Efficacy of Intervention for a Bilingual Child Making Articulation and Phonological Errors

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Case Report

*Efficacy of Intervention for a Bilingual Child Making Articulation and Phonological Errors**

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Abstract

This treatment case study presents a five-year-old bilingual Cantonese/English speaking boy with articulation and phonological errors. It reports two treatment phases: articulation therapy and phonological therapy. The articulation therapy was given in English and targeted the distorted production of /s/. The result was a perceptually acceptable pronunciation of /s/ in both English and Cantonese. The phonological therapy, also given in English, targeted cluster reduction, but it was only effective in treating English errors. The reduction of consonant clusters in Cantonese remained unchanged. These data have implications for two issues: the separateness of bilingual children's two phonological systems, and the differences between articulation and phonological errors.

Key Words

bilingualism

phonological development

speech disorder

therapy

Introduction

As many as half the world's children are expected to acquire two languages in the preschool years (Grosjean, 1982; de Houwer, 1995). In contrast, research in child language development and disorder has focused primarily on monolingual children. For example, bilingual children's phonological acquisition has received very little research attention (Watson, 1991). This dearth of information reflects an important gap in the knowledge base of speech-language pathologists given that speech disorder is the most common developmental communication disorder (Weiss, Gordon, & Lillywhite, 1987). Harasty and Reed (1994) suggest that speech disorder affects at least ten percent of otherwise normal children entering school. It could be predicted, then, that a significant number of children exposed to two languages in the preschool years will be referred to speech-language pathology for clinical management of a speech disorder.

The assessment of the speech of bilingual children involves a range of difficulties. For example, the speech-language pathologist might have little knowledge of one of the child's languages. Also, few norms exist for children acquiring various combinations of languages even though norms for monolingual acquisition of one of the languages may be available.

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Preliminary evidence suggests that the course of phonological acquisition by bilingual children, initially exposed to Cantonese as a first language and then to English at preschool, might be different to that of Cantonese-speaking and English-speaking monolingual children (Dodd, So, & Li, 1996). Their rate of acquisition of some aspects of each phonological system was delayed (e.g., use of assimilation or final consonant deletion well past the age expected for monolingual children). They also consistently used some atypical phonological error patterns in both languages (e.g., backing of alveolars or initial consonant deletion). Individual children used different sets of patterns, and few atypical patterns were used in both languages simultaneously. Consequently, without bilingual norms, it is very difficult to identify children with phonological disorders (Dodd, Holm, & Li, in press). Further, speech-language pathologists have very little information regarding what constitutes good intervention practice for bilingual children.

Research addressing the clinical issues of assessment and intervention could also have important theoretical implications for two unresolved areas in child language development:

1. *The separateness of bilingual children's two emerging phonologies*

Ingram (1981) observed differences in one two-year-old English/Italian bilingual child's phonological error patterns in the two languages. He concluded that the characteristics of the input phonology of each language had a greater influence on the child's speech errors than the individual child's preferences for certain simplification strategies. Alternatively, children learning two phonologies in the preschool years might also provide evidence for one phonology affecting the other. For example, Dodd et al. (1996) reported that a number of their Cantonese/English speaking preschoolers added an intrusive final consonant to many open (CV) Cantonese single syllable words, to create a CVC form which is more typical of English word structure. Nevertheless, in most cases, the consonant these children chose to add was selected from the small range of consonants that may occur word finally in Cantonese. Studies of the effect of intervention in one language on the bilingual child's other language could clarify the extent to which the two speech systems operate independently.

2. *The distinction between articulation and phonological errors in a child's speech*

The demarcation between phonology and phonetics is sometimes difficult to establish. Beckman and Kingston (1990, p.1) argue the need to elucidate how "the discrete symbolic or cognitive units of phonological representation map onto the continuous psychoacoustic and motoric functions of its phonetic representation." In contrast, other theorists (e.g., Browman & Goldstein, 1992) dispute the need to distinguish between the two, arguing that representations of words include both phonological and phonetic specifications. The study of bilingual children's speech errors could provide evidence that will clarify this issue. While most languages share some phonetic units that are the same, each has its own distinctive phonological system.

Comparing the effects of therapy that targets phonetic and phonological units in one language on the performance on the other language allows testing of the following hypotheses:

> Therapy, given in English, targeting the phonetic distortion of /s/ which is apparent in both languages, will result in remediation of /s/ production in both languages; and
>
> therapy, given in English, targeting the phonological process of cluster reduction, which is apparent in both languages, will result in remediation of consonant cluster production only in English.

