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# Clinical Forum

## Parents and children together (PACT): a collaborative approach to phonological therapy

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### Introduction

Developmental phonological disorders are a group of developmental language learning disorders of unknown aetiology, occurring at a phonological level, and manifested in the use of abnormal speech patterns, by children, impairing their general intelligibility. This is one of a series of papers arising from an efficacy study of a treatment model for developmental phonological disorders proposed and tested by Bowen (1996).

'PACT', the name we have coined for the current therapy approach, is an acronym for 'parents and children together', and reflects our belief that children with phonological disorders should be guided along the normal developmental route in solving their intelligibility problems, with parents and significant others taking an active role in management. PACT therapy takes into account Stoel-Gammon and Dunn's (1985) proposal of four basic interacting components: auditory perceptual, cognitive, phonological and neuromotor, for the formulation of a model of normal phonological development. Almost a decade later, Stackhouse and Wells (1993) were critical of the limitations of existing categories for developmental speech disorders such as 'dyspraxia' (within a medical-diagnostic model that identifies clinical entities) or 'phonological disorder' (within a linguistic-descriptive model that describes output language behaviour at phonetic, phonological, syntactic, semantic, and pragmatic levels of analysis). They argued the case for a psycholinguistic model that viewed children's speech difficulties in terms of three levels of breakdown: input processing (decoding the speech signal); internal representations of linguistic items stored in memory; and output processing (encoding and articulating speech).

Stackhouse and Wells' psycholinguistic classification and assessment proposals, which emphasized the *interplay* of the levels they identified, was reminiscent of Ingram (1976) who proposed that the organization of the sound system involved three levels: how sounds are stored in the mind (underlying representations), how

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the sounds are articulated, and an organizational level in which phonological rules or processes map between the other two levels. These perspectives, and Grunwell's approach to clinical phonology (e.g. Grunwell 1995), helped shape our view that therapy approaches that attempt to deal with the problem of phonological disability at all three levels of phonology, taking into account Stoel-Gammon and Dunn's (1985) interacting components, will be the most efficient and effective, provided that the child shows developmental readiness.

The therapy model was constructed to include the interaction of five dynamic constituents: family education, metalinguistic tasks, phonetic production procedures, multiple exemplar techniques, and homework, included in therapy according to the individual needs of particular children and their families. It is broad based in the sense that it takes into account linguistic, motoric and developmental factors. Kamhi (1992) argued the need for such broad-based therapy methodologies that had some explanatory value, stating that 'Such models are consistent with assessment procedures that are comprehensive in nature and treatment procedures that focus on linguistic, as well as motoric, aspects of speech' (p. 261).

The PACT model differs from previous approaches in three important respects. First, it is innovative in terms of the manner in which family/teacher education, which includes the provision of comprehensive written information, is achieved. Second, the unique scheduling of appointments in planned alternating treatment blocks, and breaks from therapy, each of about 10 week's duration, sets the approach apart from its predecessors. Third, while the five components of the model comprise a synthesis of several existing approaches, the particular blend of these constituents yields a new treatment approach. Our aims here are to describe and explain in detail the therapy model itself, but first we provide a brief account of the research that validated the treatment approach.

## Research background

In the efficacy study, 14 preschoolers, aged 2;11 to 4;9 at the outset, with phonological development significantly below age expectations, were treated, and their progress in acquiring the target system was compared with that of a matched control group of eight children who did not receive treatment.

The study itself was unique, being the first of its kind in child phonology to provide an untreated control group. The control group was drawn from waiting lists for assessment at New South Wales Department of Health speech pathology clinics in Sydney and a rural city. In establishing the control group, waiting lists were perused and 108 suitable children were identified and assessed. Putting ethical considerations and the children's welfare first, their parents were provided with written assessment reports strongly recommending appropriate intervention near where they lived. Consequently, 92·6% of the parents removed their children from the waiting lists and arranged services, usually with our assistance, either privately or at another publicly funded agency. In fact, two of the potential control subjects, 3T and 6T, lived close enough to our clinic to become part of the treatment group. Through this process of attrition there were ultimately fewer children in the control group than in the treatment group.

The treated children 1T, 2T, 4T, 5T and 7T through 14T were seen as a subset of the first author's normal clinical caseload in the order in which they were referred for assessment. Our eight control children, 15C through 22C, remained on their

waiting lists from 5 to 11 months. The waiting policy at the time in the relevant clinics was that parents spoke by telephone to a speech-language pathologist who placed their children's names on a waiting list in order of referral, on a first-come-first-served basis. Parents were told that their children would have to wait up to 11 months and, by report, were often reassured by the person on the phone that waiting would not result in negative consequences in the long term. Children were assessed in the same order as they had been put on the list and, if appropriate, became eligible for immediate treatment. We timed the final assessment for each control-group child in the study to occur just prior to the termination of their waiting list status. Because we had recently assessed them, children were not re-assessed by the Department of Health clinician but received immediate intervention.

The criteria for entry to the study were that

(1) the children should be no less than 2;10 of age (in the event, the youngest child in the treatment group was 2;11 and the youngest in the control group 2;10), and not yet have started school;
(2) they should have received no previous speech-language pathology intervention;
(3) they should have normal hearing; and
(4) they should have English as their first language and live in monolingual households.

As we wanted the children's communication impairments to represent reasonably pure examples of phonological disability, receptive vocabulary and expressive language development were to be within 6 months of age expectations, and none were excluded on this basis. Children with other communication impairments (for example, vocal nodules and stuttering) were excluded. However, if other communication difficulties arose after acceptance into the study, the children were retained in their respective groups.

Using our own Severity Index (Bowen 1996) we found that, reflecting the severity range in the general clinical population, one child in each group had a mild phonological disability, one in each group had a severe phonological disability, and the remainder fell in the moderate category. At the probe (post-treatment) assessment, the 14 treated children showed accelerated improvement in their phonological patterns compared with the untreated eight, who did not. A commensurate improvement in receptive vocabulary and Mean Length of Utterance in morphemes (MLUm) was not observed in either group, pointing to the specificity of the treatment.

