In conclusion, the model itself is theoretically sound and the results of the efficacy study are encouraging. Future research might usefully be directed at investigating the relative importance of each of the aspects of the model, the efficacy of the planned breaks and the effects of parent education and involvement in therapy. The model offers a broad outline to aid clinicians in planning effective therapy programmes. The emphasis of approach will be based on the detailed analysis of each child's phonological system and articulatory skills and therapy tasks can be drawn in from several different resources.

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Reply

A phonological therapy in depth: a reply to commentaries

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Introduction

It was most rewarding for us to read the commentaries relating to our description of a broad-based, family-centred approach to phonological therapy ('Parents and

children together: a collaborative approach to phonological therapy', or PACT), and realize that much of what we had written was viewed in a positive light by the four commentators (Fey; Grundy; Ingram and Ingram). Equally welcome, however, were their pertinent and constructive clinical insights, measured criticisms, and well-considered questions. It is our intention in this reply to address some of the issues raised in the commentaries, and in so doing, to give a more detailed account of our work. With this aim in mind, we begin by providing further information about the research study into the efficacy of the therapy, and then move on to look at the therapy model itself in greater depth. To give the reader a better 'feel' for the therapy process, the data of one child, 'Ceri', will be used throughout. Ceri's history and therapy participation are summarized in table 1. For comparison, a case study of another child, 'Nina', also using PACT therapy, is contained in Bowen and Cupples (1998).

Table 1. Ceri's history and therapy participation summary

Initial consultation age	53 months (4;5)
Initial severity rating	3.75 moderate phonological disorder (Bowen and Cupples 1998)
Initial PCC	35% severe phonological disorder (Shriberg and Kwiatkowski 1982)
Initial PPVT-R standard score	113
Initial MLUm	4.8
Number of consultations	23
Number of treatments	18
Number of assessments	5
Duration of therapy	10 months
Age at discharge with phonology within normal limits	63 months (5;3)
Attendance	Mother accompanied Ceri to all consultations Sibling (off school, sick) attended one treatment consultation
Homework	Homework was 100% with mother 1:1 with teacher nil Speech book to preschool once per week, where teacher gave general encouragement and modelling.
Therapy blocks and breaks	Block 1: 11 consultations Break 1: 8 weeks Block 2: 11 consultations Break 2: 10 weeks Block 3: 1 consultation
Phonology[†]	
Incidence category 5: 80–100% four phonological deviations	Velar fronting; palato-alveolar fronting; cluster reduction SIWI; gliding of fricatives SIWI
Incidence category 4: 60–79% one phonological deviation	Cluster reduction SFWF
Incidence category 3: 40–59% one phonological deviation	Gliding of liquids
Incidence category 2: 20–39% one phonological deviation	Stopping of fricatives SFWF

[†]Ceri's phonetic inventory was complete, but characterized by seven phonological deviations in the incidence categories shown in the left hand column (the percentages refer to the percentage of occurrence of each phonological deviation).
SIWI = syllable initial word initial position; SFWF = syllable final word final position.

The efficacy study

Allocation of children to groups

The most potent criticism of our work came from Fey, when he questioned whether the therapy approach had been validated experimentally at all. His primary concern stemmed from the failure to assign children to the control and treatment groups at random. According to him, this failure made it seem 'likely that the control group of children and families differed on clinically relevant variables from the children and families in the treatment group'. In support of this view, he referred to our difficulty in obtaining a group of control children, hypothesizing that the 7.4% of children who stayed on as controls might have come from households less conducive to phonological acquisition. This certainly was not our impression. Although we cannot claim that the two groups were matched *exactly* on *all variables* related to learning, there were few obvious differences between them that would result in faster development among the treatment children.

Four of the control children were from a rural city, and four were from suburban Sydney, but it is improbable that this factor alone could have affected the phonological progress of either subgroup relative to the treatment group children, all of whom were from suburban Sydney.

Because therapy was family centred (McWilliam *et al.* 1996), we attempted to obtain subjects whose family structure (Briggs 1994, Sarantakos 1996) and child-rearing practices (Ochiltree 1990, Guilding 1997) were similar. In terms of family structure, all the children except Ceri lived at home with both their biological parents. Ceri lived with her mother and elder sibling, her father having left the family, without prior warning, the day before Ceri's initial assessment for the study (i.e. after she had been accepted as a potential treatment subject). Two of the treatment children were sisters. All the parents were in their first marriage, and none had children from previous relationships. The children each had from one to three siblings, but no adopted, foster or step siblings. None of the families had additional people living in their household, and all had at least one parent in full-time employment. Potential subjects were not excluded on the basis of family history of communication impairment or learning disability. Seven children in the treatment group and four children in the control group had reported family histories of one or two of the following: dyslexia, language delay, speech delay or dysfluency.

With regard to child-rearing practices, we, as researchers and clinicians, did not feel that the control group parents were any less nurturing, supportive, educated, or 'stimulating' than the treatment group parents. Initially, it was ascertained that all parents talked, played and read appropriately with their children, pursuing home activities that Fey noted may facilitate development.

Finally, it is reassuring to note that parents' educational status and occupational prestige (Broom *et al.* 1977, Daniel 1983, Jagtenberg and D'Alton 1992) did not differ between the groups. In fact, the parents' prestige scores (Daniel 1983) re-scaled 0–100 (Jagtenberg and D'Alton 1992) showed a small advantage in favour of the control group (58 vs. 49), although the difference did not approach significance ($F(1,20) = 1.55$). In addition, there was no significant interaction between parent (mother/father) and group ($F(1,20) = 1.22$).

