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Identifying phonological patterns and projecting remediation cycles: Expediting intelligibility gains of a 7 year old Australian child

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Abstract
The primary purpose of this case study was to analyse phonological deviations of a 7 year old with highly unintelligible speech in order to (a) identify deficient phonological patterns, (b) determine the severity of his phonological impairment, (c) identify optimal target patterns for treatment, and (d) obtain baseline data to be used for comparison following treatment. The method involved analysing transcriptions of 50 phonological assessment words for occurrences of (a) syllable/word structure omissions, (b) consonant category deficiencies, and (c) substitutions and other strategies. The total occurrences of major phonological deviations placed this client's performance in the profound range of phonological impairment. Primary target patterns for the first cycle of intervention include: (a) final consonants, (b) /s/ clusters, (c) velars, and (d) liquids. Potential optimal phoneme targets to enhance the phonological patterns were projected for cycle one (approximately 16 contact hours). In addition, potential secondary target patterns for later cycles were discussed.

Keywords: *Cycles approach, phonological assessment, phonological intervention, phonological pattern, unintelligible speech.*

Introduction

Children with histories of highly unintelligible speech typically experience greater difficulty in the areas of reading and spelling than most of their phonologically normal peers (Bird, Bishop, & Freeman, 1995; Clarke-Klein & Hodson, 1995). According to the Critical Age Hypothesis (Bishop & Adams, 1990), children need to be intelligible by age 5;6 (years; months) or literacy acquisition most likely will be compromised. The child in this case study was still highly unintelligible at age 7 years, and, according to reports, he was experiencing some difficulties in the literacy domain. An urgent need exists to enhance his overall phonological system and to expedite intelligibility gains.

The primary goal of this case study involved analysing and categorizing phonological deviations (Hodson, 2004) of a 7 year old boy with highly unintelligible speech. The second purpose involved selecting optimal target patterns and projecting potential target phonemes for the first cycle of phonological remediation (Hodson, 2006; Hodson & Paden, 1991). The overriding goal was to develop a plan that would enhance the development of this client's phonological system and thereby expedite his intelligibility gains.

In the following sections, assessment and intervention methods that focus on phonological patterns are explained briefly. The client case study section includes phonological assessment results and treatment goals that were derived from the assessment results. Specific targets (patterns and phonemes) for cycle one are projected, and possible targets for later cycles are discussed.

Theoretical and conceptual considerations

Assessment

The culmination of some 30 years of clinical research and practice involving several hundred children with highly unintelligible speech has resulted in the *Hodson Assessment of Phonological Patterns-3*rd *edition* (HAPP-3; Hodson, 2004). Pattern-oriented analyses are used in the HAPP-3 to identify three basic types of deviations (a) word/syllable structures (omissions of: syllables, consonants in sequences/clusters, and singleton consonants [prevocalic, intervocalic, postvocalic]); (b) consonant category deficiencies (substitutions of a consonant from a different category or omission of the consonant); and (c) substitutions and other strategies (e.g. stopping, assimilations).

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The HAPP-3 has components that are compatible with aspects of three phonological theories (a) generative (Chomsky & Halle, 1968), particularly distinctive features, (b) natural (Stampe, 1972), and (c) nonlinear (e.g. Goldsmith, 1990). No one theory to date, however, totally suffices for analysing highly unintelligible utterances.

In the HAPP-3, some distinctive feature classes (e.g. stridents) are included under consonant category deficiencies. Distinctive feature analysis (e.g. McReynolds & Engmann, 1975) is useful for identifying feature differences between a sound that is substituted and the target phoneme, but there is one crucial limitation. Distinctive feature analyses do not account for omissions, an extremely common phenomenon in utterances of children with highly unintelligible speech. In the HAPP-3, omissions are coded twice, once for syllable/word structures and also for consonant category deficiencies. This double coding for omissions allows for (a) additional weighting for omissions (which have a more adverse effect on intelligibility than substitutions or distortions), and (b) differentiation in scores as children improve (from omissions of sounds to substitutions and/or distortions).