After the efficacy study concluded, we continued to collect within-group data from the treatment group while they completed their therapy, that is, until their phonological development was within normal limits and they were discharged from therapy. One child's data (10T's) had to be excluded from the final within-group data analysis because of non-compliance with attendance criteria following probe. The phonological patterns of seven of the remaining 13 were normal within 3–10 months of initial assessment (mean = 7·4 months). The other five children had normal phonology within 12–19 months (mean = 15·8 months). In the 'faster' group, the number of 50 minute consultations the children had ranged from 10 to 23 consultations (mean = 16 consultations). In the 'slower' group, the children had from 22 to 36 consultations before their phonology was age-appropriate (mean = 33 consultations). Overall, the 13 children averaged 10·6 months of therapy and 21 consultations.

### A structural plan

Fey (1992) proposed a plan, an adaptation of which is included in figure 1, for analysing the form of language intervention approaches in terms of a hierarchical progression from (1) phonological theory to (2) theoretically congruent phonological

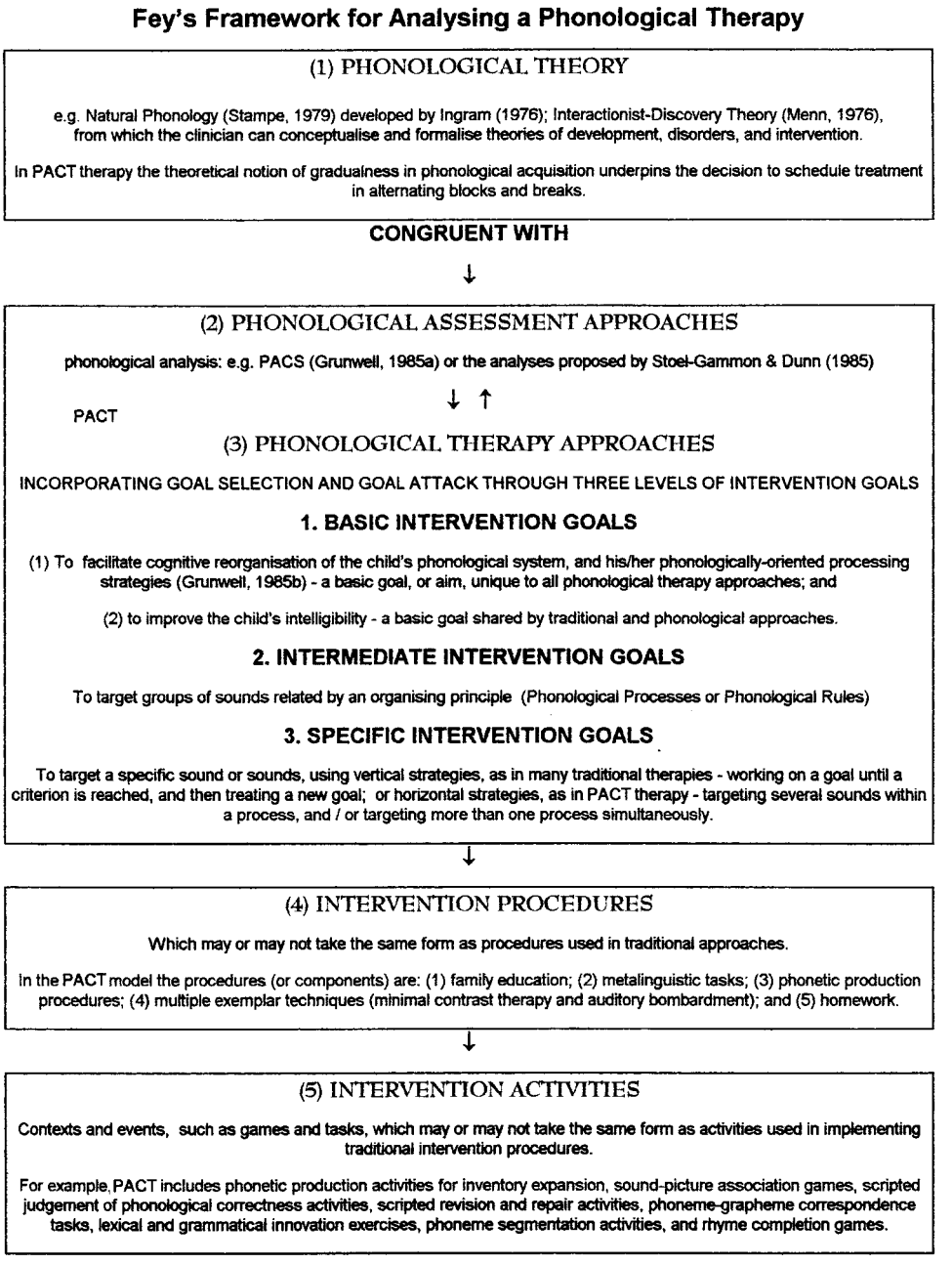


Figure 1. Hierarchical progression from phonological theory to theoretically congruent phonological therapy approaches, procedures and activities (after Fey 1992).

analysis to (3) phonological therapy approaches through three levels of intervention goals with goal selection and goal attack as critical components, from which arise (4) intervention procedures and (5) intervention activities. We have found this structure useful in explaining the current model (Bowen 1998a, Bowen and Cupples 1998).