Background information: Case JL

JL was initially assessed as part of a research project into bilingual children's speech development when he was 5;2 years. JL was born at full term after a normal pregnancy. He has had no serious illnesses or accidents, and no serious ear infections or hearing problems. He has occasional asthma attacks. His parents reported that his developmental milestones were normal. JL's parents are fluent speakers of Cantonese and English, although his mother's speech is characterized by a lateral articulation of /s/. Cantonese is the only language spoken at home, although JL occasionally addresses his ten month old sister in English. JL acquired English through ten hours a week attendance, from age 3;3 years, at a child care centre where English is the only language spoken. When he turned four, JL began attending the centre for 25 hours per week. JL's only other exposure to English has been through television. His parents reported no concerns about his development of speech or language in either Cantonese or English. Although JL's mother reported that he stuttered quite severely in early childhood in Cantonese, he was never assessed by a speech-language pathologist for disfluency and his current speech is fluent.

Pre-intervention assessment

A detailed description of JL's articulation errors and pattern of phonological processes has been reported previously (Dodd et al., in press). He was assessed at his child care centre by a native Cantonese speaking speech-language pathologist and then on the next day by an English speaking speech-language pathologist. The following communication skills were assessed:

Receptive Language: Results of the Test of Auditory Comprehension of Language-Revised indicated delayed receptive English language skills. His age equivalent score was 45 – 47 months (at 62 months). JL's Cantonese language comprehension was not assessed formally, although neither his parents nor the Cantonese-speaking speech-language pathologist were concerned about his language development.

Oro-motor Skills: Performance on an informal oro-motor assessment suggested age appropriate oro-motor skills.

Speech Production: The Cantonese Segmental Phonology Test that samples all phonemes in Cantonese was administered. The Goldman - Fristoe Test of Articulation was given in English. Picture books and toys were used to elicit 30 minute spontaneous language samples in both languages.

All of the assessment sessions with JL were recorded using a Marantz CP130 audio cassette recorder and a Sony lapel microphone. The reliability of the phonetic transcription of JL's assessors was measured as part of a larger study. Two independent judges, both native speakers of the language, were asked to transcribe the standardized tests. Ten English samples were transcribed with 89% agreement. Five Cantonese samples were transcribed with 92% agreement.

Table 1 summarizes JL's articulation and phonological errors in Cantonese and in English. Dodd et al. (in press) discuss JL's assessment results in comparison to other normally developing monolingual children as well as normally developing bilingual (Cantonese/English) children. Their conclusions are listed below.

Table 1: Summary of Error Data

	Cantonese	English
Words in error (%)	29	70
Consonants in Error (%)	14	42
Phones Missing	/l/	/θ,ð,r/
Phone Distortion	/s,ts,tsʰ/	/s,z,ʃ/
Phonological Processes	Cluster Reduction*	Cluster Reduction*
	Consonant Harmony*	Gliding
	Affrication*	Stopping of affricates
	Nasalization^	Final Consonant Deletion*
	Backing^	Voicing*
	Blending of two words^	Fronting*
		Deaffrication^

Notes:

1. Quantitative data is based on the 31 words from the Cantonese Segmental Phonology Test and 43 words from the Goldman Fristoe Test of Articulation.
2. Five of the items from the Goldman - Fristoe were imitated.
3. Qualitative data is based on the spontaneous samples as well as the articulation test responses.
4. Expected and delayed* processes were determined to be present if there were at least five examples of the process on different lexical items. Atypical^ processes were noted if there were at least three examples of the process.

Comparison of JL's performance with norms for monolingual Cantonese-speaking children of the same age (So & Dodd, 1995), showed that he made many more errors (29% vs. 1.4%). JL's phoneme repertoire lacked one phoneme, /l/, usually acquired by four years by monolingual children. His articulation of the phonemes /s, ts, tsʰ/ was distorted. In contrast, monolingual Cantonese-speaking children have acquired adequate articulation of all phones by five years. JL used three atypical error patterns in Cantonese — patterns either *not* occurring, or evident for less than 10% of the large monolingual sample (So & Dodd, 1995). JL also used three developmental error patterns that were inappropriate for his chronological age.

Comparison of JL's performance with norms for monolingual English-speaking children indicated that his speech was poor. He was producing 70% of words in error at an age when most monolingual English children produce intelligible speech and have acquired a complete phone repertoire, with errors confined to stopping of /θ, ð/ and gliding of /r/. Vowels are rarely in error. While JL's English phone repertoire was missing only /r, θ, ð/ he misarticulated /s/ and /ʃ/. JL's English included one atypical error pattern (Dodd & Iacono, 1989) and four developmental error patterns that were inappropriate for his chronological age. Two error patterns were appropriate for JL's chronological age (Grunwell, 1981).