Having demonstrated that the treatment and control families were similar to one another on the above variables, it remains to determine why some parents would leave their children on waiting lists for therapy rather than obtaining immedi-

ate help. One contributing factor is undoubtedly the very existence of waiting lists, which conveys to parents that it is acceptable for children to wait for speech-language pathology services. Another important factor can be the religious and/or philosophical/political belief systems of the parents. In our own study, there were two striking examples of control parents who made considered decisions to wait for therapy on such grounds.

One mother and father, a medical practitioner and a pharmacist/theologian respectively, were engaged in providing medical/pharmaceutical care and famine relief in third world countries, including war zones, until their elder children reached school age, and they had returned to Sydney to live. When their child's developmental phonological disorder was diagnosed, they were content to wait, on four somewhat contradictory grounds. In light of their experience of health care in underdeveloped communities they did not perceive the speech problem as serious; their religious beliefs encouraged them to accept the disability; they felt it was extravagant to pay for therapy when there was a free alternative pending; and they liked the idea that their participation in the research might contribute to knowledge and help others. All of this was in the context of a conservative, musical, 'bookish', and home-loving family.

In a similar vein, another child's parents disagreed in principle with demonstrating discontentment with an individual's genetic endowment, and were opposed to changing physical attributes (e.g. by using make-up, hair colour, or having orthodontic treatment). University educated, they were on unsure ground when it came to speech-language therapy, but putting their child on a waiting list gave them time to decide. They too were a family-oriented couple who enjoyed their children, and liked the thought of helping others by being in the control group.

Others of the control group parents had political objections to private services, feeling that they paid their taxes and therefore should avail themselves of the service provided by the government, even if that meant waiting. In addition, some expressed the view, in confidence, that the speech-pathology services in their local area were ineffectual, because professional staff were too young, overworked, and/or inadequately supervised.

In sum, while random allocation of children to treatment and control groups might well have been a sounder methodological strategy than the one we adopted, it was not a practical or ethical option in the circumstances. Moreover, we would argue that the control children and families did not differ from the treatment children and families on any variables that were of obvious clinical relevance.

Phonological characteristics of the children

Another concern raised in the commentaries (Fey; Grundy) was that we had provided insufficient information about the children's phonological characteristics at the beginning of the study. This concern led Fey to question for whom the therapy is likely to work. In retrospect, our reporting of measures that were specific to our own study certainly made it difficult for readers to gain a sense of the severity and nature of children's initial (and subsequent) phonological disorders. To remedy this shortcoming, we report here (a) the results from a more widely known measure of phonological disorder, namely Shriberg and Kwiatkowski's (1982) percentage of consonants correct (PCC); and (b) a more detailed description of how children's speech was assessed, and the means by which we quantified and described

their phonological characteristics. Before doing so, however, we need to address another of Fey's comments; namely, that 'it simply is impossible to tell how impaired these children were, especially when some were younger than 3 years of age at the time treatment began'. In fact, only two children in the study were under three at the outset, one in the treatment group (who was 2;11) and one in the control group (who was 2;10). The next youngest child in either group was 3;5.

Children's initial severity levels (PCC)

Although the PCC score is not our preferred measure of phonological development for purposes of therapy, it is a familiar and popular procedure (especially in the USA), and has been acknowledged as providing 'a rough measure of phonological severity' (Edwards 1994, p. 57). It was calculated on the basis of a conversational sample of at least 100 words, as follows: PCC = (sum of correct consonants / sum of consonants) × 100.

The range of PCC scores obtained at the outset of the study was from 28 to 66 for children in the treatment group (mean = 49.1%), and from 28 to 67 for children in the control group (mean = 44.1%). Using the divisions recommended by Shriberg and Kwiatkowski (1982), there were seven treatment children and five controls with a severe phonological disorder (< 50% consonants correct), six treatment children and two controls with a moderate–severe disorder (50–65% consonants correct), and one treatment child and one control with a mild–moderate disorder (65–85% consonants correct). (Notably, our own severity rating measure [described below] placed fewer children in the severe category, only one from each group, and more treatment children [six] in the mild–moderate category.)

By the time the probe assessment was conducted, the PCC scores of children in the treatment group had improved dramatically (mean = 91.7%, range from 63% to 100%), while those of children in the control group had changed little (mean = 55.4%, range from 33% to 72%).

Assessing, quantifying, and describing children's phonological characteristics

As mentioned above, PCC is not our measure of choice for therapy purposes. To provide a clearer picture of the way in which therapy is actually conducted, it would seem appropriate, at this point, to give a more detailed account of how children's phonological difficulties were assessed, quantified, and described in the efficacy study.

Phonological assessment

The children who participated in the research were referred because they were unintelligible or very difficult to understand. Phonology was screened using the *Metaphon Resource Pack* screening assessment (Dean *et al.* 1990). In answer to Ingram and Ingram, we used the *Metaphon* screener because (a) it provides a reasonable summary overview of phonological development, (b) it is quick to administer and score, (c) it is generally attractive to young children, and (d) it is an easy way of introducing (observing) parents to key concepts about phonological intervention. When parents observe the scoring procedure, it gives a good demonstration of patterns of speech sounds.