## Basic principles of the model

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

(1) The therapy model is based on phonological analysis and assessment (Grunwell 1985a, Stoel-Gammon and Dunn 1985), which also defines the basic, intermediate and specific goals (Fey 1992) in treatment.
(2) Therapy planning is predicated on the principle that there are predictable patterns or regularities in the child's productive phonology (Grunwell 1985a, Ingram 1986).
(3) Therapy is based on the principle that the main function of phonological patterning is its communicative function in signalling meaning (Grunwell 1985a, Stoel-Gammon and Dunn 1985).
(4) Therapy emphasizes the importance of fostering in the child an awareness that the purpose of phonological development is effective communication and hence, aims to nurture metaphonetic and metaphonological awareness (Magnusson 1991).
(5) Therapy aims to change the child's phonological patterns so as to facilitate the development of a more functional system of sound structures and contrasts (Grunwell 1985a, Ingram 1986).
(6) Therapy is structured to take advantage of the organization of phonological patterning by eliciting and establishing changes in the child's productive patterns, through the use of natural sound classes and structures (Grunwell 1985b).
(7) Therapy involves enlisting family participation in a range of formal and informal homework activities, for reasons inextricably bound up with the connections between communicative context, communicative intent, and communicative effectiveness (Menn 1976, Gibbon and Grunwell 1990, Crago and Cole 1991, Crais 1991, Dodd 1995, Blosser 1996).

## The therapy model

### *Assessment*

For consistency across subjects in the research project, we needed to administer the same initial and probe assessment procedures to each child. Initially, case history information was collected, and the following tests/procedures administered: oral peripheral examination, phonological evaluation, stimulability testing, structural analysis of a language sample of no fewer than 200 utterances, assessment of receptive vocabulary, and an audiogram. Phonology was assessed using the *Metaphon Resource Pack* screening assessment (Dean *et al.* 1990), with the *Metaphon* test

picture/word 'gun' replaced by the picture/word 'gone'; the *Phonological Assessment of Child Speech (PACS)* (Grunwell 1985a), and an independent and relational analysis (Stoel-Gammon and Dunn 1985). In the normal clinical situation, as distinct from the research setting, there are various screening measures and comprehensive phonological assessment approaches to choose from, and it would be a matter of the clinician's discretion as to what additional assessment procedures should be used.

### *Attendance schedules*

If we agree that phonological development is *gradual* and *individual* (Vihman 1996) then it follows that therapy should be flexible enough take account of these two characteristics. The notion of gradualness has implications for time management and scheduling of consultations (or *when* the therapy takes place), while the concept of individuality is implicated in having an approach that suits individual families, and which can be geared to the specific requirements of the child (or *how* the therapy is implemented).

Clinicians planning attendance schedules have little information available regarding the time taken for new phonological learning to consolidate. Research into what might constitute an optimal balance between therapy attendance and breaks from therapy is required. There are reports in the literature of children with phonological disorders being treated in therapy blocks and breaks (e.g. Hodson and Paden 1983, Stone and Stoel-Gammon 1990), where the breaks were imposed by university or school vacations. The difference in the current model is that the breaks are planned as a necessary component of the therapy, accommodating to the gradual nature of phonological acquisition. Children attend with their parent(s) weekly for approximately 10 weeks, then have about 10 weeks break from therapy attendance. The first therapy appointment after a break includes a review assessment, and further therapy appointments are scheduled, as required. If children miss therapy appointments (due to illness, for example), additional appointments are arranged at the end of the series of 10 weeks, if necessary.

### *Target selection*

Therapy targets are selected using linguistic criteria taking into account motivational factors. For instance, using linguistic criteria in targeting fricatives, they might be targeted first for a particular child, in syllable final word final (SFWF) position, in response to Ferguson's (1978) observation that fricatives often develop first in word final position. For another child, using motivational criteria, final fricatives might be targeted first because the child had evidence of development of fricatives SFWF, and by focusing on them the child would experience success in therapy, and hence be encouraged and motivated. Selection of treatment goals is individual for each child, and based on clinical judgement, aided by suggestions from several sources, for example: Bernthal and Bankson's (1998) remediation guidelines for linguistic approaches (p. 350); Edwards' (1983) criteria for phonological process and target sound selection; Elbert and Gierut's (1986) 'predictions' of what sounds will develop if other sounds are taught (see also Gierut *et al.*'s (1996) phonetic and phonemic factors); Grunwell's (1992) seven decision-making principles in treatment planning; and potentially facilitative phonetic contexts discussed by Edwards and Shriberg (1983), Ferguson (1978), Grundy (1989) and Kent (1982).

Target selection is best demonstrated via detailed case studies explaining rationales for treatment planning decisions (Bowen 1998a), such as our study of Nina's response to PACT therapy (Bowen and Cupples 1998).

### *Intervention procedures*

#### (1) *Family education*

It is generally accepted by clinicians that active, informed involvement in the intervention process, when possible, of primary care givers and significant others in the phonologically disabled child's immediate communicative environment, has the potential to enhance therapeutic management (Fey 1986, Gibbon and Grunwell 1990, Crago and Cole 1991, Crais 1991, Dodd 1995, Blosser 1996). Family education and training occur through a combination of observing and participating during assessment and therapy sessions, general and specific written information, direct instruction, role play, and discussion.

*Rationale for the family education constituent.* Gibbon and Grunwell (1990) hypothesized that phonologically disabled children might be overwhelmed by the phonetic complexity of the sound patterns to which they were exposed: so much so that they would be unable to abstract new information from the speech environment. This state of being overwhelmed is mirrored in the bewilderment and anxiety expressed by many parents of phonologically disordered children, when they present at a speech-language pathology clinic seeking advice. Often, parents of children whose speech is largely unintelligible, simply don't know where to start correcting, or even whether they should.

The model is family centred (McWilliam *et al.* 1996) stressing family involvement in the intervention process, both during *and* between therapy attendances. Such family involvement is nurtured in the belief that if therapy is to be communication centred (Low *et al.* 1989, Grunwell *et al.* 1990, Howell and McCartney 1990), it should be integrated with the communicative interactions within the family where children are generally assumed to spend most time.

*The process of family education.* Providing parents with guidance in the form of a structured, supervised therapeutic management plan that is readily understood, and easy to implement, is the essence of the family education constituent of the therapy model. Management begins with information sharing in the initial consultation, when the parent(s) watch the assessment, then have the opportunity to ask questions, discuss relevant issues, and express concerns, feelings and ideas about the child's difficulties, the clinical diagnosis, and the proposed management plan. As an adjunct to the verbal discussion parents are provided with an informational book (Bowen 1998b).