Consonant categories are considered to be deficient if a substitution from another category occurs or if a target consonant is omitted. If a child substitutes /t/ for /s/ or omits /s/, the column for stridents under consonant category deficiencies is coded (for either type of deviation) because the strident target is lacking. If, however, a child substitutes a strident for a strident (e.g. /s/ for /z/), the strident category is not coded because such a substitution does not indicate that the strident category is deficient. The appropriate column under substitutions and other strategies (i.e. devoicing) would be marked.

The HAPP-3 also was influenced by the natural phonology theory (Stampe, 1972). Omissions (e.g. cluster reduction) and common developmental simplifications (e.g. fronting), as well as a number of other phonological "processes" (e.g. assimilations), can be coded. One of the limitations of natural process analysis (e.g. Shriberg & Kwiatkowski, 1980) is that children with highly unintelligible speech often demonstrate unusual deviations (e.g. backing, initial consonant deletion) that are not "natural simplifications". In addition, typical phonological process analyses do not lead directly to specifications of deficient phoneme classes that need to be targeted. For example, a child with extensive omissions might not demonstrate velar fronting during an initial evaluation because fronting is often "blocked" by omissions. If the assessment results do not indicate that velar fronting is a problem, the lacking of velars might be missed on some phonological process analysis forms. Moreover, it is not uncommon for occurrences of velar fronting to increase during a later examination because substitutions commonly replace omissions temporarily as a child's speech improves.

Thus consonant categories need to be assessed directly for deficiencies. In many respects, the concept of scoring consonant category deficiencies as well as word/syllable structure omissions is compatible with nonlinear phonology theories which focus on "what the child can do, and what is missing from the child's system that needs to be there" (Bernhardt & Stemberger, 2000, p. xi).

Intervention

The Cycles Phonological Remediation Approach is based on phonological theories (e.g. Browman & Goldstein, 1986; Stampe, 1972), cognitive psychology principles (e.g. Hunt, 1961; Vygotsky, 1962), phonological acquisition research (e.g. Dyson & Paden, 1983; Grunwell, 1987; Porter & Hodson, 2001; Preisser, Hodson, & Paden, 1988), and ongoing clinical phonology research (Almost & Rosenbaum, 1998; Gordon-Brannan, Hodson, & Wynne, 1992; Hodson, 1978; 1982; 1983; 1989; 1994; 1997; 2001; 2004; 2005; 2006; Hodson, Chin, Redmond, & Simpson, 1983; Hodson, Nonomura, & Zappia, 1989; Hodson & Paden, 1983; 1991). The theory that the cycles approach aligns with most closely is gestural phonology (Browman & Goldstein, 1986; Kent, 1997). The term, gesture, refers to a class of articulatory movements. A basic tenet of gestural phonology is that phonological representation is based on speech perception as well as speech production physical constraints.

The seven underlying concepts that serve as the basis for cycles approach decisions are listed in Table I. The first concept (gradual acquisition, Ingram, 1976) is the major reason for cycling patterns. We have learned from developmental phonology research (e.g. Dyson & Paden, 1983) that typically developing toddlers/preschoolers do not master (to a prespecified criterion) one sound (or pattern) at a time. Rather considerable experimentation and vacillation occur in the process of acquiring

Table I. Underlying concepts for the Cycles Phonological Remediation Approach.

1. Phonological acquisition is a gradual process.
2. Children with "normal" hearing typically acquire the adult sound system primarily by listening.
3. Children associate kinesthetic and auditory sensations as they acquire new patterns, enabling later self-monitoring.
4. Phonetic environment can facilitate (or inhibit) correct sound production.
5. Children are actively involved in their phonological acquisition.
6. Children tend to generalize new speech production skills to other targets.
7. An optimal "match" facilitates a child's learning.

speech. The seventh underlying concept is the reason that we conduct a phonological evaluation (see Hunt, 1961; Vygotsky, 1962). Our phonological assessment procedure allows us to find the child's "match" and "zone of proximal development" so that the child can be challenged optimally but also experience immediate success.

Highlights of our clinical phonology treatment session structure are provided in Table II. Although the cycles approach was created and refined in a university setting, it has been adapted successfully by speech-language practitioners in schools, hospitals, and private clinics. Potential optimal target patterns for expediting intelligibility gains are specified in Table III (beginning cycles) and Table IV (later cycles). (See Hodson, 2005; 2006; Hodson & Paden, 1991, for more detailed information about the Cycles Phonological Remediation Approach.) Rationales for target selection for the client in this case study are explained in an ensuing section.