We had ample opportunity to confirm the children's intelligibility problems, both in performing Grunwell's (1985) *Phonological Assessment of Child Speech (PACS)*, and in collecting language samples for structural analysis. For the PACS, audiotaped phonological data samples of 200 to 250 'spontaneous' (not imitated) words were elicited, according to the directions in the manual, while for purposes of structural analysis, additional language samples of at least 200 consecutive utterances were collected in three communicative contexts; with children conversing (a) parent to child, (b) sibling to child, and (c) examiner to child. All children were diagnosed as having a phonological disability, with at least three phonological deviations (see below) occurring greater than or equal to 50% of the time, in the absence of any known sensory, cognitive, neuromotor, or physical problems.

Ingram and Ingram were correct in assuming that we endorse flexibility in the choice of phonological screener and phonological assessment, provided the assessment itself is adequate for treatment planning. Our preference, for children whose phonological problems fall in the moderate to severe range, is to submit their data to at least the following analyses of the PACS: (a) the phonetic inventory, (b) the contrastive assessment, and (c) the developmental assessment. When a different perspective may help, we also perform independent and relational analyses (Stoel-Gammon and Dunn 1985).

The PACS, like the other measures mentioned above, is not standardized, but, according to Lowe (1994) has good construct and content validity. It measures the theoretical construct (phonological development) it was designed to measure (Anastasi 1988, Murphy and Davidshofer 1994) enabling the examiner to differentiate between children with or without phonological disability, determine developmental status (and change), and evaluate communicative adequacy. Content validity is also satisfactory in terms of the extent to which it provides relevant information about the behaviour being tested (Anastasi 1988). It is true that the PACS is lengthy to perform (Ingram 1987, Ingram and Ingram, this issue), but after a dozen or so PACS analyses we became quicker, besides which the time was well spent in that having a comprehensive phonological analysis for each child saved us time in treatment planning.

Incidence category scores and the sum of phonological deviations

Two of the objective measures that we used to quantify and describe children's phonological deviations were 'incidence category scores' and the 'sum of phonological deviations'. 'Deviation' is used in the sense that the child's speech attempt varied from the adult target. Some deviations, such as gliding of liquids (/l, r/→/w, j/) and gliding of fricatives (/f, v/→/w/; /s, z, ʃ, ʒ, /→/j/), were counted as one phonological deviation, irrespective of word position. Others, such as cluster reduction were considered in terms of initial and final word position (but not intervocalic). Age-appropriate *phonemic replacements*, such as /θ/→/f/, and /ð/→/v/, observed in the phonologies of some children, were not counted as *phonological deviations*. To summarize, these sound-class processes were each counted as one phonological deviation:

- backing of alveolar stops,
- context sensitive voicing,
- gliding of liquids.

The following syllable-structure processes were each counted as one phonological deviation:

- initial consonant deletion,
- initial cluster deletion (but not counted if initial consonant deletion was 100%),
- final consonant deletion,
- final cluster deletion (but not counted if final consonant deletion was 100%), and
- weak syllable deletion.

The remaining processes or deviations were considered in terms of initial and final word position. The reason for this distinction was that some children presented with a phonological deviation word initially or word finally only, while others evidenced the same deviation word initially and word finally. For instance, if a child exhibited fronting of velars SIWI (Syllable Initial Word Initial) and SFWF (Syllable Final Word Final), it was counted as two phonological deviations. If they just exhibited fronting of velars SIWI or SFWF it was counted as one phonological deviation. The other deviations in the sample, which were each counted as one phonological deviation, were:

- word final devoicing
- stridents replaced by /h/ (glottal replacement) SIWI
- /s/ replaced by /h/ (glottal replacement) SIWI
- /t/ and /k/ replaced by /h/ (glottal replacement) SIWI
- fricatives replaced by /j/ (gliding of fricatives) SIWI

In computing incidence category scores, the percentage of occurrence of each phonological deviation was determined, first, by dividing the number of actual instances of a deviation by the number of potential occurrences (Grunwell 1985, Stoel-Gammon and Dunn 1985). Ceri's percentages of occurrence are displayed in table 2. Second, the deviations were allocated to one of five incidence categories. For example, category 5 contained all a child's phonological deviations with an incidence of 80 to 100%. Because Ceri evidenced velar fronting 100%, palato-alveolar fronting SFWF 100%, gliding of fricatives SIWI 87% and cluster reduction SIWI 100%, she gained a score of 4 in incidence category 5 at her initial assessment. Incidence category scores below 15% were not included in the initial assessment figures. In subsequent assessments, incidence category scores below 5% were

Table 2. Ceri's percentage of occurrence of phonological deviations from 4;5 to 5;3

	% Occurrence				
Phonological deviation	Age 4;5	Age 4;8	Age 4;10	Age 5;0	Age 5;3
Velar fronting	100	0	0	0	0
Palato-alveolar fronting SFWF	100	33	0	0	0
Gliding of fricatives SIWI	87	100	87	0	0
Gliding of liquids	50	0	25	0	0
Cluster reduction SIWI	100	64	35	0	0
Cluster reduction SFWF	66	33	33	0	0
Stopping of fricatives SFWF	33	83	83	50	0

excluded. In practice, the lowest score in category 1 across all subjects was 7%. The sum of deviations procedure entailed tallying the number of deviations in the five categories.