*Family involvement in the initial assessment consultation.* The importance of a successful first meeting between child, parent(s) and therapist cannot be emphasized too strongly. They need to *join* with the therapist in establishing a co-operative working relationship. Family education and training *begins* with the initial consultation appointment, which consists of a case history interview, followed by the speech and language assessment. Observing the assessment, and having the opportunity to question the therapist during the first visit, is an important element of the *therapy*,

enabling parents to gain an understanding of the assessment process and its connection with treatment planning.

*Family involvement in the treatment sessions.* It is not considered necessary or desirable to have parents 'in' the whole time during treatment. It is preferable for the therapist to have some time one-to-one with the child. This time alone strengthens the relationship between the therapist and the child, and creates a safe emotional environment in which children can take risks and experiment with their phonology, without feeling threatened. For that to happen, there has to be an emotional, and what might be termed 'intellectual', *closeness* between therapist and child, which is not always possible with a third person continually present.

*Family involvement in homework.* Each time a child attends for therapy, some of the activities from the therapy session are included in the homework. Parents are instructed to do the homework in 5 to 7 minute sessions, once, twice or three times daily, 5 or 6 days a week. The practice sessions can be separated by as little as 10 minutes. They are asked to do the homework in 'good' listening conditions, and to create about an equal balance between the 'talking tasks' and 'listening and thinking tasks', but to err on the side of reducing the talking tasks and increasing the listening and thinking tasks. This point may have to be emphasized, as some parents (and teachers) see speech production practice as the most important and beneficial part of the homework programme.

Families are asked not to practice in the morning prior to a therapy session, but as far as possible, always to practice later the same day as a therapy session. The request to do homework later, on the same day as a therapy session, is explained in terms of enhanced reinforcement due to a recency effect. Suggesting no homework earlier in the day of a therapy session is motivated simply in terms of not wanting to overload parent or child with too much to do on the same day, *and* guarding against their becoming bored with too much homework. Parents are encouraged to make the homework as informal, 'natural' and enjoyable as they can. If possible, brief 'homework' at preschool, once (or at most, twice) per week, with a teacher or a preschool early intervention resource teacher is encouraged, in addition to home intervention.

*Written information for families and teachers.* In the parent information book (Bowen 1998b), developmental phonological disorder is defined and described in the context of linguistic development overall, and the concept of developmental readiness explained. The process of assessment and phonological therapy is outlined, and the questions that families often ask about phonological disability answered. Direct instruction in providing the child with appropriate modelling and modelling corrections is included. Parents learn how to encourage self-monitoring and self-correction; to reinforce the use of phonological revisions and repairs; and to integrate these techniques into naturalistic contexts.

(2) *Metalinguistic tasks*

With its emphasis on children following the normal developmental route in resolving their production problems, the therapeutic regime requires that they must learn self-monitoring abilities. This learning, in turn, relies upon the development of

certain metalinguistic knowledge and skills, including the awareness that the purpose of phonological development is effective communication (Magnusson 1991).

*Rationale for a metalinguistic tasks constituent.* The rationale for the inclusion of the metalinguistic tasks constituent is to provide the parents and child opportunities to talk, think and learn about language, with an emphasis on the phonological levels.

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

- *Metaphonetic activities.* Metaphonetic activities incorporate many of the 'ear training' (Bernthal and Bankson 1998, p. 316) activities found in traditional therapy such as those involving recognition of sound-effect–picture associations, for example, a picture of a snake associated with /s/, representing a hissing snake sound-effect.
- *Phoneme–grapheme correspondences.* These activities involve metaphonological knowledge of phoneme–grapheme correspondences or sound symbol relationships, for example, recognizing that 's' corresponds to /s/ (Allerton 1976).
- *Activities involving phoneme segmentation for onset matching.* In these activities children are helped to sort words by initial phoneme, e.g. 'Find **B**aby **B**orn things to put in her **b**ag that start with the same sound as her name, /b/', from a selection such as **b**ook, **b**lock, rattle, **b**all, **b**onnet and mirror.
- *Activities to increase word and rhyme awareness.* Word and rhyme awareness are targeted through reading books such as *Hop on Pop* (Dr Suess Beginner Books Series for Beginning Beginners), or *Big Bird's Rhyming Book* (Random House, CTW), emphasizing sound patterns.
- *Conceptualizing 'sound' and 'word' (or 'name').* These activities nurture a rudimentary knowledge of what 'sound' and 'word' (or 'name') mean, using, for example, the *Ordinary Sounds and Special Words Game* in which pictures representing 'ordinary' sounds are sorted into an 'ordinary box' and 'special words' are sorted into a 'special box'; or talking about sounds and words while story-reading. An example of the *Ordinary Sounds and Special Words Game* follows. The child is presented with a set of six picture cue cards, comprising three sets of two identical pictures: two snakes, two sleeping babies and two dripping taps. S/he is told that some of the cards have 'special words' (or 'names') on them, and some of them just have 'ordinary sounds' on them that are not words (names) at all. The child is shown one picture each of snake, baby and tap, and told that the 'special words' (names) that go with the pictures are 'snake', 'baby' and 'tap'. Then they are shown the remaining three pictures, and told that the 'ordinary sounds' that go with them are /s/, /ʃ/, and /t/. The connections between the pictures, words and sounds are explained simply:

| | | |
|---|---|---|
| /s/ | [snake cue card] | 'A snake goes sss' |
| /ʃ/ | [sleeping baby cue card] | 'People go shhh when a baby is asleep' |
| /t/ | [dripping tap cue card] | 'A dripping tap goes t-t-t' |

When the child can point appropriately to the pictures, whether the clinician says a phone or a word, a plain cardboard box and a fancy box and 12 pictures representing the words and phones are produced (e.g. two pictures of the tap paired with the word 'tap', and two pictures of the tap paired with the phoneme /t/, and so on with 'baby' (/ʃ/), and 'snake' (/s/)). The child is told that 'special *words*' (or 'special *names*') belong in the 'special box', and 'ordinary *sounds*' belong in the ordinary box. The adult then hands the cards to the child one by one in random order, and the child sorts them into the two boxes according to whether the adult paired them with a spoken word or phone.

