basis of native speaker intuition and introspection of how language works (see, for example Ball & Kent, 1987, and for further discussion Müller & Ball, 2013a).

Like other scientists and philosophers, linguists construct taxonomies of categories and build models that aid them in thinking about phenomena they encounter in the real world; in other words, they build theories. The path from linguistic theories to clinical application is essentially a one-way street. The theories and interpretive categories we use to

analyse, interpret and hopefully understand language produced by people with a variety of language disorders are by and large, imports, that is, they are frameworks developed with normal language, and typically functioning language users in mind as the models (which are usually taken for granted). There are no linguistic theories (including phonology) of disordered language that do not start out as theories of normal language. However, most modern linguistic frameworks, including phonological theories, have, to a greater or lesser intent, had an impact on clinical linguistics. Some aspiring or practicing clinicians may, on reading this, think, 'but I'm not interested in all this talk about theory. I just want to know what to do in practice'. We need to keep in mind, though, that humans cannot think without theorising, and categorising: Thinking, and talking about, and striving to understand, any phenomenon we encounter is, in essence, an exercise in theorising. And any terminologies and categories that an SLP/SLT uses to describe and understand the phenomena encountered in clinical practice (e.g., speech output impairments) are the product of a set of underlying assumptions about the nature of the phenomena thus categorised. Further, when we use tools provided by linguistic theories to describe, analyse and understand patterns in disordered language, we need to ask ourselves the question whether we take the theoretical model we use as just that, namely a handy hook to hang our thinking on, or whether we assume that the descriptive categories we use are close representations of psychological, or mental, realities.

To illustrate: There is a sizeable body of work that applies Chomskyan generative linguistics, in its various versions, to the study of impaired language. Some key assumptions in generative theory are that language is a 'cognitive system that is represented in a speaker's mind/brain with a grammar as its core element' and the human language faculty is regarded as 'a mod-

ular cognitive system that is said to be autonomous of non-linguistic cognitive systems' (Clahsen, 2008, p. 165–166). The 'mental grammar' is also conceptualised as a modular system with distinct components, that is, lexicon, phonology, morphology and syntax. From such a perspective, language impairments are viewed, and investigated as, 'selective, *within-language* deficits' (Clahsen, 2008, p. 166). The aim of the linguist working within a Chomskyan generative model is to build a generative account of mental categories and operations. Language use, in the generative tradition of clinical linguistics, is of interest only insofar as it can give an insight into the mental representations that give rise to it and is thus not an object of investigation for the generative linguist.

Cognitive linguistic approaches, on the other hand, take different perspectives both with regard to the nature of language and cognition and to language use. In what Langacker (1987, 2000) termed 'cognitive grammar', and in subsequent variants of cognitive approaches to linguistics, such as Bybee and colleagues' cognitive phonology, grammar is considered to emerge from general cognitive abilities; language learning uses the same cognitive abilities as other types of learning, such as 'memory, motor control, categorization and inference making' (Vogel, Sosa & Bybee, 2008, p. 485, following Bybee, 2001). The term 'usage-based' is intended to capture the status of language use as crucial in the shaping of language structure, 'with structure seen as both a generator and a product of language use' (Vogel, Sosa & Bybee, 2008, p. 481). A usage-based account of language acquisition, for instance, gives an important role to language use in a continuous process of modifying and building a child's linguistic system, which in turn is seen as a dynamic, emergent system. This is very different from seeing the role of input as that of a mere trigger for the setting of a finite number of pre-determined parameters in a child's internal grammar, as in the

principles and parameters account of generative grammar. Generative and cognitive linguistic approaches are thus diametrically opposed to each other in how they view the relationship between language and cognition on the one hand, and the role of language use in the shaping of language knowledge.

How and why does this matter for clinical practice? And how and why does it matter whether we take theoretical models as 'just models', that is, aids in thinking, or as representing a mental (or psychological) reality? Let us consider the notion of contrastivity in spoken language, which is a fundamental concept in all theories of phonology. Every linguist or SLP/SLT has, at one time or another, learned about the notion of the phoneme as the segment-sized embodiment of contrastivity, more typically defined as the smallest unit of sound in a language that can bring about a change in meaning between two words. There are two ways to think about the *phoneme*: We can treat the phoneme as a *real thing*, something that is psychologically real, a part of language knowledge that is acquired as part of language acquisition (or second language learning), and that in turn, somehow, drives speech production. If we think of phonemes as mental categories in the Chomskyan generative tradition, then we will most likely conceptualise them as made up of distinctive features, and of language use, or input, as a trigger for the setting of feature specifications. Since in Chomskyan generative linguistics phonology and lexicon are thought of as two separate modules within language knowledge, it should, in theory, not matter how rich and varied the language use is that we provide if we target phonemic contrasts in intervention, since, again in theory, any one minimal pair is a representation of a target contrast.

On the other hand, we can use the term *phoneme* as a useful summary that certain minimal differences between otherwise similar sequences of articulator configurations result in acoustic output that is perceived

as representing different meanings. Thus, the syllables /tɪp/ and /dɪp/ illustrate that fortis and lenis plosives in English represent different phonemes. Thus, the term *phoneme* embodies a complex of cognitive as well as physical *processes* that link the properties of words as semantic entities with sound production and perception. In other words, /t/ and /d/ are a very economical way of representing that the production of a fortis versus a lenis plosive, in an otherwise identical syllable structure, is 'different enough' to represent different semantic categories, or words. We can further note that this difference is expressed most typically, in English word-initial position, by way of an aspirated voiceless plosive [t^h] versus a partially devoiced plosive [d̥], and to these latter categories we typically refer to as allophones of their respective phonemes. This way of thinking, in our view, aligns well with cognitive or usage-based models of language: From this perspective, phonology – and with it contrastivity – is considered to be an emergent property of vocabulary learning. In terms of intervention it would therefore make most sense to use many different exemplars to facilitate the emergence of the target contrast.

To summarise: SLPs/SLTs need linguistics (including phonetics) because linguistic frameworks provide tools to discover patterns in communication events involving language (or other) impairments, which in turn can contribute to an explication of communication successes and breakdowns and ideally inform efforts to improve communicative success. We believe that it is most useful to take models just as that, namely, as aids to thinking, rather than as representing the 'mental truth' of language and speech. A further important assumption that we make about a clinically useful linguistics is that it is data driven, in other words: the starting point of our endeavours is always *language use in context*. This means, in turn, that we need to marry theories about discrete phenomena with speech in 'real life': To return to our

earlier example, the phoneme neatly captures the notion of contrastivity in terms of a *minimal* contrast: /t/ and /d/ are phonemes of English, represented by IPA symbols for static articulatory configurations. However, speech in real life is about movement, precision and coordination, all of which contribute to 'meaning making', and intervention needs to take this into consideration. With this in mind, we believe that SLPs/SLTs need to critically evaluate the terminologies and categories they encounter and use, which in turn makes it necessary to study the underlying assumptions.

Articulation development

In work whose impact was far-reaching, Irene Poole, a speech teacher at the University Elementary School in Ann Arbor, MI, pursuing a doctorate, produced a developmental schedule for phonetic development (Poole, 1934). This was consistent with the prevailing, and persisting, view that intervention for speech impairment should be based on typical developmental expectations of 'articulatory proficiency'. Other accounts of phonetic mastery criteria have followed, up to the present day (e.g., Templin, 1957; Sander, 1972; Prather, Hedrick, & Kern, 1975; Arlt & Goodban, 1976; Kilminster & Laird, 1978; Smit, Hand, Freilinger, Bernthal, & Bird, 1990; and so on, through to more contemporary summaries of acquisition by Stoel-Gammon (2010) and McLeod (2013)).

A study of phonetic age-norms by Kilminster and Laird (1978) involved single-word citation-naming by children age 3;0–8;6 in Queensland, Australia, with the aim of determining the ages, in years and months, by which 75% of children had mastered 24 English phones. Most developmental profiles of phonetic acquisition are similarly structured, but Shriberg (1993) took a fresh approach when he produced a clinically useful breakdown of the 'early-8', 'middle-8' and 'late-8' acquired sounds, based on monosyllabic words in conversa-

Table 1.2 Developmental schedules for phonetic development

Age of acquisition (Kilminster and Laird, 1978 ^a)	Order of acquisition (Shriberg, 1993 ^b)
3;0 p b t d k g m ŋ w j h	Early 8
3;6 f	m n j b w d p h
4;0 l ʃ tʃ	
4;6 s z dʒ	Middle 8
5;0 ɹ	t ŋ k g v tʃ dʒ
6;0 v	
8;0 ð	Late 8
8;6 θ	ʃ ʒ l ɹ s z ð θ

^aData source: single word citation naming.

^bData source: monosyllabic words in conversational speech samples.

tional speech samples: reflecting the approximate *order* of acquisition rather than approximate *ages* of acquisition. The norms provided by Kilminster and Laird, and Shriberg's early-, middle- and late-8 are contrasted in Table 1.2.

But, we must remind ourselves that all of this clinically relevant information emerged in the 1970s environment in which practice was still heavily influenced by the medical model and American behaviourism; 'SODA' articulation analysis of errors of (S) substitution, (O) omission, (D) distortion and (A) addition; and 'Traditional Articulation Therapy'. This treatment, or at least close variations of it, is still widely implemented today. For example, Brumbaugh & Smit (2013a, b) surveyed 2084 US clinicians working with 3–6 year olds, gathering 489 usable, fully completed or sufficiently completed responses. They reported that more SLPs indicated that they used traditional intervention than other types of treatment. Of the 489, 49% often or always used traditional therapy, and 33% sometimes did.