Severity ratings

By contrast with the objective measures of phonological disorder described above, severity ratings relied on the subjective judgement of four experienced speech-language pathologists who viewed the objective data from each of the children's assessments and assigned it to severity rating bands:

- a severity rating of 1: phonological system within normal limits
- a severity rating of 2: mild phonological disability
- a severity rating of 3: moderate phonological disability
- a severity rating of 4: severe phonological disability

The mean severity rating for each child at each assessment was calculated by adding the ratings and dividing by 4. For example, at the initial consultation, rater 1 gave Ceri a severity rating of 3, and the others each gave her a score of 4, yielding a severity rating of 3.75. To give the reader a sense of how the various measures of phonological disorder compared with one another, Ceri's incidence category scores, contrasted with her sums of phonological deviations, severity ratings, and PCCs (Shriberg and Kwiatkowski 1982) are shown in table 3.

Hopefully, the additional information we have provided in this section will convince readers that the subjects in our efficacy study were representative of the clinical range, and that, in terms of Shriberg and Kwiatkowski's (1982) PCC classification, the therapeutic approach was successful with children who ranged from the mild-to-moderate category to the severe category. If so, we can be encouraged by Fey's statement that 'Clinicians can be confident of similar results [to Bowen (1996)] ... if their clients are from the same population as those who participated in Bowen's investigation'.

Criteria for dismissal from the study

Another of Fey's concerns with our efficacy study was that the criteria for dismissing treatment children from the study were unclear. Again, it is undoubtedly true that the use of our own measurement procedures clouded interpretation of this aspect

Table 3. Ceri's incidence categories, sums of phonological deviations, severity ratings and PCCs

	Incidence category[†]							
Age	5	4	3	2	1	Sum of phonological deviations	Severity rating	PCC (%)
4;5	4	1	1	1	–	7	3.75	35
4;8	2	1	–	2	–	5	3·25	59
4;10	2	–	–	3	–	5	3.25	66
5;0	-	–	1	–	–	1	1.75	89
5;3	-	–	–	–	–	0	1.00	100

[†]5: 80–100%; 4: 60–79%; 3: 40–59%; 2: 20–39%; 1: ≤ 19%.

of our research. As a general rule, children were dismissed from the study when they had no phonological deviations (as defined above) present in their speech output. In practice, half of the treatment children (seven) achieved this criterion prior to discharge. The decision to discontinue therapy for the remaining children was a little more complicated, typically being based on clinical intuition (Anastasi 1988) that any remaining problems would resolve without further intervention.

One child had a single phonological deviation remaining at discharge (gliding of liquids 25%), but at 4;10, our raters considered this pattern to be age appropriate. A further three children also had a single deviation remaining (cluster reduction SIWI), but these problems had resolved when the children were reviewed between 2 and 4 months later. In the case of a fifth child, two deviations remained at discharge (cluster reduction SFWF 10%, and weak syllable deletion 10%), neither of which was observed on review 1 month later. A sixth child, Nina, had four phonological deviations present when placed on review at 5;1 (cluster reduction SIWI 64%, cluster reduction SFWF 33%, gliding of liquids 25%, and stopping of fricatives SFWF 11%). When re-assessed 6 months later, her remaining phonological deviations were gliding of liquids 20% and cluster reduction SIWI 33%. She received no further therapy, and when she was followed up again 2 months later, no phonological deviations were apparent (for further detail see Bowen and Cupples 1998). Finally, one child, whose progress was compromised by poor compliance with recommended attendance requirements after probe, had four deviations at 6;1 (gliding of liquids 20%, cluster reduction SIWI 15%, and palato-alveolar fronting SIWI 15%). He attended three times over 9 months for review assessments, exhibiting the same percentage of occurrence scores for these three deviations on each occasion, indicating that his phonology had stabilized. Eventually, his parents returned with him for further therapy, and between 6;10 and 7;1 he had eight further consultations and was discharged with no phonological deviations. Follow up at 7;7 revealed that this progress had been maintained.

To summarize, although our main criterion for discharging treatment children from the efficacy study was the presence of no phonological deviations in their speech output, we were influenced by clinical intuition in some cases that the deviations remaining would resolve without further therapy.

Probe assessments

Another aspect of the efficacy study which was apparently unclear from our original description was the timing of children's probe assessments (Grundy). Two separate issues that arise in this regard are (a) how we ensured that the gap between the initial and probe assessments was similar for the treatment and control children, and (b) when the probe assessment occurred in relation to therapy blocks and breaks.

With regard to the comparability of treatment and control children, our strategy was as follows. Probe assessments for control children were administered as close as possible to the termination of their waiting list status. This procedure resulted in a mean waiting period of 8.6 months (range 5–11 months) for these children, and had the benefit that it maximized the time between their initial and probe assessments. Since the treated children's phonology was assessed repeatedly throughout the study (as part of the usual ongoing clinical evaluation underpinning treatment planning), we were able to obtain a good match between their intervention periods and the waiting periods of the control children by simply selecting, for each

treatment child, an assessment which fell within 12 months of their initial assessment, as the probe. This procedure resulted in a mean intervention period of 9.1 months (range 3–12 months). Not surprisingly, this gap did not differ significantly from the waiting period for control children ($F < 1$).