- *Activities to increase awareness of sound patterns between words.* Examples of activities that highlight rhymes and other sound patterns include

  (1) sorting minimally contrasted word pairs pictured on playing cards: key–tea; call–tall; cork–talk;
  (2) performing rhyming cloze tasks: fat rhymes with ... pat; fall rhymes with ... Paul; fair rhymes with ... pear;
  (3) sorting words pictured on playing cards according to their phonetic characteristics (curl–girl, Kate–gate, cot–got, come–gum);
  (4) sorting words pictured on playing cards according to their structural characteristics (moo–moon, bow–boat, sea–seed; tar–star, top–stop, tack–stack).

- *Judgement of phonological correctness.* Activities include games and scripted routines that require an understanding that you have to say a word the 'right' way to make sense, and judging when a word, spoken by another person, sounds 'right' and when it sounds 'wrong'; for example, the 'You-be-the-teacher' game: 'You be the teacher and tell me if I say these words the right way or the wrong way'.
- *Awareness of revisions and repairs.* Activities nurture the awareness of and the ability to perform revisions and repairs or 'self-corrections', and metalinguistic knowledge of when or why we make revisions and repairs. For example, the 'fixed-up-ones routine' (Bowen and Cupples 1998), using pictures to guide the scripted discussion: 'If I wanted to say "ship", but I accidentally said "tip", I would have to fix it up and say "ship". I would have to quickly think to myself, it's not "tip", it's "ship". Did you hear that fixed-up one? First I said "tip", then I quickly fixed it up and said "ship"'.
- *Lexical and grammatical innovations.* These activities utilize lexical and grammatical innovations involving morphophonological structures such as plurals (boy/boys), possessives (boy/boy's) and past tense (mow/mowed) to facilitate the emergence of new phonological contrasts (Shriberg and Kwiatkowski 1980).

(3) *Traditional phonetic production procedures*

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

(1) the child must be aware of the inadequacy of the current production;
(2) the child must have the desire to change it;
(3) the child must have knowledge of the required target or targets; and

(4) the child's vocal apparatus must have sufficient dexterity to implement newly learned sounds at speed, and in a variety of phonetic contexts.

Acceptance of Hewlett's conditions, in particular (3) and (4), is an integral part of the theoretical base for the inclusion of a phonetic production training element in the therapy model, especially for the children who require phonetic inventory expansion.

*Rationale for a phonetic production component.* The phonetic production aspect of the therapy approach sits well with Stoel-Gammon and Dunn's (1985) four-tier model of phonological development, referred to previously, which contains a neuromotor component, encompassing the ability to plan and execute the articulatory movements underlying speech. Not all would agree, however, that the stimulus methods applied in traditional approaches, which predated the application of phonological principles to intervention, may form theoretically congruent components of phonological therapy regimes (e.g. Schwartz 1992). In the current model, phonetic production training is not counted as a phonological component *per se*, but it is considered theoretically coherent to include it in the model. Phonological therapy is, by definition, directed at activating the child's underlying system for phoneme use, but somewhere along the line the child has to learn how to produce the phonemes (Saben and Costello-Ingham 1991). Having said that, while there is ample experimental evidence demonstrating the value of production practice for the development of new sounds in children's phonetic inventory (Gierut *et al.* 1987, Elbert *et al.* 1991, Gierut 1992), phonetic production procedures must of course be used advisedly with children with phonological problems, or they may become counterproductive (Bleile and Hand 1995, Grundy 1995, Miccio 1995).

For some phonologically disabled children, many of whom are at the severe end of the phonological disability spectrum, inventory expansion is their most pressing need, and traditional methods suffice. Phonetic production training is essential (usually only in the early stages of therapy) to teach them to produce the full range of phonemes, and also to achieve a degree of familiarity and automaticity as they learn to incorporate their new sounds into their speech patterns. At the other end of the spectrum, some children's phonological disabilities are so mild, and their developmental readiness so ripe, that the phonetic production training component of the model is all that is necessary to trigger the final step or two necessary for their phonological patterns to conform to the norm.

*The process of phonetic production training.* Bearing in mind that we still do not know how to determine the amount of intervention that can be directed at the phonetic level before it begins to interfere with phonological processing, traditional phonetic placement techniques are incorporated, and phonetic production practice is included, but minimized, in the belief that if children with phonological problems are treated with too strong an emphasis on phonetic production, it will impede their progress. Children with restricted phonetic inventories and phonotactic repertoires are taught early in therapy, to produce the absent phonemes, or at least phonemes in the same sound class, and to extend their range of phonotactic options.

Amongst the typical clinical caseload to date, most children have some direct traditional instruction ('stimulation') in producing target sounds, around half have incidental production practice of single words containing target phonemes as part of metaphonological and metaphonetic tasks, and around half have a very small amount of formal production practice. The *proportion* of production practice, for

those who need it, is greater in homework sessions than during therapy sessions. A balance of around 50:50 between *listening and conceptual* and *speaking* tasks is suggested to the parents.

(4) *Multiple exemplar techniques*

In practice, minimal contrast activities and auditory bombardment frequently overlap and are referred to collectively as multiple exemplar training. Both relate logically to the other parts of the therapeutic model and to familiar and enjoyable child–parent communicative interactions such as story reading, nursery rhymes, rhyming humour, cloze (sentence completion) tasks, and games.