Client history

Jarrod was administered a battery of tests for this project in July 2005 at age 7 years (see Holm & Crosbie, 2006). According to reports, Jarrod was diagnosed with asthma at 18 months and had grommets inserted at ages 2 (2000) and 4 years (2002). A mild hearing loss was documented in August 2002. Jarrod was referred for speech/language services by his family physician in 2002 (age 4 years). A report dated May 2005 indicated that Jarrod received private speech therapy support and also speech therapy intervention through his preschool in 2004. Information was generally lacking regarding (a) what specifically was targeted in therapy between 2002 and 2005, (b) the number of contact hours for treatment, and (c) treatment outcome data.

Results obtained from language and cognitive assessment indicated that Jarrod's performance generally was within normal limits for both. His nonverbal performance was better (as would be expected) than his verbal performance on measures of intelligence. His performance on phonological awareness subtests (rhyme-oddity and beginning sound identification) yielded a standard score of 3 and a 1st percentile rank for both. The standard score for letter knowledge was 7, with a percentile rank of 16. Jarrod's level of performance at age 7;0 (years; months) for phonological awareness tasks and letter knowledge was well below expectations for children at age 6;11 (the upper age limit for normative data for the *Preschool Inventory of Phonological Awareness*, PIPA, Dodd, Crosbie, McIntosh, Teitzel, & Ozanne, 2000).

Phonological assessment and analysis: HAPP-3

The HAPP-3 is a standardized phonological assessment instrument that is both criterion-referenced

Table II. General structure of cycles approach treatment sessions.

1. Review of prior session's production-practice words.
2. Presentation of "listening" list (with slight amplification) containing approximately 20 words with the target pattern for the day (approximately 30 seconds).
3. Experiential-play production-practice activities (e.g. basketball, puzzles, crafts); child produces the target pattern correctly in the carefully selected words and then "takes a turn".
4. Metaphonological activity to enhance primary literacy skills (e.g. segmentation, blending).
5. Probing to determine optimal target for next session.
6. Repetition of listening activity with slight amplification.

Home program (2 minutes per day). Caregiver reads listening list to child; child names pictures of week's production-practice words.

Table III. Potential optimal *primary* target patterns for beginning cycles.

Word Structures (when phonemes are omitted)
- "Syllableness" (for omitted vowels, diphthongs, vocalic/syllabic consonants resulting in mostly monosyllabic productions)
- 2-syllable compound words (e.g. *ice cream*) for appropriate number of syllables
- 3-syllable/word combinations (e.g. *ice cream cone*)
- Singleton consonants (when consistently omitted per word positions below)
  - CV (word-initial /p/, /b/, /m/, /w/)
  - VC (voiceless final stops /p, t, k/; possibly final /m/, /n/)
  - VCV (e.g. *apple*)

/s/-clusters
- Word-initial (e.g. /sp/, /st/)
- Word-final (e.g. /ts/, /ps/)

Anterior/Posterior Contrasts
- Word-final /k/; Word-initial /k/, /ɡ/ (for "Fronter"); Occasionally /h/
- Alveolars/Labials (if "Backer")

Liquids (facilitation)
- Word-initial /l/
- Word-initial /r/ (suppress Gliding initially)
- Word-initial /kr/, /ɡr/ (after the child readily produces singleton Velars)
- Word-initial /l/ clusters (after child readily produces prevocalic /l/)

Table IV. Potential *secondary* target patterns/phonemes.