The second issue in regard to the timing of treatment children's probe assessments concerns their relationship to therapy blocks and breaks, an aspect that was not controlled in any sense within our experimental design. Grundy queried whether the timing of probe assessments could perhaps be used to inform us about the effectiveness of the therapy blocks and breaks. Thus, if the majority of probes were made immediately after the first block of treatment sessions, one could deduce that the therapy techniques were effective, but would have to question the effectiveness of the 10 week breaks. In response, it is important to note that the majority of treatment children (12 out of 14) received more than a single block of treatment sessions. In fact, only two children attended for a single block of treatments, and of those, one had the probe immediately after treatment, and the other immediately after the following 10 week break. Interestingly, this even distribution of probe assessments (before and after a break) turned out to be typical of the entire sample, with the probe assessment occurring at the end of a treatment block for exactly half (seven) of the children, and just after a break for the other children.

Blocks and breaks

Further with regard to blocks and breaks, Ingram and Ingram pointed out that we provided no rationale for recommending blocks and breaks of approximately 10 weeks duration each, rather than say 12 weeks or 6 weeks (for a similar point, see Fey). We are in complete agreement with this point, and indeed would recommend a degree of flexibility in this regard. In fact, there was considerable variability in our own research study. The first full treatment block comprised 9.8 (weekly) sessions on average (range 9–14), while the first break spanned an average of 9.1 weeks (range 8–13). Similarly, the second full treatment block comprised an average of 9.4 weekly sessions (range 8–11), while the second break was 9.6 weeks on average (range 7–11). Currently, we are experimenting with shorter therapy blocks and longer breaks, and vice versa, but preliminary data are not yet available. Furthermore, we agree with Grundy's suggestion that the duration of therapy blocks (relative to breaks) could decrease with time as parents become increasingly adept at implementing the educational techniques to which they have been exposed. Finally, although we agree with Fey's point that it would be interesting to know what would happen if there were no breaks from treatment at all, this question has been beyond the scope of our research to date.

In response to Grundy's request for additional information about children's progress during breaks from therapy, it is important to note that they typically made identifiable gains, both in terms of phonemes targeted in therapy, and in terms of generalization to other targets. Furthermore, we agree with her that parents who had received instruction in helping their children to overcome their phonological difficulties would be unlikely to stop doing so completely during breaks from therapy attendance. Thus, it is important to emphasize that parents were asked simply to do no *formal* practice for about 8 weeks. They were, however, to focus on providing modelling corrections, reinforcement of revisions and repairs, and metalinguistic activities, incidentally, as opportunities arose. Two weeks prior to

the next treatment block, they were asked to read the speech book with the child a few times and to do any activities in which the child showed an interest.

Further research directions

A number of further research directions were suggested by the commentators, many of which we would also like to see pursued. We have already mentioned the need for further investigation of the 'blocks and breaks' approach. On a related note, all the commentators were concerned with the question of the relative importance of each of the therapy components. There is no doubt that this issue requires investigation, especially in terms of developing a more refined and streamlined version of PACT therapy, and evaluating the contribution made by families and teachers, but it seemed to us to be of secondary importance in comparison to the one we addressed, that is, whether the therapy was effective in its original form. Similarly, Grundy's suggestion that the relative effectiveness of the different therapy components might depend on the particular difficulties experienced by individual children deserves close examination. It is noteworthy in this regard, however, that one strength of the approach (highlighted by Grundy, and Ingram and Ingram) is its flexibility. As these commentators pointed out, it is not a 'cookbook' approach to therapy, but rather, one in which the therapist makes informed decisions about the correct balance of various intervention activities, only after assessing an individual child's phonological abilities in detail.

Another area for future research, suggested by Grundy, is the comparison of our approach to phonological therapy with other treatment approaches. Again, although this question of the differential effectiveness of alternative treatments is of obvious clinical importance, we considered it secondary to the question of whether our treatment *per se* could facilitate phonological development beyond the level expected with age.

Both Fey and Grundy made positive comments about the inclusion of metalinguistic tasks in the therapy approach, noting that their use might well reduce the likelihood of children developing later reading difficulties. Unfortunately, we could not investigate this issue in our study. Although data on literacy skills were readily available and interpretable for the treatment children, the situation was somewhat more complicated for children in the control group, who were managed clinically in widely disparate ways after their probe assessments. To illustrate: four children had a series of up to six once-weekly individual consultations per school term for up to four terms; two children were managed via a consultative model, where a speech-language pathologist advised a teacher on how to intervene on the basis of our written report; one child had group therapy; and one child had periodic review assessments only (i.e. no therapy *per se*). On a somewhat different point, this variation in clinical management also prevented us from following the progress of the control children in therapy, a step which would have enabled us to compare their response with that of our treatment children.

In addition to the above points, the commentaries raised a number of ideas that we had not considered previously, and alerted us to the existence of resources of which we were unaware. For example, the possibility that the approach might work as well or even better with the inclusion of maximal rather than minimal contrasts (Gierut and Neumann 1991) had not occurred to us until Ingram

and Ingram made the suggestion, and this might certainly form the basis for an interesting comparative study.