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

There are at least two potential ways of providing intensified, systematic, and repeated exposure to multiple exemplars of phonological structures and contrasts (Ingram 1989): first, through the techniques developed by Blache (1978, 1982), Weiner (1981) and others, often referred to as minimal contrast therapy or minimal pairs therapy; and second, auditory bombardment (Hodson and Paden 1983, Monahan 1984). By increasing lexical frequency, minimal contrast activities provide a means of facilitating the child's ability to recognize contrastive phones. It confronts them with the interconnections between the way a word is pronounced, the transmission of meaning, and communicative effectiveness. Auditory bombardment also increases lexical frequency and controls phonological input for limited periods, potentially presenting an opportunity for children to discover underlying phonological patterns for themselves. Often, in the clinical setting, it has been observed by the authors to trigger spontaneous rehearsal of bombardment words by children.

*The process of multiple exemplar techniques training.* Multiple exemplar training includes minimal contrasts therapy and auditory bombardment. Both are performed within therapy sessions and for homework.

*Minimal contrasts activities.* The minimal contrasts activities usually involve simple card games with minimal meaningful contrasts (MMCs) pictured on playing cards, or on pictures pasted into the children's speech books. Examples of training sets, always consisting of pictures, and usually accompanied by written words, are displayed in table 1.

**Table 1. Examples of training sets of words for minimal contrasts activities**

| Final consonant deletion | | Cluster reduction | | Velar fronting | | Deaffrication | |
|---|---|---|---|---|---|---|---|
| boat | bow | glow | low | car | tar | chip | ship |
| moon | moo | black | back | cap | tap | chew | shoe |
| couch | cow | steam | team | corn | torn | chop | shop |
| | | clip | lip | kite | tight | cheep | sheep |
| | | ski | key | call | tall | choose | shoes |
| | | spit | pit | key | tea | | |
| Context sensitive voicing | | Palato-alveolar fronting | | Word-final devoicing | | Glottal replacement /t/, /k/→/h/ | |
| bowl | pole | ship | sip | weed | wheat | toe | hoe |
| buy | pie | sheet | seat | wag | whack | tie | high |
| big | pig | shoe | Sue | pig | pick | tip | hip |
| beep | peep | shell | sell | cub | cup | cot | hot |
| gum | come | show | sew | Marge | march | cart | heart |
| Sue | zoo | short | sort | feed | feet | key | he |
| | | | | cab | cap | | |
| | | | | tag | tack | | |
| | | | | buzz | bus | | |
| Stopping of fricatives | | Gliding (of liquids) | | Stopping of affricates | | Glottal replacement /s/→/h/ | |
| fat | pat | lead | weed | chin | tin | sauce | horse |
| feel | peel | line | wine | chair | tear | seal | heel |
| fill | pill | lock | wok | chip | tip | soup | hoop |
| full | pull | lick | wick | chop | top | sew | hoe |
| fall | Paul | | | cheese | tease | sum | hum |
| foal | pole | | | chick | tick | sip | hip |
| ship | tip | | | | | | |
| shoe | two | | | | | | |
| sew | toe | | | | | | |

Training sets of cards, or pictures in the speech books, range in number from three pairs to nine pairs (depending how many an individual child can cope with). All the activities are modelled for the children first, until they understand what to do; for instance, they might have to sort the cards into two piles, 'with' vs. 'without' final consonants for final consonant inclusion. Some typical examples of minimal contrasts activities, most of which include pictures accompanied by spoken and printed words throughout, are listed below (see also Bowen 1998b).

(1) *'Point to the one I say'* in which the child points to pictures of words, spoken in random order (e.g. glow, black, low, steam, back, team, glow), or rhyming order (e.g. low, glow, back, black, team, steam), by the therapist or parent.

(2) *'Put the rhyming words with these words'* in which the therapist or parent sets out three to nine picture-cards (e.g. pat, peel, pill, pull) and the child places rhyming picture-cards beside them (fat, feel, fill, full).

(3) *'Say the word that rhymes with the one I say'* in which the therapist or parent says words pictured on cards containing the target phoneme, and the child, prompted by a cue card, says the rhyming non-target word (e.g. the adult points to a picture representing 'fill' and says 'fill' and the child is shown a picture representing the word 'pill' and says 'pill').

(4) *'Give me the word that rhymes with the one I say'* in which the adult says the non-target word, and the child selects the rhyming word containing the target sound (e.g. the adult says 'pill' and the child selects the picture representing 'fill').

(5) *'Tell me the one to give you'* in which the child says the word, and the adult responds to the word actually said. So, for example, if the child attempted to say 'fill', but produced it as 'pill', the adult would give him or her the picture of 'pill', causing them to experience a communication failure. This game is based on the homophony confrontation tasks described by Weiner (1981). The aim is for the children to realize the failure to communicate their message, and attempt to revise their production. This is the only minimal contrasts activity that is not included in homework. It requires a 'light' touch, and humour that the *child* finds funny and did not go on for too long. Games involving homophony confrontation are not played in therapy sessions when siblings are present, because of the possibility of their giving rise to teasing.

(6) *'You be the teacher, and tell me if I say these words the right way or the wrong way'* in which the adult says the words (pointing to pictures on cards, sheets or pasted into the speech book) in rhyming or random order, and the child judges whether the words have been produced correctly or not.

(7) *'Silly sentences'* in which the child judges whether a sentence is a 'silly one'. For example, the adult might say 'We flew to Melbourne in a pane (plane)', showing the child a cue card of a plane, and the child judges the sentence a 'silly one'.

(8) *'Silly dinners'* is a variation of *'Silly sentences'*. The adult says what they want for dinner, and the child judges whether it is a 'silly dinner' or not (e.g. 'For my dinner I will have 20 hot ships (chips) and two delicious shops (chops)'). Again the target and rhyming non-target words are pictured on cards, with the words printed under the pictures.

(9) *'Shake-ups and match-ups'* is a game in which the child is presented first with four picture cards representing minimal meaningful contrasts (MMCs) such as: car/calf; tie/tight. The word pairs are repeated to the child several times, then the picture cards are put into a container and 'shaken up'. The child is then asked to take the cards out of the container and arrange them on the table 'the same as they were before' (i.e. in pairs).