Mirla Raz, an experienced licensed speech pathologist certified by the American Speech–Language–Hearing Association, regularly uses the approach in her practice. An SLP in private practice at Communication Skills Center in Scottsdale, Arizona, Ms. Raz has worked extensively with children, remediating speech sound disorders, language disorders and stuttering. She is the author of the *Help Me Talk Right* book series

that includes: *How to Teach a Child to Say the "R" Sound in 15 Easy Lessons*, *How to Teach a Child to Say the "S" Sound in 15 Easy Lessons* and *How to Teach a Child to Say the "L" Sound in 15 Easy Lessons*. In her response to Q4 she describes an intervention for a 4-to-5-year old based on traditional assessment data and combining traditional therapy without the auditory discrimination or ear training step, and with the inclusion of word pairs ('contrastive pairs'). As noted below, the two-word combinations were not necessarily minimal pairs, and this was not minimal pair intervention in the conventional sense (Barlow & Gierut, 2002; Weiner, 1981a, b).

Q4. Mirla G. Raz: From articulation therapy to Apps

Three of your *Help Me Talk Right* books (Raz, 1993, 1996, 1999) are rooted in the so-called 'Traditional Approach' to the remediation of articulation disorders. Such hierarchical, sound-by-sound interventions still have a place in the speech and language clinician's repertoire, but perhaps not always in a form that would be instantly recognisable to Van Riper (1978). In particular, he would probably be surprised to see oral placement therapy (Rosenfeld-Johnson, 2010) and other non-speech oral motor treatments in such prevalent use alongside his methods (Hodge, A31; Lof, A35). Can you outline and illustrate with a case study both the assessment procedures and the therapy methodology you use and point to evidence in support of the traditional approach? A proliferation of Apps for articulation assessment and intervention is flooding the market (Bowen, 2013; Toynton, A33). Are there certain ones that stand out for you as worthwhile additions to a clinician's toolbox in implementing articulation therapy, is evidence associated with them, and can you speculate on where articulation assessment and intervention Apps might head in the future?

A4. Mirla G. Raz: One clinician's adaptations of traditional articulation therapy to work with a child with phonological disorder

Among approaches to speech sound disorders in children, traditional therapy has a long history and is widely implemented. However, it is not necessarily the intervention of choice when a client demonstrates numerous phonological errors (Kamhi, 2006). That is because sound-by-sound correction can be time consuming, and there are more efficacious therapy approaches for children with phonological disorder. But, how does an SLP/SLT determine whether or not to use a traditional therapy approach or another approach? The key lies in reviewing assessment data to see if the child's SSD has a predominantly phonemic (phonological) basis, or a predominantly phonetic (articulatory) basis or a combination of these. I avoid approaches such as NS-OME that have little or no empirical support (Lof, A35; McCauley, Strand, Lof, Schooling & Frymark, 2009).

Articulation testing

During my nearly 40 years of evaluating and treating children with SSD, I have steadily relied on the *Goldman-Fristoe Test of Articulation* (Goldman & Fristoe, 1969, 2000) for speech assessment. It is easy to use and offers a clear picture of the child's speech production at the word level. Using the sounds-in-words subtest, one can transcribe and note the child's word productions and speech errors. I transcribe a child's production of a word if more than the targeted sound is in error. If the test indicates the child has, what I regard to be, 'standard substitutions' such as w/l, w/ɹ, f/θ, d/ð, θ/s, ð/z, t/k or d/g, I do not explore further.

If the child is difficult to understand and/or has significant token-to-token variability and I suspect phonological disorder, I then record a sample of the child's conversational speech. The sample can take anywhere from 5 to 15 minutes. I may get a sufficient sample from a talkative child in 5 minutes, whereas with a reticent child may take longer. Doing so is advisable as Eisenberg & Hitchcock (2010) demonstrate. They found that standardised tests did not offer sufficient words to allow an SLP/SLT to draw conclusions about a child's phonetic inventory. The question is what is a sufficient sample? Weston, Shriberg and Miller (1989) were not clear as to how many utterances were required for a sufficient sample but suggested that the number may be as high as 225. It is also important to note that, for some children, obtaining an accurate speech sample is extremely difficult. These are children whose connected speech is so difficult to understand that I have been unable to determine what the child is saying.

Case example

Philip was 4;8 when I began working with him. The Photo Articulation Test (Lippke, Dickey, Selmar & Soder, 1997) had been administered at his school and showed a phonetic repertoire comprising /p/, /b/, /t/, /d/, /j/, /n/, /w/ and /h/. Additionally, he omitted final consonants and only used /w/, /b/ and /n/ intervocalically. Stimulability testing indicated that Philip was able to produce all phonemes, in isolation, with the exception of /k/, /g/, /x/, /w/, /θ/ and /ð/. Just 10% of his speech was intelligible to me, and 5% to the SLP who administered the test.

To rule in or out language impairment I administered the Peabody Picture Vocabulary Test III (Dunn & Dunn, 1997) (Standard Score 113; Percentile Rank 81) and the Preschool Language Scale-3 (Zimmerman, Steiner, & Pond, 1991). His Auditory Comprehension Standard Score was 115 (PR 84);

Expressive Communication Standard Score 108 (PR 70); and his Total Language Score was 113 (PR 81). Clearly this was a child with average language skills. However, his reduced intelligibility made it impossible to accurately assess his conversational language. I felt that any deficits in conversational language would become apparent as I got to know him better and his speech improved.

Philip was scheduled for individual therapy twice weekly for 30 minutes each session. I began Philip's therapy program by targeting /k/ and /g/ using a modified traditional articulation approach. I use the term modified since I have eliminated sound discrimination, comparing and scanning (Van Riper, 1978) from my therapy approach. The first step was to target /k/ and /g/ in isolation. Philip succeeded in producing both sounds the first session, and vowel-consonant (VC) combinations by session 2 and so was challenged to use the velar stops syllable-initial-word-initial (SIWI) and syllable-final-word-final (SFWF) in real words. By the end of the third session, Philip was able to produce the sounds in paired words such as: *come-cow*, *go-girl*, *make-bake*, *hug-bug*). However, a glitch arose when Philip was confronted by a word containing a velar stop and /t/ or /d/. Thus, when he said them, *kite* became *tite*, *goat* became *dote*, *take* became *tate* and *dig* became *did*. To tackle this issue, a 'contrastive pairs' approach was introduced. Philip was shown four different sets of paired pictures comprising initial and final /k/ and /t/ contrasts, and initial and final /g/ and /d/ contrasts. Philip's task was to name the pictures pronouncing both the velar and alveolar stops correctly. In session 6, Philip was asked to use the paired words in short sentences such as *I hug the bug* and *I come to the cow*. During this session, Philip was able to use /k/ and /g/ within words. Initial clusters were introduced in the ninth session. By the 10th session, he was ready to use the targeted sounds in sentence repetition tasks wherein the targeted sounds occurred randomly, as

in: *The cat loves catnip* and *The bag is full of chocolate cookies*. He progressed rapidly and by the 12th session he had mastered /k/ and /g/ in elicited conversation. In the elicited conversation condition the therapist manipulates input to encourage the child to use the target conversationally. For instance, playing an airport game, I might ask, 'What do we need to buy to get on the plane?' to elicit 'ticket'. Philip was ready to begin using the targeted sounds in conversation by session 13. As Philip was working on using /k/ and /g/ in conversation, /w/ was introduced. Two sessions later, Philip was able to use /w/ at the sentence level. In session 23, Philip's new goal was to use all sounds, with the exception of /ʃ/, /tʃ/, /dʒ/, /l/, /ɹ/, /θ/ and /ð/ in sentence repetition tasks. Two sessions later, /ʃ/, /tʃ/, /dʒ/ and /l/ were added to the same task. We began working on using all sounds, with the exception of /ɹ/, /θ/ and /ð/, in elicited conversation at session 35 and two sessions later Philip was challenged to begin using the sounds in conversation. At this point, language goals were introduced, because as Philip's speech became more intelligible, grammatical deficits became evident. Soon after, /ɹ/ was targeted and later /θ/ and /ð/. Fourteen months after beginning therapy, Philip, now aged 5:10, had mastered all phonemes and was completely intelligible.

Apps and articulation therapy

It is years since I saw Philip for intervention and he still stands out as one of the most phonologically impaired children on my caseload. Would my therapy program be different today with all the available technology? Would I use Apps to assist me in speech therapy?

When the tablet first came out, I was certain these devices would have a significant effect on clinical practice. I still feel it will. However, at this time Apps for speech therapy

have definite limitations. These shortcomings are due to technological limitations. At the time of writing, Apps are not yet able to accurately recognise many individual sounds and their interpretation of sound can be flawed. The technology works best when it recognises the user and when it analyses large communication segments, such as words in phrases. The finer the analysis needed, the less accurate the technology becomes, so that voice recognition technology is highly unreliable when it comes to analysing sounds in words, syllables and in isolation. Let us say that a client is working on /d/ production and the App records the client's production. Let us assume the client produces /b/ instead of /d/. There is a good likelihood that the App will indicate that the sound was produced correctly. This is precisely what happened when I tested *Tiga Talk* (Tiga Talk, 2011) by Tac-tica Interactive, featuring cartoon characters from a Canadian children's television show. Regardless of the sound I produced, the App treated the sound as the correct production. Using such an App, an unsupervised child is rewarded whether he or she says the target sound or another sound. This happened for each of the 23 sounds the App offered.