Nor had we encountered Flynn and Lancaster's (1996) excellent *Children's Phonology Sourcebook* with its innovative, theoretically driven approach to multiple exemplar training using auditory input therapy, until Grundy drew it to our attention. We share her enthusiasm (and Mathisen's 1998) for the auditory input procedure, involving activities that will ensure high lexical frequency of target phonemes for the child to hear over a concentrated period. For example, in one of several activities for /v/ SIWW (Syllable Initial Within Word) the child hears the story of David the removal van man (p. 153) who has many things in his van. Story telling is enhanced by pictured target words of David, removal van, aviary, raven, liver, diver, beaver, hovercraft and oven. The book's appealingly illustrated activities almost guarantee that clinicians will find something to apply usefully in therapy that appeals to most preschoolers and their care givers. The illustrations of guns (e.g. on pp. 100, 137, 141, 145, 150 and 186) and other weapons can be removed without spoiling the activities or the fun. In the wake of Dunblane, Port Arthur, and Jonesboro, how disappointing it is to find firearms still featuring prominently in newly published speech-language pathology therapy materials for very young children.

After disarming the characters, our brief experience with auditory input activities shows that they combine well with other multiple exemplar activities, supporting the authors' claim that one of the advantages of the strategy 'is that work on phonological skills can be implemented with very young (2–3 year-old) children in conjunction with treatment which addresses other levels of language' (p. ix). Although we are more interested in streamlining our approach than adding to the activities, future research should evaluate the contribution of auditory input therapy.

Target selection

Clinical researchers can never have enough information about the specifics of treatment target selection, which Ingram and Ingram pointed out, is a central decision. Referring back to the framework (Fey 1992) illustrated in figure 1 in the lead article, basic goals in therapy are to facilitate phonological change and improve intelligibility. Our intermediate goals are to target groups of sounds in the two broad categories of structural and systemic simplifications (see Grunwell 1997 for an explanation). Using a horizontally structured treatment programme (Fey 1986, 1992), several specific intervention goals (targets) can be attacked simultaneously. Thus, one might work on one or two of the following within a treatment session:

(1) one, some, or all phonemes absent from the child's phonetic inventory (inventory expansion);
(2) establishing one, some or all absent phonotactic combinations (syllabic shapes);
(3) establishing one or more exemplars of a sound class;
(4) establishing a sound class (e.g. all fricatives);
(5) establishing a sound class in a specific context (e.g. all fricatives SFWF); and
(6) establishing a syllabic structure process (e.g. final consonant inclusion, weak syllable inclusion, or cluster inclusion), or a systemic process (e.g. establishing velar–alveolar contrasts, voiced–voiceless contrasts, or stop–continuant contrasts).

In selecting targets for multiple exemplar (cognitive/listening) activities and production tasks, we confine ourselves to the phonotactic combinations already in the child's repertoire, except, of course, when working on syllable structure processes.

Caution is necessary in deciding just how many sounds within a process to target in a given session: all possible sounds, one sound, or several, avoiding overwhelming children with too much too soon. It is often advisable to begin slowly with just one or two exemplars, and, working at a comfortable pace, ultimately to expose children to a wide range of sound productions, with the objective of facilitating the acquisition of several treatment targets simultaneously. Grunwell's (1989) advice holds good in this regard: 'expose the child systematically to the dimensions of the target system absent from his/her speech in a way in which both their form and communicative functions are made evident' (pp. 318–319).

Rather provocatively, Ingram and Ingram asked whether it is possible to select *any* set of targets and expect progress over the treatment period. The answer is that we haven't been reduced to such a strategy, because when faced with an individual client, something generally happens in the mind of the clinician. This something, probably best called clinical judgement, is informed by a combination of

(1) detailed phonological analysis, including a developmental assessment which indicates where the child is 'stuck' phonologically, and where they might be headed next, given the right facilitating conditions;
(2) an appreciation of goal-setting criteria for linguistic approaches to intervention (e.g. Grunwell 1992, Bernthal and Bankson 1998);
(3) experience with similar children/phonologies; and
(4) clinical intuition (Anastasi 1988).

When that something doesn't happen, it is time for collaboration with peers, or a second, even third opinion—for the starting point is not always immediately obvious. Sometimes, with seemingly impenetrable phonologies, a more detailed phonological analysis provides the clue to goal selection and attack. Once the intervention process has begun, further targets, it seems to us, suggest themselves in an orderly and predictable way, which is hardly surprising, given the systematic nature of phonology and the knowledge base available to us as clinicians. Ceri's therapy provides examples of this target-setting process for one of the children, adhering to the structural plan suggested by Fey (1992).

Case study of Ceri

Ceri was a sensitive, interested, conforming and conscientious four-year old. As her parents had separated the day prior to her initial consultation, we suggested that it might be advisable to defer therapy until the family had time to adjust. Ceri's mother, however, was anxious for therapy to proceed. Ceri and her mother enjoyed therapy. All homework was done as suggested, except for occasional production practice of bombardment words, and Ceri's mother kept a precise homework record. Emotional factors were prominent, and Ceri became increasingly demanding of her mother's attention. She was self-conscious about her poor intelligibility, embarrassed at times in therapy by difficulties with auditory discrimination, and intolerant of homonomy confrontation activities. She had irregular weekend access visits to her father and his partner, who were encouraging, but who took no active part in

therapy. Her preschool teacher provided general encouragement and modelling, and viewed the speech book once weekly.