Palatals
- Glide /j/
- Palatal Sibilants /ʃ, ʒ, tʃ, dʒ/
- Vocalic /ɚ/, /ɝ/ (unless dialectal)
- Word-medial /r/

Other Consonant Sequences
- Word-medial and Word-final /s/ plus Stop (e.g. *biscuit*, *desk*)
- CC with Sonorants
  - Glide Clusters (e.g. /kw, kj/)
  - Other Liquid Clusters (e.g. /tr/, /sl/)
- **CCC** (e.g. /skw, skr/)

Singleton Stridents (e.g. /f, s/)

Voicing Contrasts (Prevocalic only)

Vowel Contrasts (Nondialectal)

Assimilations

Any remaining idiosyncratic deviations

Note: Target only those that remain problematic.

and norm-referenced. It was designed to (a) assess and categorize all phonological deviations, (b) yield a valid rating of severity, (c) provide a treatment direction (optimal target patterns) for a child with highly unintelligible speech, and (d) yield post-treatment data that could be compared with pre-treatment scores for evidence-based practice documentation. The HAPP-3 typically requires less than 20 minutes to administer and less than 30 minutes to score (by hand). The *Hodson Computerized Analysis of Phonological Patterns* (Hodson, 2003) software requires approximately 5 minutes to input data (depending on severity) and scores the major phonological deviations in seconds.

HAPP-3 has 48 stimulus items (common objects, including three crayons that elicit five words, three body parts, and a few pictures [e.g. *smoke*]) that are used to elicit spontaneous productions of 50 words for the Comprehensive Phonological Evaluation. HAPP-3 words were selected to meet the following criteria: (a) the words are generally familiar to English-speaking children, (b) most can be elicited spontaneously by three-dimensional stimuli, (c) the words provide at least 10 opportunities for occurrences of each of the 11 major phonological deviation patterns assessed on the HAPP-3, (d) each word provides opportunities for assessing more than one phonological deviation, (e) all English consonants and most English vowels and diphthongs are included, (f) the stimulus words contain common consonant clusters/sequences (e.g. /str/), and (g) multisyllabic, as well as monosyllabic, words are assessed. Three-dimensional manipulatives are used because they are more interesting for young children and more ''real'' than pictures. In addition, children's responses while manipulating objects have been found to be more representative of their current level of generalization compared to naming pictures or imitating words.

Pattern-oriented analyses are used to identify three basic types of deviations (a) word/syllable structures (omissions of syllables, consonants in sequences/clusters, and singleton consonants); (b) consonant category deficiencies (omissions and substitutions of consonants from different categories); and (c) substitutions and other strategies (e.g. stopping, assimilations). The Total Occurrences of Major Phonological Deviations score (sum of word/syllable structure omissions and consonant categories deficiencies occurrences) provides a means for determining severity (profound, severe, moderate, mild). The Comprehensive Phonological Evaluation Record Form provides spaces for recording inventories for consonants and vowels and also stimulability information.

Several changes were made to this revision to internationalize it for English-speaking children in other countries. The Transcription Recording Form has blank spaces for vowels and vocalic (r). Examiners are to write transcriptions of vowels for their respective linguistic communities in the spaces. In addition, several alternate words (containing the same consonants) are provided for objects that have different names in other countries (e.g. for countries that refer to a *truck* as a *lorry*, the alternate word is *track*).

Client results

Word/syllable structure omissions and consonant category deficiencies for Jarrod's first HAPP-3 phonological assessment at age 7;0 are provided in Table V.[1] The total occurrences of major phonological deviations was 156, which placed his expressive phonological performance in the highest severity interval—profound. Because his score was in the bottom 10-point range of the interval (see Hodson, 2004), his level of severity was designated as low profound. A comparison of his Consonant Categories Deficiencies Sum of 96 with performances of 102 7 year olds in the HAPP-3 normative sample indicated that his expressive phonology performance was below the 1st percentile.

The HAPP-3 uses a 40% cutoff for initial review to determine what patterns need to be considered first. Percentages of occurrence were higher than 40% for five phonological deviations: (1) omissions of consonants in sequences (92%), (2) omissions of postvocalic singletons (69%), (3) liquid deficiencies (89%), (4) strident deficiencies (98%), and (5) velar deficiencies (91%). Transcriptions of Jarrod's productions also were reviewed to obtain specific information regarding where (e.g. word-final) and what specific phonological deviations occurred.

Table V. Jarrod's major HAPP-3 phonological deviations for HAPP-3* at age 7;0 (years;months).