Another drawback to speech Apps can be the poor sound output quality, making it difficult for the client to hear an accurate model of many sounds. The sound output quality is highly dependent on the quality of the recording device and playback devices. This points to the need for developers to employ a good-quality microphone during the development of any App, because a tablet's speakers will not be able to compensate for substandard recordings. When working with children on articulation, it is essential that all sounds be clearly produced. Apps focusing on minimal pairs are particularly vulnerable to clarity issues when they present contrasts that the child customarily confuses. At the time of writing, it is preferable, in my view, to look for Apps in which the SLP/SLT provides visual feedback, for example by

tapping a 'plus' if a child's response is correct or an X if it is incorrect.

Apps and EBP

In the last few years much has been written about evidenced-based practice. SLP/SLT application software technology is so new that there have not yet been studies of the efficacy of using Apps in therapy or for testing. My view is that because Apps are technological versions of the paper materials widely used, the same evidence supporting paper materials may be valid for Apps. SLPs/SLTs must be careful, however, when it comes to taking any statements regarding evidence at face value. For example, SLP and App developer Barbara Fernandes cites work by McGregor, Newman, Reilly and Capone (2002) in support of her 2012 language App *Go-Togethers* (Simms, 2012). Their research does not, in fact, support the claims Fernandes reports for the App's effects.

Apps are becoming increasingly sophisticated with numerous attractive and time-saving features. They currently have the capacity to compute responses for individuals and groups within databases and allow users to record speech and other sounds. As yet, few Apps for speech sound disorders utilise two potentially appealing features: animation and interactivity, and it is hoped that far-sighted developers will move in this direction. Improvements in voice recognition technology have the potential for enhancing our work with children's speech. I anticipate that our devices will one day be able to accurately determine whether or not a sound was said correctly. I envision a client being able to observe how far from the target sound her production was and make the changes according to the device's feedback. But in answer to my own question about whether Apps might have helped in Philip's treatment, the answer at this stage probably has to be a qualified 'no'.

Revolution?

Did the hackneyed term 'paradigm shift' (Kuhn, 1962) overstate what actually happened? *Was* there a phonological revolution? *Did* the new principles change practice? Certainly there were changes in the way assessments were conducted (Grunwell, 1975, 1985a; Hodson, 1980; Hodson & Paden, 1981; Ingram, 1981; Shriberg & Kwiatkowski, 1980; Weiner, 1979), but did the *intervention* work of Elbert, Dunn, Gierut, Grunwell, Hodson, Ingram, Paden, Stoel-Gammon and others alter what happened in therapy? The answer probably has to be, 'not much'. In a US context, Brumbaugh and Smit (2013) report that 33% of their respondents frequently used the cycles phonological patterns approach and suggested the possibility that 'SLPs who treated preschoolers were using hybrid interventions, influenced primarily by traditional intervention, but also by minimal pairs and cycles approaches' (p. 316).

In 2004, when Barbara Williams Hodson, co-developer with Elaine Pagel Paden in the mid-1980s of patterns or cycles therapy (Hodson & Paden 1983, 1991), was asked in an online interview for *Thinking Big News* (Thinking Publications, 2004): 'If you could change one thing in how SLPs work with clients what would it be?' Her response was: 'The one thing I wish most is that SLPs would work on patterns when serving an unintelligible child, rather than to focus on teaching isolated sounds to a criterion'. This resonated with something she wrote some 12 years before (Hodson 1992, p. 247) about the relative lack of application of phonological principles by North American SLPs to either assessment or intervention:

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 90s, 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.

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American Speech and Hearing Foundation Frank Kleffner Lifetime Clinical Achievement Award, and was recognised with ASHA's Honors of the Association in 2009. In A5 she discusses the continuing adherence by many clinicians to sound-by-sound intervention.

Q5. Barbara Williams Hodson: A phonological patterns focus

In the preface of *Evaluating and Enhancing Children's Phonological Systems: Research and Theory to Practice* (Hodson, 2010 p. xi), there are echoes of the statements you made in 1992 and 2004, mentioning the concerns for severely and profoundly involved clients with highly unintelligible speech, when the focus remained on mastering individual phonemes one at a time (e.g., /f/ singleton) to a pre-selected criterion as contrasted with facilitating phonological patterns (e.g., 'syllableness', final 'consonantness' or /s/ clusters). You go on to write:

Most treatment programs are phoneme-oriented. The majority of these focus on mastering each phoneme before progressing to the next target. Some use contrastive techniques (e.g., minimal pairs, maximal oppositions, multiple oppositions). A few target word structures, referred to as 'phonotactic' by Velleman (2002). Our preference for children with severe/profound disordered expressive phonological systems is to target patterns that are deficient, including word structures related to omissions (e.g., /s/ clusters, final consonants) as well as phoneme categories (e.g., velars, stridents). Phonemes are considered to be a means to an end rather than the true targets.

Given the empirical evidence for cycles (Baker, Carrigg & Linich, 2007; Prezas & Hodson, 2010, p. 144; Rudolph & Wendt, 2014), latterly called the *Cycles Phonological Pattern Approach (CPPA)*, it is really unfathomable that this still needs to be said. Why do not more US clinicians target phonological patterns when they have clients with unintelligible speech?

A5. Barbara Williams Hodson: Cycles phonological pattern approach

One of our observations in the 1970s was that working on one phoneme-at-a time seemed adequate for a child with a mild speech sound disorder with only a few phonemes in error (e.g., /θ/ and /ɪ/). Children with highly unintelligible speech (i.e., extensive phonological deviations), however, were requiring years of intervention in order to 'master' all of the sounds and word structures. In the mid-1970s, David Ingram's book became available. Ingram (1976) helped us see beyond individual phonemes. As we began experimenting with targeting broad patterns at the University of Illinois clinic, we observed faster intelligibility gains.

One comment I have heard from a rather large number of practicing speech-language pathologists in the United States is that although they learned how to identify the various approaches on exams, they never actually learned how to provide pattern-oriented treatment in their classes or clinical experiences. Often, while watching videos, they seem to be astounded at the huge gains in intelligibility of clients during a period of 2 years or less (contact time 60 minutes per week).

Another consideration is that we do know that everything we do (Ingram, 1983, p.1) leads to improved speech overall. But we also are aware of the critical age hypothesis (Bishop & Adams,

1990) and know that children need to be intelligible by age 5 1/2 years or they surely will have greater difficulty acquiring literacy.

The CPPA was initiated in 1975 in an experimental clinic for young children with highly unintelligible speech at the University of Illinois (see Hodson, 2011). Rapid changes occurred in our treatment methodology during the late 1970s, as hypotheses were formulated and tested, revised as needed and tested again. For example, singleton /s/ was a common target the first year, which was a mistake. It was observed that when these clients attempted to produce word-initial singleton /s/, they did succeed in producing the /s/, but then they inserted their original substitution /t/; thus *sun* was realised as *stun*. At first the student clinicians taught the child to delete the /t/. Children were then able to say *sun*, but words with /s/ clusters were being produced with /s/ singletons (e.g., *say* for *stay*). It was hypothesised that targeting /s/ clusters before /s/ singletons might be more expedient for children with highly unintelligible speech. Moreover, as children began incorporating /s/ clusters/sequences into their conversational speech, their intelligibility improved dramatically (Gordon-Brannan, Hodson, & Wynne, 1992).

Targeting phonological patterns via *cycles* (time periods varying from 5 to 16 hours depending on each child's needs) was explored at our first experimental phonology clinic, and then this approach was revised numerous times. Typically a phoneme (or consonant cluster) is targeted 1 hour per week (i.e., one 60-minute session, two 30-minute sessions or three 20-minute sessions), with each pattern usually being targeted from 2 to 5 hours per cycle. (Note: the time is doubled [i.e., 120 minutes per target] for children with cognitive delay). Thus, targets for the CPPA are Phonological Patterns (e.g., 'syllableness'. final 'consonantness'), with phonemes (e.g., final /p/) serving as a 'means to the end' rather than being the goal.

One other clinical research finding has been learning the importance of incorporating some phonological awareness (PA) activities (e.g., rhyming, syllable segmentation) in treatment sessions. Not only do PA skills help children acquire literacy, the PA tasks also often help children improve aspects of speech (e.g., final 'consonantness' after focusing on rimes in rhyming activities).

Theoretical considerations and underlying concepts

The CPPA is based on developmental phonology theories and cognitive psychology principles as well as on-going clinical phonology research. This approach is aligned most closely with two theories: Gestural Phonology (Browman & Goldstein, 1986, pp. 219–252, 1992) and Dynamic Systems (Thelen & Bates, 2003). Eight underlying concepts (see Table A5.1) serve as the basis for this approach (Hodson, 2010; Hodson & Paden, 1991).

Table A5.1 Underlying concepts

1	Children with 'normal' hearing typically acquire the adult sound system primarily by <i>listening</i> .
2	Phonological acquisition is a <i>gradual</i> process.
3	<i>Phonetic environment</i> in words can facilitate or inhibit correct sound productions.
4	Children associate <i>auditory</i> and <i>kinaesthetic</i> sensations that enable later <i>self-monitoring</i> .
5	Children <i>generalise</i> new speech production skills to other targets.
6	An optimal <i>match</i> facilitates learning.
7	Children learn best when they are <i>actively involved/engaged</i> in phonological remediation.
8	Enhancing a child's <i>metaphonological</i> skills facilitates enhances the child's speech improvement and also development of early literacy skills.