Comparison with children from the same linguistic background indicated that he produced slightly more words in error (29%) compared to the group mean for a normative

bilingual group (24%) which included 16 children aged between 25 and 52 months (Dodd et al., in press). However, JL's score was high, particularly when compared to the older children in the group. JL's percentage of Cantonese phonemes in error was comparable to the group mean. JL's Cantonese phoneme repertoire was not limited compared to other children from the same linguistic background, although unlike any children in that group, his articulation of /s/ was distorted.

The percentage of English words JL produced in error was high compared to the group mean for the normative bilingual group (13%) as was his percentage of English phonemes in error compared to the group mean (5%). Although JL's English phoneme repertoire was almost complete, unlike any children in the normative sample, his articulation was characterized by distortion of two phonemes. All but two of JL's phonological error patterns that were atypical of monolingual Cantonese-speaking and English-speaking children's phonological development, were evident in the speech of the normative bilingual sample. The exceptions were JL's nasalization of the phoneme /l/ and his blending of two distinct words into one (e.g., /wui hoey/ [hui] and /sɔ ji/ [sɔi]).

JL's phonological patterns were quite distinct in each language. Only one developmental pattern (cluster reduction) was evident in both Cantonese and English. Seven of the younger children in the normal bilingual sample had one or two shared developmental error patterns. None of JL's atypical patterns were evident in both languages. Although JL consistently substituted [n] for /l/ in Cantonese, when he was speaking English, initial /l/ was correct while he substituted [w] for /l/ in other word positions. Another example of the distinction of JL's phonological systems is that he used the atypical process of consistently backing /t/ to [k] word finally in Cantonese but not in English. The only phoneme distorted in both languages was /s/ with JL's distortion of this phoneme perceptually the same.

JL made articulation errors in Cantonese and English: such errors are atypical of both monolingual and normal bilingual development.

JL made some phonological errors in Cantonese and English that were different to normally developing bilingual Cantonese/English speaking children. That is, his errors cannot simply be attributed to interference between the two developing phonological systems.

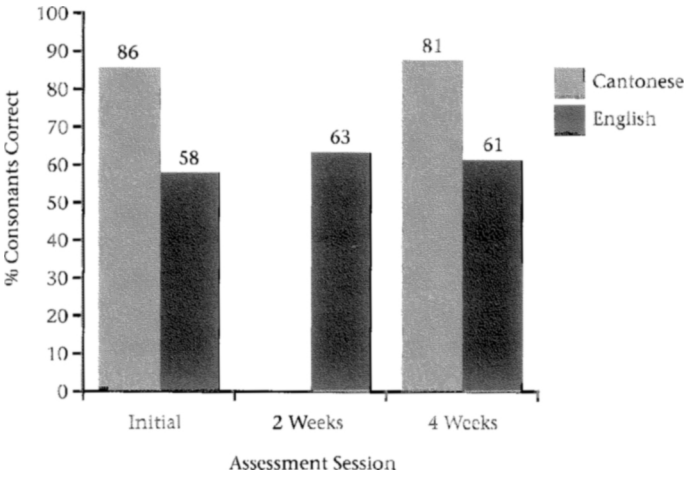
Baseline Data

To establish the stability of JL's phonological system, baseline data was collected prior to intervention. JL was assessed three times, at two-week intervals, by the English speaking speech-language pathologist; and twice, with a four-week interval, by the Cantonese speaking speech-language pathologist. Data in the form of single word naming responses on the Goldman-Fristoe Test of Articulation and the Cantonese Segmental Phonology Test were compared across the assessments. JL's speech sound systems were relatively stable prior to intervention, with no notable differences between the error profiles (see Figure 1).

Phase I: Articulation Therapy

A Queensland Department of Education articulation program was used to elicit correct /s/ production. Intervention was conducted entirely in English. Therapy was provided on an

Figure 1: Baseline data



Note:

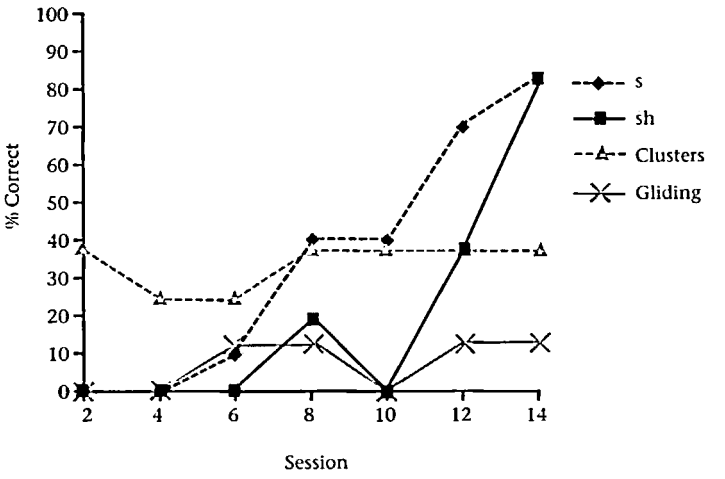
1. Quantitative data collected from the Goldman-Fristoe Test of Articulation and the Cantonese Segmental Phonology Test.
2. Three English assessments were made every two weeks. However, there were only two Cantonese assessments, with a four-week interval.

individual basis with the clinician twice weekly. Therapy sessions were held at JL's child care centre in the morning and were approximately 20 minutes in length. Although JL's parents did not attend the sessions, they were given feedback on JL's performance and activities for JL to do at home.

The articulation program involved progressive stages: production of /s/ in isolation; in syllables; in words; in phrases and sentences; and in conversation. A criterion of 90% accuracy was reached before progression to the next stage. Initial position /s/ words were targeted first, then word-final /s/ words, then words with intervocalic /s/. A different set of 10 core words were targeted in each session. The sessions usually involved five minutes revising the previous session, five minutes targeting the core words, and then the rest of the session was used to do an activity or game involving the core words.

A set of 20 words that were not targeted in therapy (including four words with initial /s/, four words with final /s/, and two words with intervocalic /s/) were elicited, as single words, at the end of every second session in order to monitor generalization of /s/ production to untreated words. Words containing the /ʃ/ sound were also included to assess generalization of therapy to this sound. JL's productions of /s/ and /ʃ/ were similar in that he used an atypical oral position (a labiodental lip position with palatalization of the tongue). It was expected, therefore, that once JL had been taught to use a correct articulatory posture for the production of /s/, he would also be able to articulate /ʃ/ more clearly. The phonological processes of gliding and cluster reduction were also monitored throughout the therapy phase by including words in the generalization probe set that allowed JL to show evidence of these patterns. A list of the generalization probe words is provided in the Appendix.

Figure 2: Progress on untreated generalization probes during articulation therapy



Notes:

1. Quantitative data collected from 20 word generalization probe collected at every second therapy session.
2. Clusters were counted as correct if both elements of the cluster were marked.
3. There was a two week interval between Sessions 9 and 10.

Progress during articulation therapy

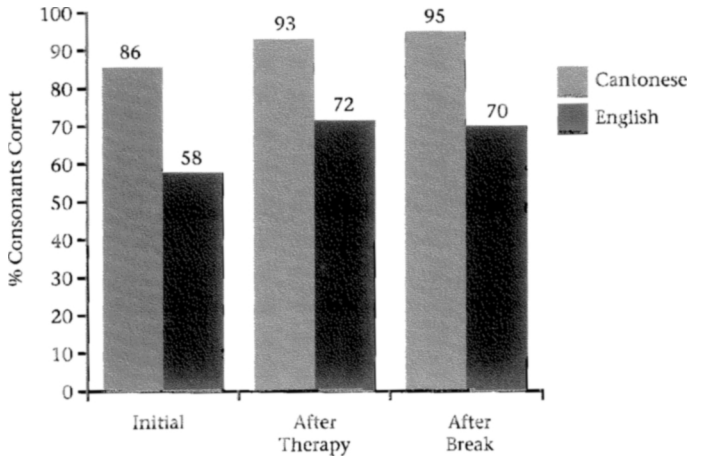
JL required two sessions of practice and feedback before he was able to produce /s/ accurately and consistently in isolation. The next two sessions of therapy targeted initial /s/ in nonsense syllables. Sessions 5 – 8 focused on initial /s/ single syllable words and introduced final /s/ nonsense syllables. Session 9 involved using the core words in carrier phrases. JL then missed two weeks due to asthma. Sessions 10 – 11 continued to use carrier phrases and introduced final /s/ words. Sessions 12 – 14 involved longer sentences with initial /s/ words, final /s/ words in short phrases and the introduction of medial /s/ words. Session 15 was a reassessment of JL's speech in both Cantonese and English. A four week break from therapy occurred over the Christmas holidays. Following the break JL was again reassessed to monitor the stability of his productions.