	Occurrences	*Percentages*
Word/Syllable Structures (Omissions)		
Syllables	1	6
Consonant Sequences/Clusters	36	92
Consonant Singletons		
Prevocalic	0	0
Intervocalic	2	14
Postvocalic	22	69
Consonant Category Deficiencies**		
Sonorants		
Liquids	17	89
Nasals	5	24
Glides	2	20
Obstruents		
Stridents	41	98
Velars (e.g. Fronting)	20	91
Anterior Nonstridents (e.g. Backing)	11	37
Total Occurrences of Major Phonological Deviations	157	
Severity Interval***	Low Profound	

*Scored by *Hodson Computerized Analysis of Phonological Patterns* (Hodson, 2003). **Coded for specified substitutions and also for omissions. ***Severity Intervals (<50 = Mild; 51 – 100 = Moderate; 101–150 = Severe; >150 = Profound).

A review of Jarrod's consonant inventory revealed that he produced all English consonants at least once during the sample except /s/, /l/, and palatal sibilants. In many instances, the consonant productions occurred as substitutions for other target sounds in the stimulus words. His deviations were coded to determine what types of substitutions he used when he did not produce target patterns/sounds. His most prevalent strategies were Gliding ([19 examples] e.g. *leaf*→[jeɪ]) and Glottal Stop Replacement/Insertion ([18] e.g. *black*→[bwæʔ]). The next most frequently occurring strategies were Stopping [14] and Prevocalic Voicing [11], (often co-occurring with other deviations; e.g. *fork*→; [ɔ]). In addition, Fronting was evidenced five times for the 22 velars assessed (seven velars were omitted, four were replaced by glottal stops, and gliding occurred for four velars). Some unusual substitutions of nasals for each other also were noted (e.g. *snake*→[meɪʔ]; *thumb*→ [θʌŋ]). Many inconsistencies were noted in Jarrod's productions, a common phenomenon observed in children who have received intervention emphasizing mastery of individual phonemes (vs. pattern-oriented treatment).

Intervention targets

Selecting target patterns for beginning cycles

Jarrod's target patterns were selected by reviewing HAPP-3 results (see Table V) within the framework of optimal potential primary target patterns for beginning cycles (see Table III). He did not need to target syllableness or prevocalic/intervocalic singletons. Substitutions occurred in these word positions, but omissions were well below the 40% cutoff. Consonant category deficiencies involving nasals, glides, and anterior stridents also were below the cutoff.

Typically we do not target patterns that a child (particularly if a preschooler) is already producing (even if inconsistent). Because of Jarrod's age and overall severity of phonological impairment (profound), it was decided that all of the deviations above 40% should be targeted during his first cycle of intervention. The occurrence percentages for omissions involving consonants in sequences (92%) and for postvocalic singletons (69%) were extremely high for a 7-year-old. For consonant category deficiencies, stridents (98%) and velars (91%) were both above 90%; liquids (89%) were close to 90%. According to the transcriptions, Jarrod did produce some word-final stops and nasals in the sample; two velars (one word-initial /ɡ/ and one word-final /k/ preceded by a glottal stop); and two /r/ allophones, but no /l/. In addition, he produced one strident /f/, but no /s/ (singletons or clusters). The initial treatment goal for Jarrod's first cycle of phonological intervention would be to enhance his phonological system and increase his intelligibility by targeting the following phonological patterns: (a) final consonants, (b) /s/ clusters (for consonant sequences and stridents), (c) velars, and (d) liquids.

Projection for cycle one

Each pattern would be targeted at least 2 hours. Phonemes are used as a "means to an end" to facilitate the development of patterns (rather than as an end in themselves).

Final consonants. We typically use voiceless stops (/p/, /t/, /k/) to help a child learn to produce word endings. Because of his current difficulty with velar productions during his phonological assessment, it is likely that his more successful targets for teaching final "consonantness" would be final /p/ and final /t/. Another target that usually can be elicited readily is final /m/. He did produce /b/, /d/, and /m/ prevocalically so it is likely that he would be stimulable for final /p/, /t/, and /m/ (1 hour each). The stimulus materials would then be filed away until reassessment between cycles. Typically we do not need to re-present final consonant targets because most young children start closing syllables several weeks after their presentation. If another cycle is needed, the materials from cycle one would be used again, and additional production-practice words would be added.