Source: Adapted from Hodson (2010)

Targeting phonological patterns

Typically a phoneme (e.g., final /k/) or a word structure (e.g., /s/ clusters in words) is targeted 1 hour per week. At least two exemplars (e.g., /sp/ and /st/) of the current target pattern (e.g., /s/ clusters) are presented before moving on to another target pattern (e.g., velars, liquids) or structure (e.g., final 'consonantness') within the cycle. Most target patterns are recycled one or more times with complexity being increased gradually for each succeeding cycle.

Based on clinical research that is on-going, phonological patterns have been divided into *Primary* (those targeted first and then recycled as needed until they began emerging in conversational speech) and *Secondary* patterns (Figure A5.1).

It is critical that the child be *stimulable* and capable of producing the target sound (assisted by various tactile cues and amplification at first) in order to help the child produce the sound and thus develop a new accurate kinaesthetic image. Amplification is used to help children produce the sound and then to develop a new accurate auditory image. We use a small portable battery-operated amplifier and child-sized headphones. We have been able to elicit sounds with the amplifier that had not been stimulable by any other method. The term 'kinaesthetic image' refers to the sense/awareness in the brain of relative movements/positions of parts of the body (see Servomechanism explanation by Fairbanks, 1954). Sounds that initially are 'nonstimulable' (e.g., /k/) are stimulated/facilitated for a few minutes during each session (i.e., teaching stimulability/appropriate production) and then are targeted as soon as the child can actually produce the sound(s). If sounds are targeted while they are still nonstimulable, the continued production(s) of the incorrect sound(s) can be harmful in that this reinforces the inaccurate kinaesthetic image. Table A5.2 provides information about the typical *CPPA* session structure.

Two-year olds

The *CPPA* session structure has been adapted for toddlers. Most of the children under the age of 3 years who have been referred to the Wichita State University clinic have not been willing to participate in regular production-practice activities. Some are nonverbal; others are unwilling to name pictures or imitate words. These children participate in a cycle (typically 2–3 months of weekly sessions [30–45 minutes in length]) of focused auditory input/stimulation for the primary phonological patterns. The clinician fills the room with objects and activities for a primary pattern phoneme (e.g., *mop top hop up cup tap beep* for final /p/) are incorporated to enhance awareness of final consonants.

The next phonological target is often final /k/, thus facilitating both final 'consonantness' and velars. The child participates in parallel-play activities but is not asked to name words during this cycle. The parents receive a 'listening' list of words (with the week's target pattern) to read to their child each night, but they are instructed not to ask the child to say any particular words at this time (i.e., reduce pressure). These adaptations provide a great foundation.

We have found that the child readily moves to production practice during the ensuing cycle. These children have then progressed rapidly. The new clinicians (students) report that they can tell which patterns were presented during the preceding focused auditory input cycle.

Incorporating complexity

It is important to note that complexity is increased gradually throughout the *CPPA* so that the child is optimally challenged but successful from the beginning of treatment (Hunt, 1961). Most young

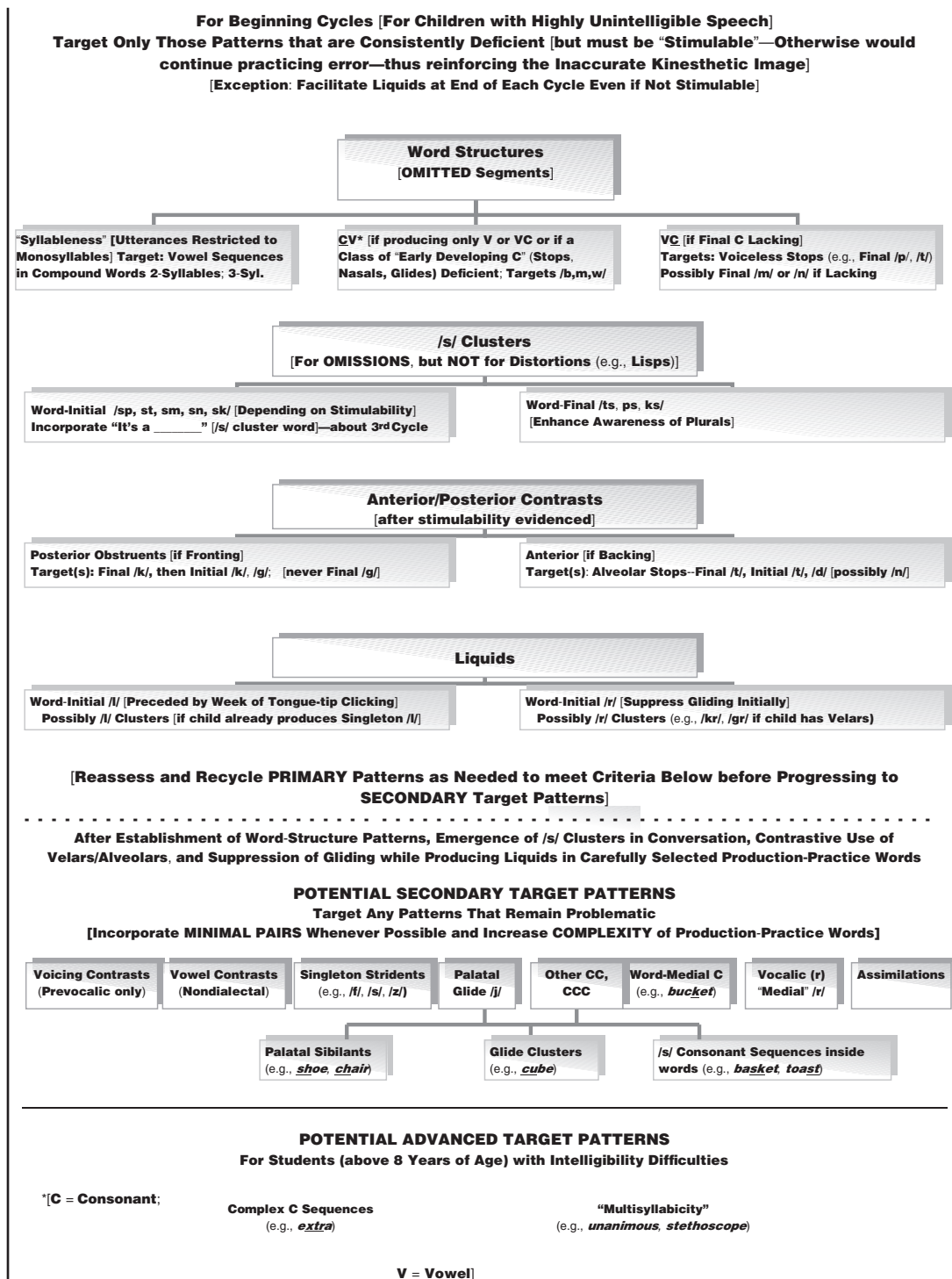


Figure A5.1 Potential optimal primary phonological patterns. Adapted from Hodson (2010).

Table A5.2 Typical clinical session structure		
1	Review	Child produces practice words (depicted on large index cards) from the previous treatment session.
2	Listening activity	Clinician reads approximately 20 words using slight amplification (this takes 30 seconds). Child then says new production-practice words for the day while still wearing amplifier headset.
3	Experiential-play motivational production-practice activities	Child says practice word by naming picture or object with correct production of the target pattern for the session before ‘taking a turn’. Clinician provides assists (e.g., modelling, tactile cue) as needed so that the child achieves 100% ‘correctness’ for the target pattern in the practice words.
4	Metaphonological activity	Incorporation of a metaphonological activity: (e.g., rhyming, syllable segmentation).
5	Probing	Probing by clinician to determine optimal target (e.g., singleton phoneme, consonant cluster) for next session’s target pattern.
6	Listening activity	Second reading of week’s listening list with slight amplification (by parent if possible).
7	Home program	Parents/caregivers are given the following from this day’s session to practice with their child 2 minutes every day. (a) week’s listening list to read to their child, (b) week’s production-practice word (picture) cards for child to name, and (c) metaphonological activity (e.g., folder with 4-line rhyme, syllable segmentation).

Source: Adapted from Hodson (2010)

clients (with initial intelligibility below 20% (Gordon-Brannan, Hodson, & Wynne, 1992) in the university experimental phonology clinics (Wichita State University, San Diego State University, University of Illinois) were judged to be essentially intelligible within 3–4 cycles (i.e., approximately 30–40 contact hours) and simultaneously demonstrated vastly improved phonological systems.

Consonant category deficiencies: Beyond phonological ‘processes’

Readers should note that consonant category deficiencies are coded (Hodson, 2003, 2004) if the specified category is lacking because the sound is either being omitted or there is a substitution from a different consonant category. For example, a velar target (/k/) is scored as deficient if it is omitted or if a non-velar sound (e.g., /t/, /j/, /h/) is substituted. This system is necessary because scoring only phonological processes does not always identify what the child needs to target. For example, some children receive a score of zero for fronting, but do not produce any velars because they either omit them or substitute a non-anterior sound (e.g., /h/ or /j/), neither of which is fronting (Hodson 2003, 2004).