(10) *'Walk when you hear the two-steps'* in which the child 'walks' with their fingers when they hear (at the same time as being shown a picture-cue card) a consonant cluster SIWI as opposed to a singleton consonant SIWI.

The therapist or parent helps the child perform the task, gradually phasing out the help until the child is performing independently. The purpose of the tasks is explained to the parents and the children as a good way of listening to, and 'thinking about', the way words sound. The parents are instructed to encourage the children to 'think the words in your mind' while performing sorting tasks. Including graphemes means that sometimes the children sort pictures visually as well as, or possibly instead of, auditorily. If they do, it is encouraged, and viewed as an additional way for children to find systematic patterns and correspondence between linguistic levels. Minimal contrasts activities typically provide a natural lead-in to a brief 'input' of auditory bombardment, and the boundaries between where minimal

contrast activities finish, and auditory bombardment activities take over, are sometimes blurred. Minimal contrast training sets sometimes double as auditory bombardment list words.

*Auditory bombardment activities.* Minimal contrast and auditory bombardment activities take a variety of forms. In the current therapy approach, auditory bombardment is included using minimal meaningful contrasts (Monahan 1984). There is no research to support the use of amplified auditory bombardment, although Hodson and Paden (1983) believed it might increase the perceptual saliency of phonemes. No amplification is used in the current therapy, so that the input is as close (acoustically) to normal conversational speech as possible. It is worth noting that for some children headphones are too distracting (e.g. either because the children like them, or because they find them objectionable).

Auditory bombardment provides children with concentrated exposure to a particular sound in a specific word context (usually SIWI, e.g. fill, feel, fall, file, foal, fool, fell, foil; or chair, cheese, chew, chin, chick, child, church, chop), or in minimally contrasted word pairs (e.g. bow–boat, cow–couch, etc.; or pay–play; back–black, etc.; see table 1). Auditory bombardment is explained to the parents and the children as a good way of listening to sounds in words. During therapy sessions, the auditory bombardment words are read to the child one to three separate times during the session. The lists comprise 10–15 different words (all familiar, or all unfamiliar, or a combination of the two) with a common phonetic feature (e.g. all starting with /s/; or all ending with a particular consonant class, such as the nasals /m/, /n/ and /ŋ/); or a list of minimal meaningful contrasts (see table 1). Two examples of auditory bombardment lists for nasals in SFWF position follow:

- List 1: fun, sun, bun, moon, soon, coon, ring, wing, sing, ring, sing, wing, moon, soon, coon, fun, sun, bun.
- List 2: pin-ping, thin-thing, win-wing, Kim-king, rim-ring, dim-ding, ping-ping-ping, ding-ding-ding, boing-boing-boing-boing-boing.

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

When auditory bombardment is included in homework, the parents are asked to present it twice in each homework session. All that is involved is for the adult to read the word list to the child while s/he listens quietly. The parents are encouraged to say the rhyming words 'rhythmically' in pairs, so that they form couplets (or triplets if there were three words, e.g. Sue/shoe/chew; sip/ship/chip; sore/shore/chore). No amplification is suggested and, indeed, the auditory bombardment is occasionally whispered to the child. Parents are told not to overemphasize target sounds (i.e. not to distort them), though they are told that it sometimes helps if they make the bombardment interesting or funny. Funny, perceptually salient made-up words like 'boing', 'ker-plop', 'ker-plunk' and 'shillyshally' often set the children laughing, and asking for 'more bombs'. 'Bombs', a name

one of the children invented for 'auditory bombardment', rapidly gained currency in the clinic, constantly seeming incongruous with the authors' serious attempts to remove pictures of weapons, particularly guns, from assessment and therapy materials for use with young children. The same child's father *marched* while proclaiming the bombardment list, which his delighted family found very funny! When tape recordings of therapy sessions are taken home, they always include auditory bombardment.

(5) *Homework*

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

*Rationale for a homework constituent.* There are several reasons homework is considered such a crucial aspect of the model.

(1) Homework activities provide practice and reinforcement and an opportunity to generalize newly learned skills, for both the child and the family. For children this practice, reinforcement and generalization involves aspects of learning more about their own phonology, and for parents, it involves developing their skills as co-therapists.
(2) It is important that parents and their child engage in the homework activities away from the therapist's supervision, facilitating independent experimentation with, and development of, the tasks presented. Experience has shown that the parents' confidence increases as they become more 'at home' (literally) with the procedures, so that they become more critical and innovative in their approach to the homework. Before long, most parents initiate appropriate steps in therapy, arising from something that occurs during homework.
(3) The homework takes the therapy away from the often contrived confines of communicative interaction within the clinic, and into more meaningful communication contexts for the child. This socio-environmental generalization enables the parents to introduce skills they have acquired, in terms of nurturing the child's phonological system as natural opportunities arise, and when they are 'in the mood' and the child is receptive.
(4) Because the homework is dynamic, it influences the form the therapy sessions take, and allows the therapist to mould the activities that occur in the clinic to suit the individual child and his or her family better.
(5) When phonological 'breakthroughs' occur at home, they are usually noticed during the homework. This is very encouraging and motivating for the families, who readily see, and value, their own contribution to such obvious progress. The parents' recognition of their active involvement in therapy is a powerful reinforcer for them, and for their child.
(6) Recognizing and taking responsibility and credit for phonological innovation and change reduces dependency (of parent and child) on the clinician's guidance, and promotes an atmosphere in which the parents can encourage the child to 'take over' his/her own independent *phonological learning*. More traditional therapy approaches lack this aspect, as the emphasis throughout therapy is on *phonetic or phonemic teaching*.

(7) Being involved in homework has the potential to help the parents to understand the approach and have confidence in it (cf. Klimacka 1995).