/s/ Clusters. Word-initial /s/ clusters would be the second target pattern for cycle one. Jarrod did not produce any /s/ clusters during HAPP-3 testing. Two patterns particularly lacking in his utterances are stridents (98%) and consonant sequences (90%). We have found that it is more expedient to target /s/ clusters before singleton stridents (e.g. /f/, /s/) for children like Jarrod. Invariably such children retain the second consonant (e.g. [stop] for *soap*) during initial attempts at targeting /s/ singleton. Children who say [toʊp] or [doʊp] for *soap* experience greater success initially adding the /s/ (resulting in a consonant cluster) than when they are asked to 'take out' the /t/ and say the /s/ in its place. We also know that the English language has /s/ sequences in many, many words and word combinations; thus a major reason to teach /s/ clusters early is to increase intelligibility. Moreover, most typically developing children include two consonants for /s/ clusters by age 3 years (e.g. Porter & Hodson, 2001) (although /s/ might be distorted [e.g. lisp] at this time).[2]

A review of transcriptions of Jarrod's productions indicated that he produced word-initial /d/, /b/, /m/, /n/, and /w/ several times and /ɡ/ once. Thus, the word-initial /s/ clusters that would be considered to be potential targets include /st/, /sp/, /sm/, /sn/, and /sw/ (i.e. consonants he already produced or their cognates so that he only had to be concerned about adding /s/ rather than how to produce the second element of the cluster; /sk/ and /sl/ most likely would not be successful yet). We would spend an hour on each /s/ cluster that is stimulable; thus word-initial /s/ clusters most likely would be targeted for 5 hours. Then these would be filed away temporarily until cycle two, and word-final /s/ clusters (/ts/, /ps/, /ks/) would be probed. Jarrod did produce word-final /t/ and word-final /k/ once each in the sample (preceded by a glottal stop in both instances), but it is anticipated that /ks/ would not yet be stimulable. Any of these final (voiceless stop plus /s/) clusters that can be elicited would be targeted for 1 hour each (emphasizing the concept of plurals). In addition, contrasting words (e.g. *bow* vs. *boat* vs. *boats*) would be incorporated for perception activities. Jarrod would point to the pictures as the clinician names them; then the clinician would point to pictures named by Jarrod. Explanations would be provided as needed. It is anticipated that 5 hours would be spent on word-initial /s/ clusters and 2 hours on word-final clusters in cycle one.

Velars. We would plan to target word-final /k/ first for 1 hour.[3] Word-initial /ɡ/ would be targeted the second hour, followed by word-initial /k/ for 1 hour (not being concerned about voicing. Depending on the level of difficulty/success Jarrod has, we would then probe for /k/-vowel-/k/ (e.g. *coke*, *cake*, *kick*) and, if stimulable, we would spend 1 hour having him practice producing words that begin and end with /k/. After targeting velars for 2 to 4 hours, we would place the velar production-practice word cards in a file until cycle two, when more target words with less facilitative environments (see Kent, 1982) would be added to increase complexity (Hunt, 1961).

Liquids. The last target pattern for cycle one is liquids. We learned many years ago that it is important to facilitate liquids at the end of each cycle (even if not stimulable) to develop a foundation for later liquid productions rather than to wait until all of the other patterns have emerged. Jarrod's most common substitutions for liquids were /w/ for /r/ and /j/ for /l/. The initial effort for targeting /r/ would be to have Jarrod produce carefully selected production-practice words without substituting or inserting /w/. We would emphasize and exaggerate the vowel in our models. For the /l/, we would teach Jarrod to "click" his tongue tip against his alveolar ridge and then ask him to do this each day for 1 week prior to targeting /l/. Depending on Jarrod's specific ability/stimulability for velars and for /s/ clusters, cycle one would be completed after approximately 16 contact hours.

The HAPP-3 is readministered following each cycle for evidence-based practice documentation and to determine which patterns are improving as well as which patterns need to be recycled. In most instances, /s/ clusters and velars (as well as liquids) need to be recycled two or three more times, with complexity being increased gradually (e.g. less facilitative phonetic environments) for each succeeding cycle. Typically the "It's a _____" phrase is incorporated by the third cycle using /s/ cluster words that the child already has learned to produce spontaneously (e.g. *It's a spoon*).