Models of phonological acquisition

It has become axiomatic in the literature to say that, because so little is known about normal phonological development, a cohesive, convincing linguistic theory of phonological disorders

has yet to be formulated. Ingram (1989a) surveyed various attempts in the field of linguistics to construct a phonological theory that covered both normal and disordered phonological acquisition, indicating that the most likely sources of elucidation of *normal* acquisition might

be universalist/structuralist theory (Jakobson, 1941/1968), natural phonology theory (Stampe, 1969), or the Stanford cognitive model (Macken & Ferguson, 1983). Of the three, only that of Stampe was directly tied to a phonological theory.

The behaviourist model

The behaviourist model dominated linguistics from the 1950s to the early 1970s. It applied a psychological theory of learning to explain how children came to distinguish and produce the sound system of the ambient language. Its adherents included Mowrer (1952, 1960), Murai (1963) and Olmstead (1971). They identified the role of contingent reinforcement in gradually 'shaping' a child's babbling to meaningful adult forms through classical conditioning. An important aspect of the model was the emphasis on 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 adults' vocalisations assuming secondary reinforcement status.

Eventually, the infant's vocalisations would become secondary reinforcers (providing self-reinforcement) due to their similarity to adult models. From this point, the caregiver could refine the sound repertoire of the infant through selective reinforcement. The behaviourist framework 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.

The structuralist model

The structuralist model (Jakobson, 1941/1968), stemmed from structuralist linguistic theory, and it 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 devel-

opment of the sound system. Evidence of regularities in pre-linguistic vocal patterns (Ferguson & Macken, 1980; Oller, Wieman, Doyle & Ross, 1976) has, however, weakened this position. As well, mid-1970s research challenged Jakobson's hypothesis of a sequence of phonemic oppositions as the basis for the 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. Really, the developmental order of phonemic oppositions has proved difficult to ascertain, because 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 (or 'lexical selection') lent weight to the theory that, in the first-50-words-stage, children target whole words (Ingram, 1989a, pp. 17–22). The phonetic variability readily observed in children in the 9- to 18-month-age range may also provide evidence against a universal order of phoneme acquisition. Irrespective of such shortcomings, Jakobson's views exerted a tremendous, enduring influence on linguist thought. Ingram (1989a p. 162) counted the structuralist model as one of the 'most likely candidates' for a theory of normal phonological acquisition. He talks about this in A6 and also addresses the topic of whole word measures of correct speech production in A12 in the following chapter.

Dr. David Ingram received his PhD from Stanford University in 1970, where he studied language universals under Professor Joseph Greenberg and phonological acquisition in children under Professor Charles Ferguson. His interest in language disorders was developed during two subsequent years as a Research Associate at the Scottish Rite Institute for Childhood Aphasia. He was a professor at the University of British Columbia from 1972 to 1998 and has been a professor at Arizona State University since 1998. His research is on language acquisition in typically developing children and children with

language and phonological disorders. The focus is on both English-speaking children and children acquiring other languages. The language areas of primary interest to him are phonological, morphological and syntactic acquisition. He has published over 100 articles and is particularly known for his seminal work, *Phonological Disability in Children* (1976), and his comprehensive textbook, *First Language Acquisition* (1989b).

Q6. David Ingram: Theory and speech sound disorders

Can you comment on this quotation from Powell, Elbert, Miccio, Strike-Roussos and Brasseur (1998) who said, 'Perhaps we err in our attempt to find a single theory to support all of our work with children with phonological disorders. When we acknowledge the heterogeneity of this target population, we are logically moving towards acknowledging that different theoretical approaches may have to guide our work with different subgroups. We seem to have moved past the more simplistic "one theory fits all" view'. It is a moot point in SLP/SLT circles whether clinicians spend much time thinking about theories, but most clinicians probably incorporate into their 'theory of intervention' (Fey, 1992b) the idea that you cannot work effectively with children with SSD unless you have a good grasp of normal development. In this context, the notion of 'typical acquisition' is usually around age-of-acquisition and order-of-acquisition schedules that focus on surface forms and not much to do with theories of development and models of phonology. Do you continue to regard the structuralist model as a frontrunner in the formulation of a theory of normal phonological acquisition (Ingram, 1989a), and what are the other contenders? How do you see a theory of acquisition informing the development of theories of disorder and intervention, and how can clinicians use this information?

A6. David Ingram: The role of theory in SSD

This quotation by Powell, Elbert, Miccio, Strike-Roussos and Brasseur (1998) is a well-intended comment on the complexity of determining a theoretical account of children's SSD. The effort to do so has a long history of moving from simpler to more complex explanations. Originally, SLP/SLT began with little if any theory, treating speech sound errors as errors with individual sounds, and with subsequent treatments that were based on the intuitively reasonable assumption that improvement would result from drill and repetition. These early efforts were supported by subsequent acceptance in many circles of behaviourism, a movement clearly described in the present book.

With the demise of behaviourism (Chomsky, 1959), a new era of linguistic explanations emerged, with the result over time being a daunting range of possible theoretical accounts (c.f. summaries in Ball and Kent, 1997). In the 1970s, the field of SLP/SLT was sympathetic to these efforts, and the proposals have constituted major sections of most textbooks since (Stoel-Gammon & Dunn, 1985; Bauman-Waengler, 2004). At least two potential problems arose with these efforts at theoretical explanation. For one, phonological theories became more and more complex and abstract, and de facto harder to assimilate and make clinically relevant. Second, no clear theoretical approach has won out; in the sense of demonstrating it is, without argument, the best and clinically most relevant account. The positive from all this is the impression that a range of intervention approaches 'work' (with some debate whether one or another might be even more effective). The Powell et al. suggestion captures this state of the art. That is, they reflect the impression: (1) that many theories have shown success and (2) that children with a range of speech sound

problems respond to different approaches. This leads the authors to the intuitively reasonable conclusion that specific theories, and their subsequent treatment approaches, may work better for some disorders than others.

Like behaviourism, however, this intuitively reasonable assumption is wrong. It errs on both the side of treatment and the side of theory. Concerning treatment, it is certainly good news that a range of treatment approaches work and also good news that SLPs/SLTs know them. There is the implication, however, that a reasonable arsenal of treatment approaches is sufficient to treat SSD. Unfortunately, a range of available treatment approaches is no guarantee of future success without some theoretical grounding. There is no foundation to the prediction that what worked with one child will work with another child, just because the two children appear to be similar based on some assessment. Nor does it make sense simply to run a child through the approaches until one clicks. We need to understand the disorders better than that, and a better understanding can only come from a sound theoretical approach.

Let me try to make this more concrete. Let us say I am a practicing SLP/SLT with excellent skills at two quite different treatment approaches. On the one hand, I am very experienced in using a cycles approach (in a group setting) with target selection based on using developmentally appropriate sounds. At the same time, I am also well trained at using a maximal contrast approach, involving intense one-on-one intervention with target sounds well beyond the child's current developmental level. On Tuesday, I evaluate two children, Barbara and Judy. I conclude from my clinical intuitions that Barbara will benefit from a cycles model, whereas Judy will be best served with the maximal contrast therapy.

At one level, this is evidence-based practice. When I meet with Barbara's parents, I

will discuss the cycles approach and refer to Hodson (2004) and other references as needed. When meeting with Judy's parents, however, my justification will be through discussing work by Gierut (2001) and the references therein. I will also be doing exactly what Powell et al. suggest, that is, moving past the simplistic 'one theory fits all' view. I will rely on my clinical experience over many years of practice, an invaluable part of my decision-making process. Given the latitude afforded to me by Powell et al., I also have one additional option. If one or both children do not meet my treatment goals, I can just switch them to the other approach. Or, if I get to attend a national convention in the interim, I can bring home a new approach I might learn at a workshop there. I have also satisfied Powell et al. by not thinking too much about theories throughout the whole process.

Is what I have just described 'best' practice? I do not think so. The bottom line is that knowing a range of treatment approaches and selecting from them as needed for specific subgroups is not sufficient. There needs to be a single theoretical basis for these decisions. In Ingram and Ingram (2001), we discuss a situation similar to the one above. We offer the hypothesis that there may be two subgroups of children with SSD: one with poor whole-word skills and one with good whole-word skills. The former group will be children with poor intelligibility, who are having difficulties matching their speech sounds to the target models. The latter group, on the other hand, are matching the target words relatively well (over 50% of the segments) but are possibly delayed in terms of their speech. We go on to suggest that the former children are candidates for a developmental approach, such as the one described for Barbara. The latter children, however, with good matching skills, may respond well to the maximal contrast approach as mentioned for Judy. Importantly, these decisions follow a single theory, a theory that

incorporates whole-word abilities into our account of how children acquire their phonological systems. Within this theory, it makes sense to select the treatments as mentioned, and no sense to do it the opposite way.

Turning to the implications about theories by Powell et al., they make a false assumption about what theories are about. While referring to the 'one approach fits all' view as simplistic, they replace it with a Rodney King 'why can't we all get along' view. Rodney King was an American whose arrest was videotaped and found to include an excessive use of force by the police. This quote was his response to the arrest.

Here is an example of how this point of view could be applied. In Ingram (1989a), I contrast two theories of language acquisition: a maturational approach and a constructionist (Piagetian) approach. These theories make very different claims about how language is acquired. For example, it is known that certain syntactic constructions are acquired late, for example, more complex forms of passive sentences. A maturational account would say that this is because the grammatical principles needed to form passive sentences do not mature until later, say age 6. A constructionist approach would predict that these sentences could be acquired earlier through the right combination of exposure to them and internal developments of the child's language acquisition.