Figure 2 shows JL's accuracy on the 10 /s/ targets within the 20 words elicited to measure generalization. Over the 14 sessions of articulation therapy JL's ability to produce an acceptable version of the /s/ phoneme in various positions in single words improved. His production accuracy of /ʃ/ also improved even though it was not targeted directly in therapy. The lack of change in the pattern of phonological processes that were monitored indicated that JL's phonology was not developing spontaneously.

Changes in consonant accuracy following articulation therapy and after a break from therapy

Pre-treatment and post-treatment accuracy of consonants in Cantonese and English elicited by the standardized speech assessments were compared to consonant accuracy following a four-week withdrawal from therapy (see Figure 3).

Figure 3: Consonant accuracy prior to articulation therapy, at the conclusion of therapy, and after a four week break from therapy



Note:

1. Quantitative data collected from the Goldman-Fristoe Test of Articulation and the Cantonese Segmental Phonology Test.
2. The only changes in qualitative error patterns were correct articulation of the phonemes targeted in therapy. Other errors patterns were still evident.

An improvement in accuracy of consonants in the standardized assessments was observed during the therapy period. This improvement was maintained over the four week break from intervention. This improvement was evident in both JL's languages, even though the therapy was only given for English words. In the assessment session immediately following articulation therapy JL produced /s/, /z/, and /ʃ/ with 90% accuracy in the Goldman Fristoe Test of Articulation and /s/, /ts/ and /tsʰ/ with 87.5% accuracy in the Cantonese Segmental Phonology Assessment.

A spontaneous sample was not elicited during the assessment immediately following therapy. However, in the assessment following the break from therapy an English sample was elicited while looking at books at the beginning of the session. JL did not consistently produce /s/ correctly in spontaneous speech. From an 80 utterance sample, JL correctly articulated /s/ with 72% accuracy.

Phase II: Phonological Therapy

Following the successful remediation of JL's articulation errors in Cantonese and English, JL's mother requested the continuation of therapy to target some of the other errors in his speech. Cluster reduction was the only process that JL was using in both Cantonese and English. For this reason it was chosen as one of the targets for phonological therapy. The other process targeted was gliding of /r/ and /l/ to [w]. This process was chosen because baseline data had been kept on the stability of this process during the articulation therapy (see Figure 2). Both cluster reduction and gliding were consistent and stable processes in JL's speech. This was important to establish because rules that are not frequently or consistently used are not good candidates for

phonological contrast therapy (Dodd & Iacono, 1989).

Data from the assessment following the break from articulation therapy showed that JL was reducing 62% of all clusters in English to one element. The main exceptions were clusters with the structure /plosive + l / (e.g., plane, blue) which he simplified to [plosive+w] and /kw/ clusters (e.g., queen) which he would occasionally produce correctly although they were rarely elicited. In Cantonese JL less consistently reduced clusters to one element. The only legal cluster structures in Cantonese are /kw/ and /kʰw/. JL reduced these clusters to one element on 36% of opportunities.

JL commenced primary schooling in the new year so therapy was provided on a weekly basis either at JL's home or in a university clinic by the same clinician who had provided the articulation therapy. The therapy sessions were approximately 45 minutes long. JL's mother attended the therapy sessions and was actively involved in providing feedback to JL.

Phonological contrast therapy, based on the concept of making the child aware that speech sounds convey meaning, was used to target JL's phonological processes. Line drawings of minimal pairs and triplets were used as stimuli. The first stage of therapy involved highlighting the differences between the words, ensuring that JL could discriminate both the sounds and the meaning between them (e.g., lip vs. whip or ski vs. sea vs. key). Each target process used 10 sets of words. The next stage involved the production of the target words in order to signal appropriate meanings. Words in phrases were then targeted. A 90% criterion was reached before progression to the next stage. Both cluster reduction and gliding were targeted in each session. Activities were provided for JL's mother to do with him at home.

The clusters chosen for therapy were restricted by JL's vocabulary. Ideally it would have been good to work on /kw/ clusters in English so that a direct comparison to the clusters in Cantonese could be made. Unfortunately JL only had a couple of words in his English vocabulary that included a /kw/ cluster and he was able to imitate word-initial /kw/ words correctly so it was not possible to include these as therapy targets.

The same words used as the generalization probe in the articulation therapy were used to monitor generalization of the phonological therapy to untreated words. This also meant that JL's production of /s/ and /ʃ/ could be monitored. These words were elicited at every second therapy session.