Possible targets for later cycles

Potential secondary targets (see Table IV) are considered after all of the Primary patterns (except liquids, which typically progress more slowly) are emerging/generalizing into spontaneous utterances. We have observed that most of the potential secondary patterns no longer need to be targeted, however, because by the time the child completes two or three beginning cycles and the overall system has been enhanced, many of the secondary targets will no longer be problematic. Secondary targets that most often need to be targeted are other consonant clusters/sequences, including medial and final /s/ plus C (e.g. *biscuit*, *desk*), stop-plus-sonorant clusters (e.g. /kj/), and 3-consonant clusters (e.g. /str/). Minimal pairs/contrasts (Fairbanks, 1960) would be incorporated as much as possible for secondary targets (e.g. *coo* vs. *Q*).

Metaphonological awareness considerations

Metaphonological skill building activities would be an important component of Jarrod's treatment sessions because children with highly unintelligible speech experience greater difficulty on phonological awareness tasks than their phonologically normal peers (e.g. Gillon, 2004; Stackhouse, 1997; Stackhouse, Pascoe, & Gardner, 2006). Results of Jarrod's phonological awareness testing indicated that his scores were far below expectations for his age. Considerable evidence now exists (e.g. Blachman, 1991) indicating that children with poor metaphonological skills experience difficulty acquiring literacy skills. In addition, Gillon (2000) found that improved phonological awareness skills were accompanied by speech production gains. Thus enhancing metaphonological awareness skills appears to have effects on intelligibility as well as on literacy development (Hodson & Strattman, 2004).

Summary comments

The HAPP-3 and the Cycles Phonological Remediation Approach were both designed explicitly for children with highly unintelligible speech with the goal being to enhance the child's overall phonological system and expedite intelligibility gains. The assessment tool and the Cycles Approach had their beginnings in 1975 and have evolved over the years as a result of formulating and testing clinical research hypotheses and making modifications whenever new scientific evidence was obtained. The emphasis on assessing and enhancing patterns is a unique focus for both, with phonemes serving as a means to an end, but not being the actual goal.

Jarrod's HAPP-3 results were analysed for patterns of phonological deviations in order to: (a) identify his deficient phonological patterns, (b) determine the level of severity of his phonological impairment, (c) provide a direction for remediation, and (d) obtain baseline data. It was recommended that (a) final consonants, (b) /s/ clusters, (c) velars, and (d) liquids be targeted during the first cycle of intervention (approximately 16 contact hours). Potential target phonemes were recommended for each pattern, but actual targets would depend, of course, on Jarrod's individual abilities. A major limitation of this project was that direct contact with the child was not possible; thus we were unable to test our clinical hypotheses directly or recommend modifications for individual differences.

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Notes

1 Transcriptions for productions of two of the 50 HAPP-3 stimulus words (*jumping* and *crayons*) were not provided in Holm (2005). Transcriptions for these two words were extrapolated from productions of words obtained for other protocols. *Jump* had been transcribed as [jʌm] for another assessment protocol, and productions of 'ing' for *fishing* and *swimming* were both realized as [dɪŋ]. Thus, the transcription [jʌmdɪŋ] was hypothesized for *jumping*. Productions for *cry* and *crawl* had substitutions of /w/ for /r/ and omissions of /k/. Syllable/word-final nasals were produced for a number of words on the various assessment protocols. The transcription extrapolated for *crayons* was [weɪn].

2 We did target strident singletons /s/ and /f/ before /s/ clusters during our first 18 months at the University of Illinois experimental phonology clinic in 1975–76, but after realizing the difficulties children with highly unintelligible speech were experiencing when we started with /s/ singleton productions, we hypothesized that /s/ clusters might be more successful, and indeed they were. Moreover, intelligibility increased dramatically when children began producing /s/ clusters in their spontaneous utterances.

3 Typically children experience greater initial success with word-final /k/ than word-initial velars. We would not target word-final /g/ because we have found that voiced word-final obstruents are inappropriate targets (see Hodson, 2006 for further explanation).

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