Can these theories co-exist? They can, according to Powell et al. Let us again turn to a concrete example from speech sounds disorders. We know that children acquire certain English sounds late, such as the dental fricatives. On Wednesday, I assess two four-year olds, both referred with problems with these fricatives and a concern that intervention may be appropriate. I reach the following conclusions. One child, Dan, strikes me as very constructionist in his learning, whereas the other child, Tom, appears maturational. My recommendations are as follows. Dan will start an intervention program where we

will use auditory bombardment to stimulate his acquisition of the dental fricatives. We will work on a selective vocabulary with these sounds, which in turn will lead to internal gains in his language knowledge. Poor Tom, however, cannot learn these sounds because his speech development needs to mature. No amount of intervention will help Tom, who will be left alone to acquire these sounds at age six when his maturation is complete. If this makes sense to you, there is some land in Florida I would like to talk to you about.

The Rodney King approach underlies a basic misunderstanding that somehow theories can co-exist. Here is one further demonstration of this misconception. Let us consider a theory of phonological acquisition that proposes children use phonological processes to simplify speech. This theory has many processes, including Fronting (which changes k to t, e.g., 'key' is [ti]) and Backing (which changes t to k, e.g., 'tea' is [ki]). Another theory, NeoJakobson Theory, says that children's productions reflect their underlying distinctive features. This theory allows Fronting, but not Backing, as a natural process. On Thursday, I assess two children: one who shows Fronting (David) and one who is doing Backing (Caroline). My conclusions are that David is using the phonological process theory to acquire his speech sounds, whereas Caroline is using the NeoJakobson theory. Again, this is nonsense. The problem with the phonological process theory (as stated) is that it makes up any process it needs and is therefore too powerful. By explaining everything, it explains nothing. The more restricted theory is to be preferred. How then, can the NeoJakobson Theory account for our data? The theory states that children's first feature distinction is between a labial consonant and a non-labial consonant. The first non-labial consonant can either be a [t] or a [k]. Most children will opt for the [t], a more common sound in early productions, and this choice is the predicted, or

unmarked, sound. Some children, however, may select to produce [k] instead, since it still has the same underlying value of the [t], that is, both being non-labial. This becomes, therefore, the less common, or more marked, choice. It is not always easy to evaluate theories and decide that one is more explanatory than the other, but the bottom line is that such evaluations are the way theories are assessed, not by saying they all happily coexist.

If I am to stand by and defend the simplistic (sic) view that one theory fits all, then I should provide some suggestions on what this theory might look like. In Ingram (1997), I outline the basic properties of such a theory. The first point to make is that our theory for SSD has, in the short term, different goals than phonological theory. The latter has as its goal the characterization of the phonological systems of the thousands of languages that exist in the world. Our goal, by no means trivial, is to have a theoretical account of the phonological systems of children's first words, often less than a thousand in number. This goal does not require the extent of theorisation or formalism needed in linguistic theory. As suggested in Ingram (1997), it is possible to isolate the shared assumptions of phonological theory in general to form the basis of our theory of SSD. Here are some of those shared characteristics: the acquisition of an early lexicon involves the acquisition of phonological representations; these early representations, like adult representations, consist of phonological features; the early representations of children are underspecified, that is, they do not contain the full range of features of those for adult speakers; children first acquire a subset of the features underlying all languages; my research leads me to suggest these early features are consonantal, sonorant, labial, dorsal, continuant; voice; the child's productions are speech sounds that have one or more of these features; the first syllables are constructed from a small set, that is, CV, CVC, VC, CVCV, CVCVC; children's productions attempt to

match the adult models, in typical development around 70%.

I will finish with one of my favourite quotes: 'Theory without practice is speculation, practice without theory is dangerous.'¹

¹Source lost in time.

The biological model

Like Jakobson, Locke (1983a, b, c) stressed universality in his proposal of a biological model of phonological development. However, Locke emphasised *biological* constraints rather than linguistic ones. Rejecting Jakobson'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. Patterns found *only* in adult speech were acquired and patterns not contained in it were 'lost'.

The natural phonology model

Meanwhile, Stampe (1969) had proposed his natural phonology model of phonological acquisition. He posited that children come innately equipped with a universal repertoire of phonological processes: stopping, fronting, cluster reduction and so on. 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' (which were not reflexes in the physiological 'knee jerk' sense) 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 held 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. Given a potential phonological contrast, a process favoured the member of the opposition that was the:

1. least complex to produce;
2. least complex to perceive; or,
3. 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 typical development, it was acquired earlier (see Table 1.2); for example, *this* (/ðis/) is often realised by young children as /dis/ (an example of Stopping).

The child's developmental task was to suppress the natural phonological processes to achieve full productive control of the phonemes of the ambient language. Stampe 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 in output, they already had an underlying representation (a mental image or internal knowledge of the lexical items) of the appropriate adult target form (so 'this' would be /ðis/ underlyingly and /dis/ on the surface). Stampe relied heavily on 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) repre-

sented mastery of increased constraints (upon output phonology). This development occurred through the suppression of natural processes and consequent revision of the universal system. Change occurred through a passive mechanism of suppression as part of maturation. Stampe did not consider cognitive constraints related to the pragmatics of communication, or of the active learning of a language-specific phonology through problem solving, as in the cognitive model. Possibly the most contentious aspect of Stampe's interpretation of Natural Phonology was his claim that the processes were psychologically real, with Neil Smith (Smith, 1973, 1978) concluding that there was no psychological reality to the child's system because there was no evidence for the 'reflex mechanism' proposed by Stampe in applying, or rather 'using', phonological processes.

The prosodic model

The prosodic model of Waterson (1971, 1981) introduced another 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), Macken (1980) and Maxwell (1984) asserted that, in infants, 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 useful in describing the word productions of toddlers and may explain those that are not obvious reductions of adult forms.

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) 'interactionist discovery model', construed the child as *Little Linguist*, a captivating idea that dates back at least as far as Comenius (1659). Comenius insisted that, for a child, language learning was never an end in itself but rather a means of finding out about the world and forming new concepts and associations. In problem-solving mode, the child met successions 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/her phonology, the term cognitive model was used. Phonological development was an individual, gradual, and creative process (Ferguson, 1978). The Stanford team proposed that the strategies engaged in the active construction of phonology were individual for each child and influenced by internal factors: the characteristics and predispositions of the child, and external factors: the characteristics of the environment. The external factors might include the child's ordinal position in the family, family size, child-rearing practices and interactional style of the adults close to the child.

Levels of representation

Both David Stampe and Neil Smith recognised only two levels of representation. Stampe saw phonological processes as mapping from the underlying representation to the surface phonetic representation, whereas Smith (1973) saw realisation rules assuming this function. Stampe and Smith insisted that the child's phonological rules or processes were innate or learned extremely early. Then, 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 central to cognitive or Stanford theory.

Smith rejected the hypothesis that each child has a unique system 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. In this instance, phonemes were 'realised' or manifested in 'phonic substance' as phones (whereby meanings were transmitted). Smith's understanding 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.

Theories of development, theories of disorder, and theories of intervention

The theoretical assumptions upon which any speech-intervention approach is based are derived first from a theory or theories of normal phonological development, or how children normally learn the speech sound system through a combination of maturation and learning. Exploring this idea, Stoel-Gammon and Dunn (1985) posited four basic interacting components necessary for the formulation of a model of phonological development:

1. An auditory-perceptual component, encompassing the ability to attend to and perceive linguistic input.
2. A cognitive component, encompassing the ability to recognise, store and retrieve input and to compare input with output.
3. A phonological component, encompassing the ability to use sounds contrastively and to match the phonological distinctions of the adult language.
4. A neuromotor component, encompassing the ability to plan and execute the articulatory movements underlying speech.

From the practitioner's beliefs and assumptions about *normal* development comes a theory of *abnormal* phonological development: that is, a theory of disorders that explains why some children do not acquire their phonology along typical lines. Then, from the theories of normal and

abnormal acquisition, and their formalisms, a theory of *intervention* can evolve. The nature of a theory of intervention (or theory of therapy) depends on how the individual clinician understands, interprets, incorporates, adapts, and modifies knowledge of normal and abnormal acquisition, and what theoretical assumptions are made in the process. Michie and Abraham (2004) suggested that intervening without a theory of therapy could lead to 'reinventing the wheel rather than re-applying it'. Expanding on this point, they explained that, if we can isolate which parts of a treatment are doing the work (the 'active ingredients', so to speak) of facilitating desired goals, it is possible to 'fine-tune' therapy to maximise those effective components while reducing components that do not seem to exert much effect on the outcome.

A theory of therapy, that is, how best to improve the speech of a child with SSD beyond the progress expected with age must logically rely on *assessment procedures* that are congruent with the interventionist's theories of development, disorders and intervention (Fey, 1992a, b; Ingram, A6). In this regard, our timeline should record the development, mainly in the 1980s, of new speech assessments based around Natural Phonology theory and emphasising phonological process analysis. These included, in order of publication: Weiner (1979), Shriberg and Kwiatkowski (1980), Hodson (1980), Ingram (1981), Grunwell (1985a), and Dean, Howell, Hill and Waters (1990). Phonological process analysis introduced the concept of an abstract level of knowledge. This was revolutionary in its time and was the phonological version of syntactic deep structure.