Presentation

At the initial consultation Ceri was unintelligible to the clinician beyond a single word level, mainly due to her gliding of fricatives and inconsistent vowel deviations. Her initial phonological data (e.g. PCC 35%; sum of deviations 7) are displayed in table 1, and examples of her production of 30 selected *Metaphon* screening words included the following:

cup→[tʌp]	gone→[dɒn]	knife→[nɔɪs]	sharp→[jap]
fish→[jɪts]	kiss→[tɪθ]	sock→[jɒt]	thumb→[jʌm]
jam→[dəjæm]	tent→[tɪnt]	sun→[jʌn]	fly→[wɔ]
sky→[dɔ]	crab→[wæp]	sleeve→[jiz]	zip→[jɪp]
plane→[weɪn]	bridge→[dərɪdz]	train→[də'weɪn]	splash→[gəwæs]
salt→[joʊt]	van→[dæn]	foot→[jʊt]	stairs→[dɛd]
mouth→[maʊt]	scissors→[ˈjɪdɪd]	bathing→[ˈbatɪn]	river→[ˈwɪdʌ]
soldier→['joʊʤʌ]	umbrella→[ʌmə'waɪjʌ]		

Goal setting

The basic goal in therapy was to facilitate the cognitive reorganization of Ceri's phonological system, thereby improving her intelligibility. Her phonetic inventory was complete, so inventory expansion was not necessary. Accordingly, using a horizontal approach (treating several sounds simultaneously) we were able to focus immediately on the intermediate goals of targeting phonological deviations present. The initial intermediate targets selected were velars and liquids. Velars were selected on the basis that

(1) Ceri was readily stimulable for /k/ and /g/, suggesting the possibility of early success;
(2) velar fronting is a relatively early process to disappear in normal acquisition, also indicating that early success was a likely outcome; and
(3) Ceri herself was motivated to work on /k/, particularly because she wanted to say her name (/kɛri/) correctly ([ɔɪ tat jeɪ mɔ teɪd ən dəjiʤ] 'I can't say my 'k's and 'g's').

Liquids were targeted because of the deleterious effect on intelligibility of her gliding of liquids and fricatives SIWI, which involved /l/→/w/ 50% and /fricative/→/j/ 87%.

Block 1

Ceri's first therapy block began when she was 4;5 and ended when she was 4;8. She was unable to distinguish auditorily between /l/ and /j/ beyond a single phoneme level (e.g. she perceived 'yawn' and 'lawn' as homophones), so this became the basis for her first specific goal. We found that she was already able to distinguish between consonant clusters and singletons. Therefore, she was exposed to multiple exemplar training procedures which included all /kl/ and /gl/ clusters (e.g. cap:clap, keen:clean, core:claw, go:glow, gum:glum) in card games/activities. When she was

able to sort minimal contrasts such as these into rhyming pairs, the task was changed to a judgement-of-correctness game/activity, in which she had to 'be the teacher' and judge whether the (by now familiar) words were being produced correctly by her mother or the clinician (e.g. clap = [klæp] or [kjæp]). Over three sessions, Ceri learned to recognize the /l/ and /j/ contrast in words, and after 3 weeks could sort words such as lawn:yawn, lucky:yucky, loot:ute and lap:yap, so that her first specific goal was realized.

Fricatives were targeted in the same 3 week period. At first Ceri was also unable to distinguish auditorily between fricatives beyond phoneme level, for example she was unable to select between fine–shine–sign. After three weeks of multiple exemplar training with all fricatives SIWI, a second specific goal was realized in that she could now recognize the presence or absence of fricatives SIWI (e.g. eat:seat, eat:feet, eat:sheet).

One of the premises of phonological therapy is that targets are selected partly for the effect they may have on other related sounds. In week 4 it was observed that Ceri was producing velars SIWI correctly between 85% and 100%, and that /kl/ and /gl/ SIWI were being used correctly approximately 35% of the time. At this point a third specific goal presented itself and /s/ vs. /l/ and /s/ vs. /j/ SIWI minimal pairs (but, in this particular instance, not minimal contrasts) were introduced with the aim of facilitating the development of her system of adult realizations of cluster–singleton contrasts. For the next 2 weeks, therapy was entirely concerned with talking about revisions and repairs ('fixed-up ones', Bowen and Cupples 1998) and consonant clusters, or 'two-step sounds' (Bowen 1998).

In week 7 Ceri's first production task was introduced comprising seven words starting with /l/ (leap, low, lap, lip, lamb, leave and lime). In week 8, these words were paired with sleep, slow, slap, slip, slam, sleeve and slime for multiple exemplar training tasks only (i.e. not for production) using minimal pair card games. In week 9 she was given 25 intervocalic /l/ words pictured on cards /l/ (e.g. billy, goalie, koala, Kylie) for twice-daily production practice.

In the final 2 weeks of the therapy block, multiple exemplar training using /sl/ vs. /s/, /fl/ vs. /f/ SIWI was introduced. Ceri acquired the ability to produce fricative + /l/ SIWI, and was soon (in a matter of days) using it correctly all the time. There was a concurrent improvement in her other consonant clusters. Cluster reduction SIWI went from 100% at 4;5, to 64% at 4;8, while cluster reduction SFWF dropped from 66% to 33%. Palato-alveolar fronting went from 100% to 33% in the same period. Gliding of fricative SIWI increased from 87% to 100%, and stopping of fricatives rose from 33% to 83%, representing a reduction in variability.