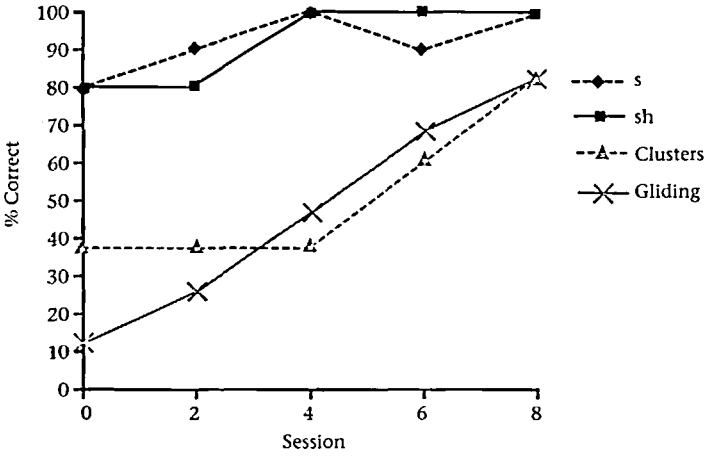
Progress during phonological therapy

JL required only one session of discrimination training. Sessions 2 – 4 concentrated on single word production discrimination between the words. Sessions 5 – 8 consolidated accurate single word production and the production of the target words in carrier phrases and sentence construction activities. This therapy approach was successful in targeting cluster development and accurate production of /r/ and /l/. Generalization to untreated words and clusters occurred (see Figure 4). The production of /s/ and /ʃ/ also remained stable reflecting the specificity of the intervention method. A spontaneous speech sample was collected at the end of the eighth session. JL was assessed on the standardized tests following a three week break from the phonological therapy. Spontaneous speech samples were also collected at this session.

Changes in consonant accuracy following phonological therapy and after a break from therapy

Specific consonant accuracy scores can be compared between spontaneous speech samples collected following the break from articulation therapy and immediately following the

Figure 4: Progress on untreated generalization probes during phonological therapy



Notes:

1. Quantitative data collected from 20 words generalization probe collected at every second therapy session.
2. Clusters were counted as correct if both elements of the cluster were present.
3. The words in the generalization probe only contained one /s/ cluster.
4. Six of the eight /r/ and /l/ sounds probed for evidence of gliding were also in clusters.

phonological therapy (see Figure 5). Overall consonant accuracy scores can also be compared between JL's productions on the standardized assessments and in spontaneous speech in both languages following the break from articulation therapy and following the break from phonological therapy (see Figure 6).

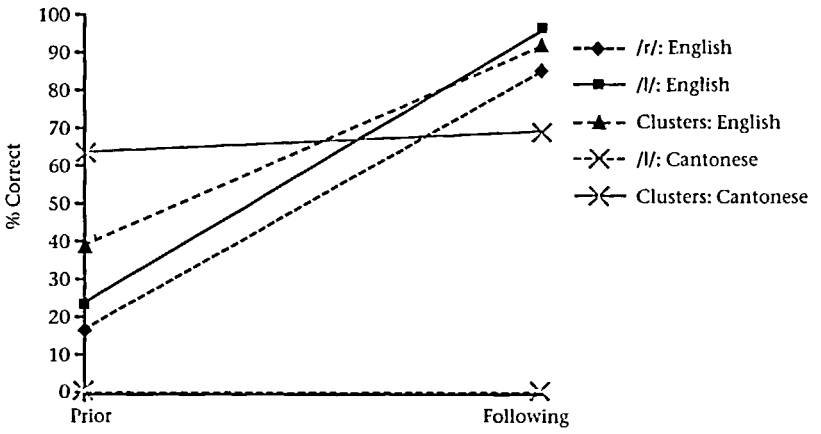
The data shows that JL's English consonant accuracy improved following the phonological therapy. However, unlike the generalization to Cantonese observed from the articulation therapy, there was no notable change in JL's Cantonese consonant accuracy following phonological therapy. JL's only shared phonological process, cluster reduction, was suppressed significantly in English, but he showed no notable change in the accuracy of his clusters in Cantonese (see Figure 5).

Figure 5 also shows the clear distinction between JL's phonological systems in regard to the phoneme /l/. In Cantonese JL continued to substitute [n] for /l/ consistently, even though after therapy he achieved correct /l/ production in English. The other processes evident in JL's initial assessments in Cantonese and English were still present following phonological therapy.