The first minimal pair therapy, inspired by Natural Phonology, appeared in the literature when Frederick Weiner had a novel idea. Calling it 'the method of meaningful contrast' (Weiner, 1981a), he described what we now know as 'conventional' (Barlow & Gierut, 2002) minimal pair therapy. More therapy ideas based on linguistic principles followed rapidly. For example, a year later, Blache (1982) presented a systematic approach to minimal pairs and distinctive feature training in a book chapter; Hodson and Paden (1983) produced the first edition of *Targeting Intelligible Speech*, which described their 'patterns' approach, popu-

larly called 'cycles therapy', and since rebadged as the *Cycles Phonological Pattern Approach: CPPA* (Hodson, A5); Monahan (1984, 1986) devised a minimal pairs therapy kit called *Remediation of Common Phonological Processes*; and Elbert and Gierut (1986) wrote the *Handbook of Clinical Phonology*. In the same period that all this action was happening in the United States, in the United Kingdom, Grunwell (1983, 1985b) provided intervention guidance in peer-reviewed journal articles; Dean and Howell (1986) wrote an inspiring article about the metalinguistic aspect of therapy for child speech that heralded the development of the *Metaphon Resource Pack* (Dean, Howell, Hill & Waters, 1990); and Lancaster and Pope (1989) developed a therapy manual, *Working with Children's Phonology*, that focused on an auditory input therapy (thematic play or naturalistic approach) approach suitable for very young children and older children with cognitive and attention-span challenges (Lancaster, A24). Still in the United Kingdom, the first of a series of books (Stackhouse & Wells, 1997) devoted to an influential psycholinguistic framework appeared (Gardner, A27).

A clinical forum on phonological assessment and treatment, edited by Marc Fey, was published in 1992 in one of the ASHA journals, *Language, Speech, and Hearing Services in Schools (LSHSS)*. Other such forums followed in 2001, 2002, 2004 and 2006, but this particular one, with articles by Edwards (1992), Elbert (1992), Fey (1985, 1992a, b), Hodson (1992), Hoffman (1992), Kamhi (1992) and Schwartz (1992), remain extraordinarily helpful as a comprehensive introduction. In one of the articles, Fey (1992b) captured the clear distinction between intervention approaches, intervention procedures and intervention activities when he described and applied a structural plan for analysing the form of language interventions, such as phonological therapies. This hierarchical plan (displayed in Table 1.3) was adapted by Bowen (1996) and discussed in Bowen and Cupples (1999a).

For clinicians, one good reason for knowing the theoretical underpinnings of the 'therapies' or 'interventions' in his/her repertoire is that it enables them to pick and choose among them, or

Table 1.3 Theory to intervention hierarchy

Source: Available from: www.speech-language-therapy.com/images/14.png

even to combine aspects of them, based on client need. In suggesting that we should be more aware of theories, it should not be assumed that theories are only incorporated into intervention if we, as clinicians, are conscious of them. As Duchan (personal correspondence 2008) points out, 'I feel that we can look at any intervention and deduce its theoretical underpinnings or at least the assumptions it is based on, even if the clinician cannot articulate them. For example, drill is based on an assumption or theory that learning is like exercise, the more you practice saying a sound or word, the better you "know" or can say it next time'.

Fey's useful hierarchy covered the steps involved in modifying and adapting theoretical principles into a practicable intervention approach. It shows the progression from (1) a given phonological theory (e.g., Natural Phonol-

ogy) to (2) a phonological analysis that is congruent with that theory of phonological development (e.g., Independent Analysis and Relational Analysis) to (3) the phonological therapy approach under consideration (e.g., Conventional Minimal Pairs Therapy), informed by (1) and (2). It then allows description of three levels of intervention goal—basic goals, intermediate goals and specific goals—with goal-selection and goal-attack as critical components. From these arise (4) the intervention procedures of choice within the selected therapy model or a coherent combination of models and (5) workable intervention activities that are both consistent with the preceding four levels and suitable for a particular client.

The 'other' clinical forums, so useful to clinicians, referred to above include one in *LSHSS* edited by Barlow (2001, 2002); one in the

American Journal of Speech-Language Pathology edited by Williams (2002a, b); another in *Child Language Teaching and Therapy*, guest edited by Bernhardt (2004); and, one in *Advances in Speech-Language Pathology* (now renamed the *International Journal of Speech-Language Pathology*) edited by McLeod (2006). More specific clinical forums dealing with particular therapy approaches are also available to guide the clinician. For example, there is one on Metaphon (Dean, Howell, Waters & Reid, 1995) in *Clinical Linguistics and Phonetics*, and one on Parents and Children Together: PACT (Bowen & Cupples, 1999a, 1999b) in the *International Journal of Language and Communication Disorders*.

Looking back at Table 1.1 and the 70-year period from the Travis articulation paragraph in 1931 to the impact of phonology in the 1970s, via the information explosion of the Internet era, to the ICF-CY view of speech impairment post 2001, we see the dominant influence of linguistics on child speech practice. Bleile (personal correspondence 2005) sees the effects of linguistics, and particularly the impact of phonology, on our practice as being less than we thought it would be. He uses the analogy of waves on a beach and a 'wave height' metaphor from surfing. The first wave, distinctive features theory, was 'over head' and went way, way up the beach; then came natural phonology theory and phonological processes, 'head high' and not so far up the beach; following that, nothing was quite 'shoulder high' or even 'waist high', with metrical phonology, auto-segmental phonology and other nonlinear approaches creating small ripples, barely wetting the sand. Can it be that linguistic theory is now exhausted as a source of ideas and insights about phonological disorders, like behavioural psychology that ran out of puff in the 1970s? Perhaps information-processing models like the psycholinguistic model of speech processing and production (Stackhouse & Wells, 1997, 2001) hold promise of enticing waves on the intervention side in the future. Maybe it is time for big new insights to come from biology, particularly developmental neurology and genetics. This notwithstanding, there are aspects of linguistic and psycholinguistic theory that we clinicians should

be well acquainted with, because certain linguistic principles can help in devising evidence-based therapies that are conducive to treatment efficacy.

Communication and advocacy

Our recent history has unfolded alongside the creation and expansion of the Internet, comprising the World Wide Web (Berners-Lee, 2002) and e-mail, and the growing use of information and communication technology (ICT), including social media by academics in general and speech and language professionals in particular (Bowen, 2003, 2012), and consumers of SLP/SLT services. E-mail, electronic mailing lists, message boards and other web-based discussion and sharing including Facebook, Pinterest and Twitter have facilitated quick, easy and enjoyable international communication and collaboration among academics and specialist clinicians who have the time to devote to it and have provided novel opportunities for professionals and consumers to engage with each other. Part of this Internet expansion has included the growth of child speech-related advocacy websites, the most prominent of which is the Apraxia-KIDS website (www.apraxia-kids.org), the online face of the Childhood Apraxia of Speech Association of North America (CASANA).

Ms. Sharon Gretz, M.Ed. is the founder and executive director of CASANA. She has been recognized and awarded in the United States for her work in advocating for children with apraxia of speech and their families. Sharon brings many perspectives to the field as both parent and professional, having completed extensive graduate course work in Communication Sciences and Disorders at the University of Pittsburgh while also being the parent of a child with CAS. Frustrated in 1997 by the lack of information on CAS, she worked with local and international SLP academics and clinicians to develop training programs for SLPs and accessible web-based information for families new to diagnosis, those seeking on going support and individuals interested in the research side. She talks about this in A7.

Q7. Sharon Gretz: Consumer advocacy and childhood apraxia of speech

As the parent of a young adult who had severe CAS at the age of three, founder and Executive Director of Apraxia-KIDS and the Childhood Apraxia of Speech Association of North America (CASANA) and a doctoral student in communication sciences and disorders, you have made an extraordinary contribution to our field and have a unique perspective on SLP/SLT child speech practice. Impressively, CASANA has become the only national non-profit organization in the United States and internationally with the sole focus of CAS. Can you provide a little of the history of what inspired you to follow this path and share your thoughts on the mutual needs, goals, expectations, roles, responsibilities and costs for the child (or adolescent or young adult), family and therapist in the assessment, therapy and management of CAS? Where do consumer advocacy and web-based communication fit, and what is your vision for the future of organisations like CASANA and smaller, more local 'CAS associations' that currently need to raise funds in order to operate?

A7. Sharon Gretz: Apraxia-KIDSSM and the childhood apraxia of speech association of North America (CASANA)

Beginning in 1994 and for a span of several years, from my seat behind a one-way mirror, I witnessed my child's emergence as a speaker and communicator. I witnessed his incredible struggle, effort, resolve and ultimate success. Eventually, after over 200 individual speech therapy sessions, my son who had been diagnosed with severe childhood

apraxia of speech (CAS) and dysarthria was a 'talker', his speech intelligible. To say that observing the painstaking, persistent work of both clinician and child was inspiring is an understatement. Fuelled by an appreciation for the good outcomes possible with proper diagnosis, treatment and clinician-parent partnerships, I turned my thoughts to what I could do to help others in similar circumstance. In the mid- to late 1990s little information on CAS existed that was comprehensible to families, and training opportunities on the topic for practicing professionals were infrequent. The Apraxia-KIDSSM listserv, followed by the website, were early efforts to address gaps in information and to create an international community of concern regarding children affected by this disorder. These developments highlighted at least three critical needs for parents and caregivers to

- gain support for the emotional and practical aspects of raising children with CAS;
- develop advocacy skills to benefit children with CAS; and
- learn how to help their children with speech and communication practice at home.