Break 1

At the end of 11 weeks, Ceri had 8 weeks break from therapy. During the break, the only follow-up suggested to her mother and teacher was to praise Ceri for making revisions and repairs (which we called 'fixed-up ones').

Block 2

At 4;10, palato-alveolar fronting SFWF had reduced to zero, and cluster reduction SIWI had dropped from 64% to 35%. Gliding of liquids, which went from 50%

to zero in the first therapy block, had risen to 25%. Gliding of fricatives SIWI was once again at the 87% level, while stopping of fricatives SFWF remained on 83%. With no direct intervention with vowels (but with many opportunities to listen to vowel contrasts during multiple exemplar activities), all vowel productions now matched acceptable adult targets for Australian English. As a rough indication of the improvement in Ceri's intelligibility 20 weeks after the commencement of therapy, her production of the 30 selected *Metaphon* screening words was as follows:

cup→[kʌp]	gone→[gɒn]	knife→[naɪts]	sharp→[jap] [sjap]
fish→[jɪts]	kiss→[kɪts]	sock→[jɒk]	thumb→[jʌm]
jam→[ʤæm]	tent→[tɛnt]	sun→[sjʌn]	fly→[fwaɪ]
sky→[skaɪ]	crab→[græb]	sleeve→[sjiʤ]	zip→[jɪp]
plane→[bɪjeɪn]	bridge→[brɪʤ]	train→[dreɪn]	splash→[bjæs]
salt→[joʊlt]	van→[dæn] [fdæn]	foot→[jʊt] [fjʊt]	stairs→[dɛədz]
mouth→[maʊts]	scissors→['jɪdəz]	bathing→['batɪŋ]	river→['rɪdə]
soldier→['joʊʤʌ]	umbrella→[ʌm'rɛlə]		

After two weeks of multiple exemplar training for all fricatives SIWI, Ceri could produce /ʃ/ SIWI in words. Within a week she was using word-initial /ʃ/ in around 40% of appropriate contexts in conversation, self-correcting, and commenting on her self-corrections: 'I fixed that one up, didn't I Mum?' Focusing as we were on broad-based stimulation of her sound system, it was fascinating to hear Ceri, intrigued by her own sound system, telling others 'I'm learning to say 'sh' now'. In week 4 she acquired the ability to produce /s/ and /f/ followed by a vowel, without an intervening /j/ (previously she had produced, for example, seed→[sjid], feed→[fjid], and she'd→[ʃjid]).

The stop vs. fricative contrast SFWF was the final contrast to be targeted directly, in weeks 5 to 10. The emphasis was upon multiple exemplar training, and no production practice was involved. Parts of all sessions were audiotaped and sent home for Ceri to listen to as frequently as she wished. Her mother reported that Ceri listened to the tapes, voluntarily, at least once daily. By the concluding session in the second block, at the age of 5;0, the only phonological deviation present was stopping of fricatives SFWF 50%.

Break 2

Ceri took a 3 month scheduled break, during which her mother and teacher were to praise correct use of syllable final fricatives when they occurred spontaneously, and to comment favourably on any revisions and repairs they noticed.

Discharge

When reviewed at 5;3 there were no phonological deviations present in Ceri's speech. She made occasional /ɵ/→[f] and /r/→[w] replacements, which she usually self-corrected. She was therefore discharged from therapy. While there were no complicating linguistic factors in Ceri's presentation and therapeutic management, there were many emotional factors constantly in play. In this sense, she was

representative of the entire treatment group. In each case there was something going on in the child's linguistic, social, emotional or 'developmental' environment which impinged upon management and progress.

Follow-up

Because of her difficulty in the early stages of therapy in reliably telling two phonemes apart, it seemed logical to expect that Ceri might have difficulties with reading acquisition (Gillon 1998). Pleasingly, in her first year at school Ceri was one of the more able students in her class, and her reading was well advanced. At 6;1 a *Neale Analysis of Reading Ability—Revised* (Neale 1988) was administered. Her results (in years) were: rate 7.6; accuracy 8.2; comprehension 8.0. The fact that Ceri learned to read early, and was seen by her teacher as a superior reader and speller, exemplified findings in reading research that children with phonological disorders often go on to become good readers and spellers (Bishop and Adams 1990, Levi *et al.* 1992). It would be very interesting to know why.

Conclusion

As we said at the outset, we were (naturally) heartened by the various points of agreement between ourselves and the commentators, and between the commentators themselves, concerning the structure and application of the model, including the positive responses to our central tenet of having an eclectic, family-centred approach to phonological assessment and intervention. We also found it encouraging that the commentators isolated key issues that had already concerned us, regarding the need for further evaluation of the model.

There is an obvious need for more research into

(1) developing a streamlined version of the model in which only essential procedures and activities are included, and this would include evaluating the role of care givers;
(2) finding an optimal balance between treatment blocks and breaks;
(3) ascertaining the impact, if any, on the later acquisition of literacy skills among children treated with the approach, especially those at the severe end of the scale; and
(4) formally comparing the model, not only with systematically altered versions of itself, but also with other treatment approaches.

We appreciate Ingram and Ingram's and Grundy's recognition that this is no cookbook approach, but a model individually geared to individual children's specific needs, based on detailed and ongoing phonological analysis. We particularly endorse Fey's call for clinicians to test carefully and report their experiences with adaptations of the model, using appropriate research methodology, and look forward to feedback from clinicians, teachers, and above all, families.

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