Discussion

The treatment case study presented shows clear evidence concerning two important issues: the difference between articulation and phonological disorders; and the existence of two separate

Figure 5: Accuracy in spontaneous English speech prior to phonological therapy and immediately following therapy



Notes:

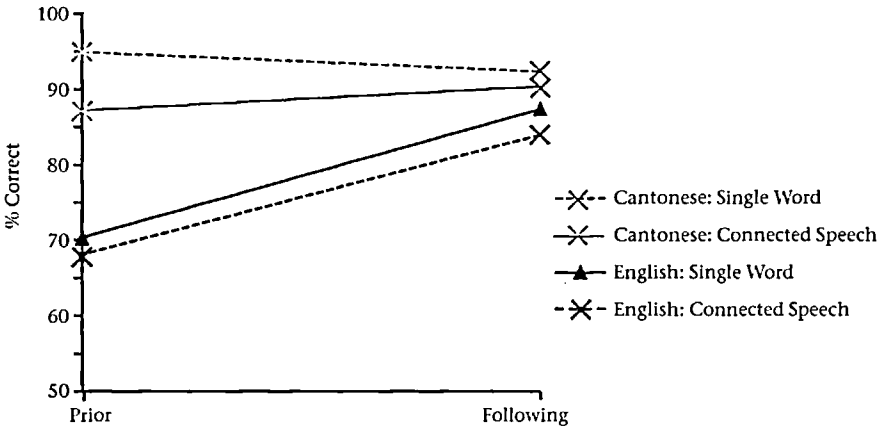
1. Quantitative data collected from an 80 utterance spontaneous speech collected following the four week break from articulation therapy and a 50 utterance sample collected at the end of Session 8 of phonological therapy.
2. Clusters were counted as correct if both elements of the cluster were marked even if one of the elements was simplified.

phonological systems in bilingual children. Articulation therapy, targeting /s/, conducted in English and only with English target words, generalized into the correct production of /s/ in Cantonese. Phonological therapy, targeting a shared phonological process across Cantonese and English, cluster reduction, did not generalize from English to Cantonese. Phonological therapy in English did not have any effect on consonant accuracy in Cantonese.

Over the last 15 years the distinction between phonology and articulation and the relationship between them has been discussed widely. Dodd (1995) clearly differentiates between articulation and phonological disorders. Phonology is the cognitive, rule-based system that organizes sounds within language, while articulation is the motor skill required to produce the sounds. Fey (1992) agrees with this distinction between articulation and phonology and views them as "highly interdependent constructs" (p.228). Elbert (1992) prefers the terms "phonemic" and "phonetic" but essentially also agrees with Dodd. One of the concerns raised by Elbert is that people will adopt an either/or dichotomy and fail to "acknowledge that an individual with a phonological disorder may have both phonetic [articulation] and phonemic [phonological] problems occurring within the same disordered system" (p.242). The errors JL produced are a good example of such an individual.

Dodd (1995) defined articulation disorders as an inability to produce a perceptually acceptable version of particular phones, either in isolation or in any phonetic context. JL was unable to produce an accurate /s/ in either Cantonese or English. His distortion of the sound was the same in both languages. He appeared to have learned the wrong motor program, in that he used a labiodental lip position with palatalization of the tongue for both /s/, /z/ and /ʃ/.

Figure 6: Consonant accuracy prior to phonological therapy and after a three week break from therapy



Notes:

1. Quantitative single word data collected from the Goldman-Fristoe Test of Articulation and the Cantonese Segmental Phonology Test.
2. Quantitative spontaneous connected English speech data collected from an 80 utterance sample collected following the four-week break from articulation therapy and a 50 utterance sample collected following the three-week break from phonological therapy.
3. Quantitative spontaneous connected Cantonese speech data from the 20 utterance sample following the four-week break from articulation therapy and following the three-week break from phonological therapy.

Articulation disorders in bilingual children are easily identifiable for phonemes shared by the two languages — by definition the child must produce the same phoneme in the same way in both languages or it is not simply a motoric error but governed by phonological constraints.

Therapy that corrected JL's motor program, through feedback about tongue and lip position, resulted in a generalized remediation in both his languages. There has been very little research into the effects of intervention across languages in bilingual children. A similar pattern to JL's, of generalization across bilingual children's languages, has been previously reported. McNutt (1994) reported evidence from seven bilingual French/English speaking children. A motor based articulation therapy program provided in English, generalized into French for all of the children. The children in the study had phonetic errors that were identical across their languages. Intervention successfully resolved the motoric errors — indicating that the errors were peripheral and not embedded in language-bound constraints.

Phonological disorders, however, are not the result of motor program errors. Consistent nondevelopmental errors might be due to an impaired ability to abstract knowledge about the nature of the phonological system to be acquired (Dodd, 1995). JL's phonological systems were not identical, and the processes he was using in each language were different, which shows that he was having trouble abstracting knowledge about both of the systems. The errors he was making were not normal for bilingual Cantonese/English speaking children either, so it cannot be suggested that his errors were due to normal interference between the languages (Dodd et al., in press).