*The homework process.* The strategy of integrating reinforcement into ordinary communicative interactions at home is particularly important with 3-year olds. With older children, it is workable and often quite enjoyable to structure therapy sessions like individually tailored 'lessons', with a related home practice schedule or 'homework'. By contrast, 3-year olds (and indeed their parents) are usually less responsive to such an approach. For them, a less formal structure is more suitable and conducive to increased concentration, co-operation, and enjoyment of the therapeutic interaction. Importantly, even if 3-year olds are able to conform to a lesson format in therapy, a comparable situation is generally impossible for parents to replicate at home, once the initial novelty has dwindled.

Homework usually takes the form of what was portrayed to the parents and children as 'talking and listening games'. Above all, they are told to make the homework regular, brief, positive and enjoyable. Homework activities are outlined week by week in an exercise book (the 'speech book'). Each child's book is individually tailored to his or her specific needs and interests, so that no two are exactly the same. The parents are encouraged to 'sell' the speech book to the child as something very special and important. To emphasize the individuality of the speech books and to make them special, they usually include some of the child's own drawings, drawings or photographs of family members, and favourite fictional characters.

*Typical therapy and homework sessions.* In terms of content, there are a number of therapy and homework tasks and activities that recur for all children: for example, multiple exemplar training, metaphonological tasks, phonological processing activities, and phonetic production activities. A typical set homework routine includes

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

The form of some of the particular homework tasks varies according to the child's and the parents' needs and capacities. Some parents, for example, can easily respond to a broad homework task such as being asked to model velars (/k/, /g/, and /ŋ/) at opportune times. Others, whose children actually require almost exactly the same type of input, are unable to cope with such general instructions, so are given a set routine to follow. Predictably enough, in general, the parents require most structure towards the beginning of the therapeutic process, and less towards the end. A typical therapy session comprises much the same activities as those listed above for a homework routine (including listening to excerpts of therapy on

audiotape), but instead of occupying 5–7 minutes, would be expanded and elaborated to spread over a longer period, with time allowed for discussion with the child's parent(s).

Whilst a homework routine is a condensed version of the most recent therapy session, a therapy session rarely includes a total 're-run' of the previous week's homework. The effect of avoiding a re-run of the homework, in favour of getting straight on with different activities, is for the child to feel that they have something new and interesting to do each week, and for the parents to have an overall sense of progress. Care is taken during the therapy sessions to determine that the child *can* perform the homework tasks. No task is ever included in the homework until the clinician is satisfied that the child can do it with reasonable ease, and that the parents understand what is required, of both themselves, and of the child for each task. Tasks that the child patently takes no pleasure in during therapy sessions are also eschewed as homework tasks; for example, a minority of children dislike the 'You be the teacher' game.

## Conclusions

A phonological therapy approach aims to facilitate age-appropriate phonological patterns through activities that encourage and nurture the development of the appropriate cognitive organization of the child's underlying phonological system. The rationale for this intervention model involves two aspects. The first aspect is a theoretically based view of phonological acquisition as a complex developmental interaction between motoric, perceptual, conceptual, and cognitive-linguistic capacities and capabilities at the intrapersonal level. The second aspect is that the development of such capacities and capabilities is facilitated by interpersonal communication experiences in the child's particular and immediate linguistic surroundings.

Phonological acquisition is seen to have four basic, interacting components: auditory perceptual, cognitive, phonological, and neuromotor (Stoel-Gammon and Dunn 1985). It depends upon the child's developmental readiness, as well as facilitative psychosocial factors in the communicative milieu. Congruent with this perspective is a theory of phonological disorders as an interruption to normal phonological acquisition, which could have its origins in one or more of the four components or their environments, thereby adversely affecting the cognitive processes involved in phonological organization and learning.

The goals in phonological therapy, therefore, are to encourage, stimulate, and recognize developmental readiness, and activate cognitive reorganization of the child's phonological system. This process thereby facilitates the emergence of new pronunciation patterns, hence improving intelligibility and ultimately fostering the emergence of age-appropriate phonology.

The PACT therapy model emphasizes the importance of the child's active cognitive involvement and family communicative participation. The model's components include metalinguistic, phonological and phonetic procedures and activities. The novel aspects of the approach are contained in the family education/involvement component, the scheduling of appointments in planned blocks and breaks, and the unique combination of existing approaches, procedures and activities.

Empirically supported guidelines for treating developmental phonological disorders, based on the PACT approach, can thus be stated:

(1) Base therapy upon detailed and ongoing phonological assessment in order to target cognitive reorganization of the underlying system for phoneme use as efficiently and as relevantly as possible for the child at any given time.
(2) Administer therapy in the form of planned therapy blocks and breaks to allow for the gradual emergence of new phonological patterns.
(3) Structure therapy sessions so that *at least* 50% of procedures and activities involve cognitive (auditory processing) skills, thereby acknowledging the important role of listening and thinking in linguistic learning, with less emphasis given to production procedures and activities.
(4) Engage parents and significant others (family and preschool teachers) in an active and informed way in the therapeutic process, thus tapping into the resources and capabilities of the most influential people in any child's early linguistic environment: that is, his or her family.
(5) Involve the child as an active participant in therapy, on the basis that language learning is dynamic, interactive and interpersonal, and that the function of phonology is communication.
(6) Include in the therapy regime the following components:

- family education;
- metalinguistic tasks, including aspects of linguistic awareness and phonological processing;
- traditional phonetic production procedures;
- multiple exemplar techniques, including minimal contrast and auditory bombardment activities; and
- homework activities, incorporating (1) to (4) above.

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*Commentaries upon this paper follow below and the response to these commentaries appears on pp. 65–83.*

# PACT: some comments and considerations

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## Introduction

In their article, Bowen and Cupples (this issue) introduce 'an empirically tested phonological therapy model' that is 'broad-based, flexible, and adaptable, comprising five dynamic and interacting components...'. The model is said to differ from previous models in (a) the extent to which it involves the children's families, (b) its scheduling protocol, with children being seen once weekly in 10 week blocks followed by 10 week periods of no treatment, and (c) the unique mix of five intervention components (none of which are original to the authors) into an