The Childhood Apraxia of Speech Association of North America (CASANA) was founded in 2000 to address those needs, and more. Since 2000, CASANA has served as a catalyst and a galvanizing force for heightened professional interest, education, research and caregiver support, worldwide, for children with CAS and their families. High-quality websites and online communities such as the Apraxia-KIDSSM website and email LISTSERV, Facebook groups and Twitter; and face-to-face events, such as the Walk for Children with Apraxia®, appear to play a vital role providing reliable information and emotional and practical support. For example, Boh, Csiacsek, Duginske, Meath and Carpenter (2006) found that 93% of surveyed parents of children diagnosed with CAS used Internet sites as information

sources regarding their child's disability. Overwhelmingly, parents report that the *most* helpful information they receive comes from the Apraxia-KIDSSM listserv (Lohman, 2000) and not from treating SLPs/SLTs. Furthermore, Farinelli, Allen and Babin (2013) found that network support alone, and no other variable, appeared to predict levels of depression and health in parents of children with CAS. They reasoned that given the relative rarity of CAS, parents of affected children might have a heightened need for a sense of belonging and connectedness than parents dealing with more common disabilities. Farinelli et al. suggested that professionals be aware of this dynamic and support families in connecting with others with similar experiences. Finally, many SLPs/SLTs report that they routinely visit specific consumer group websites, such as Apraxia-KIDS.org, to gain information about clinical cases (Nail-Chiwetalu & Bernstein Ratner, 2007).

In the years since CASANA formed, it has been a privilege to watch young people who had been affected by the disorder reach young adulthood. They, too, inspire our movement to bring awareness, information, support, education and research to CAS. Several of them serve as important ambassadors and role models for the importance of early intervention, specialised help and opportunity.

Apraxia-KIDSSM and CASANA at work

To illustrate the impact that Apraxia-KIDS and CASANA resources have on families and children, consider the story of a mother named 'Jenna' and her son 'Jacob'. Jenna subscribed to the Apraxia-KIDS listserv in a panic. Jacob 5;0 had received private and school-based speech therapy for nearly 3 years. Although identified through public early intervention as having CAS at about three, and treated by three SLPs, he had

just a handful of intelligible words. Jenna realised, through reading the Apraxia-KIDSSM listserv and website, and by asking specific questions relating to Jacob's situation, that several factors might account for his poor progress and considered potential solutions. First, his school speech therapy, delivered in a group with five other children, was not the recommended service delivery model for a child with severe CAS. Jenna learned that by law (Individuals with Disabilities Education Improvement Act [IDEA], 2004) she was considered a team member in her son's individual education planning (IEP) and that there were rules governing the process that might help her advocate for improved services for Jacob, including individual speech therapy. Additionally, Jenna came to understand that bubble and horn blowing activities that occupied most of Jacob's private speech therapy time were also not likely to make significant differences in his speech production skills (Hodge, A31; Lof, A35). Finally, Jenna came to understand that working at home with Jacob in specific ways would benefit generalization of his developing speech skills.

With help from local parents involved with CASANA's groups, Jenna located a new private SLP. She now felt prepared to interview the SLP to ensure that the professional understood the nature of CAS, its appropriate treatment and the need to actively involve Jenna. When she attended a national conference on CAS in a nearby state, she learned more about CAS itself, and about associated problems that Jacob faced and that might persist.

Soon, Jenna was able to ecstatically report to her online community that Jacob had made significant progress in speech and communication. He now had friends at school; his handwriting was improving; and his reading difficulties were being addressed. Jenna had hope for Jacob's future and felt more competent and confident as his chief advocate. She was delighted when Jacob's new school SLP attended a CASANA workshop to

learn more about appropriate assessment and treatment for CAS. Several years down the track, Jenna now *answered* questions posed by new parents to the listserv, sharing the information she had learned with others in similar circumstances.

The story of Sara and her daughter Kacey illustrates how CASANA and its support for families evolved in recent years. Sara learned about CASANA's annual conference on its Apraxia-KIDSSM Facebook group. Kacey was 4;6, and despite having a lot of speech therapy had few intelligible words. Sara was looking for new information and a better understanding of her daughter's condition so that Kacey could become a fully verbal communicator. She applied for, and was granted a CASANA parent scholarship to attend the conference, where she was delighted to finally meet other parents who had children with CAS. Sara gained hope by observing and speaking to youth and young adults – volunteers at the event – who had a history of CAS. Among the numerous conference sessions she attended, covering therapy approaches, advocacy and related conditions, was one about genetic conditions that may be accompanied by CAS. The talk prompted Sara to consider locating a geneticist to test her daughter. Several months later, Sara contacted CASANA staff to report that Kacey's genetic testing yielded a positive finding. Kacey had a rare copy number variant (CNV), with several cases discussed in the professional literature as having an association with CAS. Thinking this new information might provide answers as to why her daughter's speech progress was slower and more limited than expected, Sara was anxious to contact parents who might have children with the same genetic condition. CASANA staff told Sara about the online Apraxia Research Registry. The online registry is a CASANA project in which families assist researchers in a 'bottom up' approach by entering extensive and detailed data regarding their child's history.

Because of life situations like those of Jenna, Jacob, Sara and Kacey, CASANA's board of directors believes that its work is of an urgent nature. CAS, as a severe speech disorder, has serious ramifications on the quality of life (including activities and participation, McLeod, A1) for affected children and youth. Beyond the complicated and challenging speech disorder and its co-morbidities, issues around the children's inclusion, relationships, education, emotional functioning, social wellbeing and independence are also at stake (Markham & Dean, 2006).

Accomplishments and challenges for the future

CASANA has experienced success in bringing worldwide attention to the challenges of CAS. In a dozen years, CASANA has grown from hosting and growing online information and support to also providing a variety of educational events, funding and supporting research, and providing more in the way of individual support to children and families.

In terms of education, each year CASANA provides CAS workshops, seminars and an annual summer conference. CASANA's webinars alone have provided training to thousands of parents and professionals in over 30 countries, including remote locations where training on CAS is limited. Additionally, a strategy to boost regional CAS expertise was devised through the development of an Apraxia Intensive Training Institute, in which selected clinicians with moderate levels of experience are taught and mentored by 'master clinicians' with CAS expertise. Trainees complete over 40 hours of CAS education and submit and pass an extensive case study presentation, demonstrating knowledge gained. To date, CASANA has graduated 40 geographically dispersed clinicians from the institute.

In recent years, CASANA has funded pilot treatment research grants, leading to

increased journal publications on intervention and treatments for CAS. The CASANA Apraxia Research Registry (see above) allows parents to contribute to new understandings and research into CAS by entering comprehensive data on all aspects of their child's prenatal, birth and post-natal history, speech and language history, intervention history, medical and family history. Moreover, in 2013 CASANA hosted the 2013 Childhood Apraxia of Speech Research Symposium in which international researchers presented on the 'state of the art' in CAS research, including genomic, neuroimaging, diagnostic marker, and neurocognitive behavioural areas. CASANA will use this information to plan and implement its research funding direction, and plans to disseminate it to a worldwide audience via online video sharing.

In an effort to assist low- to moderate-income families financially, CASANA has initiated two programs. First, 'iPads for Apraxia' provides tablet computers and protective cases to a number of children with apraxia each year, aiding them in speech practice and communication. Priority is given to children who are older and those that are severely impacted by CAS. Responding to the growing financial impact families experience in trying to provide appropriate levels of intensity and frequency of speech therapy for their children, CASANA has partnered with another organization, to fund a program to provide small speech therapy grants for children.

CASANA's events serve to increase community awareness, offer support, and raise funds for its programs and research. For example, what started as a local event in one community has led to the Walk for Children with Apraxia® movement. In 2013, for example, 80 communities in the United States and Canada and over 16 000 individuals directly participated. The walks and the donations generated at the community level are CASANA's largest funding source and allowed for the vital expansion of pro-

grams and research. Of equal importance, the events serve to bring together affected children and families with a community and web of support. CASANA's 2013 inaugural Apraxia Awareness Day was highly successful with thousands of participants distributing worthwhile information about CAS and its serious impact, and about the resilience, gifts and talents of the many affected children and youth who deserve an opportunity to be heard.

As more research is conducted and published about best assessment and treatment practices; genetic, biophysical and behavioural markers of CAS; and its long-term ramifications, consumer groups will continue to have a role in the widespread dissemination of important lifespan information regarding toddlers, children and youth with this disorder. A continued challenge will be to educate professionals and parents to evaluate readily available Internet and social media information and to critically judge its authority, reliability and credibility. A likely additional challenge is maintaining adequate funding for consumer non-profit groups like CASANA. In some ways, the organization is a victim of its own success. Through its work, there is increased interest in and attention to CAS. This interest and attention leads to increased demand for assistance and education, requiring additional funding. Diversified financial resources to support and sustain existing operations and new programs into the future are essential.

Terminology

Gretz (A7) includes, among the motivational factors driving the development of CASANA, the paucity of information on CAS that could be interpreted by families. Her observation accords with the view of McNeilly, Fotheringham and Walsh (2007) that terminology in communication sciences and disorders 'presents a significant barrier

to the profession's advancement in research, clinical effectiveness, public image and political profile'. Insisting that change is imperative, McNeilly et al. are clear that, 'influencing attitudes and understanding about something as fundamental and closely tied to one's professional identity as terminology is no small task'. They also underscore the need for sufficient will, resources, and cooperation, as well as a realistic timeframe within which to effect such change. Against the historical backdrop provided here in Chapter 1, the following chapter covers a range of currently applied systems of terminology and the issues that surround them, as well as accounts of the classification, description and assessment of children's speech.

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