It would be expected that a bilingual child would have disordered phonology in both languages because the underlying process of developing a phonologically appropriate system requires the ability to abstract the relevant information about that system from the input they receive. It follows therefore that the phonological errors need not necessarily be the same if the child is developing and storing two separate sets of phonological parameters from the two different input sources. If a bilingual child only had disordered phonology in one language there would have to be careful consideration of the theories behind the causes of disordered phonology. The data clearly shows that JL had a combination of articulation and phonological errors, and that these errors had different underlying causes.

The other theoretical issue that this case study involves is the issue of the separateness of bilingual children's phonological systems. There are two pieces of evidence that suggest that JL had two separate phonological systems. The first is that the phonological error patterns were different in each language. The example, previously cited, of JL's backing /t/ to [k] in Cantonese but not in English is a clear illustration of a phoneme that had been acquired and was used appropriately in one language and yet in the other language an incorrect process was evident. The second piece of evidence is the lack of generalization across languages following phonological therapy.

The basic goal of phonological therapy is to "facilitate cognitive reorganization of the child's phonological system and his phonologically-oriented processing strategies" (Grunwell, 1985, p.99). The phonological therapy given was successful in reorganising JL's system, but only in one of his languages. Phonological therapy did not generalize from English to Cantonese. In fact, phonological therapy had no effect on JL's Cantonese. JL must have had separate phonological systems otherwise you would expect the error patterns to be identical in each language and you would expect that intervention would resolve errors in both languages not just one.

The lack of generalization clearly shows that JL's phonological systems were separate: he was not using the one phonological system for both languages. This possibility of a single system has been discussed in the bilingual development literature. Bilingual language development research has focused primarily on the issue of the extent to which bilingual children develop two separate linguistic systems. Volterra and Taeschner (1974) presented a very influential three-stage model outlining bilingual children's progression from a unitary, mixed linguistic system, to a lexical and structural separation of two differentiated systems. This model has been criticized, with some linguists suggesting that bilingual children develop two separate systems from the start (see de Houwer, 1995, for a review).

Schnitzer and Krasinski (1994) reviewed the limited research pertaining specifically to bilingual phonological development. They pointed out that evidence supporting the existence of separate lexical systems does not necessarily mean that the phonological systems are also separate. The literature they reviewed, however, seemed to support the existence of a single, undifferentiated phonological system in bilingual children. Schnitzer and Krasinski presented a very thorough case study of a bilingual child's phonological development. Their evidence suggested a similar pattern to that identified by Volterra and Taeschner (1978). The child Schnitzer and Krasinski studied initially had a single phonological system, that then differentiated into two systems corresponding with the two languages. The data in the present case study of JL supports the existence of two separate systems.

Clinical implications

Any conclusions drawn from limited case data must be extremely tentative. However, the treatment case study presented suggests important clinical implications for speech language pathologists:

Bilingual children's speech needs to be assessed in both of their languages for a clear profile of the nature of their errors.

Articulation errors, common to both languages due to incorrect motor planning, might be remediated in both languages by providing therapy in only one language.

Bilingual children appear to have two separate phonological systems for their two languages.

The deficits underlying phonological disorder are not language specific: they are the product of a general inability to abstract the phonological rules specific to that language accurately. This inability results in different error pattern profiles across the two languages. Phonological assessment in only one language is not sufficient.

In contrast to articulation therapy, although phonological errors can be remediated in the language that therapy is provided in, this therapy probably will not affect the child's other phonological system. Phonological therapy does not generalize across languages indicating that therapy will need to be carried out in each language separately.

The nature of phonological development and disorder of bilingual children requires far more research. Important theoretical and clinical issues can be explored by studying this linguistically significant group. Bilingual acquisition can show us the potential parameters for language learning, as well as identify the boundaries for intervention.

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Appendix

Generalization Probe Words

These 20 words were elicited in a picture naming task at the end of every second therapy session.

1.	sad	6.	bus	11.	rain	16.	black
2.	sun	7.	house	12.	fly	17.	plane
3.	seven	8.	mask	13.	drip	18.	ship
4.	star	9.	icing	14.	crash	19.	shark
5.	rice	10.	dinosaur	15.	brush	20.	fish

Frequency of phonemes

	/s/	/ʃ/	/r/	/l/
initial	3	2	2	
medial	2			
final	3	3		
initial cluster	1		3	3
final cluster	1			
Total	10	5	5	3