Differential diagnosis of phonological disorder in two bilingual children acquiring Italian and English

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Abstract

The need to differentially diagnose children with speech disorder is widely accepted, although how to do this remains controversial. One differential diagnostic framework proposes four subgroups of speech disorder. Investigating the error patterns of bilingual children will validate the existence of subgroups. The subgroups are differentiated in terms of their surface speech error patterns which are thought to reflect different underlying deficits in the speech processing chain. If this hypothesis is true, then bilingual children with speech disorder should show the same type of speech error patterns in each of their languages. The two case studies reported here describe the error patterns of two bilingual 4-year-old children who spoke English and Italian. Their disorders were of unknown aetiology. One child presented with an inconsistent phonological system in both languages. The second child made errors that indicated a delay of her phonological development in both languages. The results of their phonological assessments are discussed in terms of current theories about bilingual development and differential diagnosis of phonological disorders. The study identifies the clinical implications for speech-language pathologists.

Keywords: bilingualism, phonological disorder.

Introduction

Theories of language acquisition should account effectively not only for monolingual language acquisition but also for the ‘multilingual majority’ (de Houwer, 1995). Estimates of the prevalence of a bilingual language learning environment suggest that almost half the world’s population is bi- or multi-lingual (Grosjean, 1982). Bilingual language acquisition studies reveal the potential for, and limits of, language learning in early childhood. The majority of bilingual and second language acquisition research, however, has focussed on the potential of language acquisition in these children. The limitations or disorders of their acquisition have not been addressed.

Within the field of speech-language pathology, theories of phonological development and disorder have rarely attempted to account for the multilingual acquisition environment. Developmental speech disorder is thought to affect between 3 and 10% of the population (Kirkpatrick and Ward, 1984; Enderby and Phillips, 1986). Inadequate recognition of the bilingual population means that speech-language pathologists could be neglecting a significant number of children. Bilingual acquisition research has also largely ignored children with speech and language disorders, probably because the path of ‘normal’ bilingual development has yet to be described fully. However, disordered development could provide information as important as that provided by ‘normal’ monolingual development.

In contrast to bilingual research, research in monolingual phonology has targeted both children with disorders and those who develop normally. However, the longitudinal case studies (e.g. Smith, 1973; Grunwell, 1982) and cross-sectional studies of normally developing children belonging to narrow age bands (e.g. Stoel-Gammon, 1987) do not yet adequately provide an explicit description of monolingual children’s development of phonology. Consequently, most of the commonly used ‘norms’ for English phonological development are based on either case-studies or small numbers of children. Large-scale longitudinal studies of English phonological acquisition are needed (Stemberger, 1992; Dodd, 1995).

Despite the lack of solid empirical data on the normal acquisition of English phonology considerable evidence exists identifying and describing the types of errors that constitute speech disorder. Children with speech disorder do not form an homogeneous group: they differ in severity, aetiology, symptomatology, and response to treatment (Shriberg, 1982). Dodd (1995) outlined a differential diagnosis procedure for children whose speech disorder has no known aetiology. Previous research indicates four subgroups of children with speech disorder (Briery, 1987; Bradford and Dodd, 1994; Dodd and McCormack, 1995):

- **Articulation impairment**: inability to produce a perceptually acceptable version of particular phonemes, either in isolation or in any phonetic context. Children may consistently produce a specific distortion (e.g. lateral lisp) or substitute another phoneme (e.g. [w] for [t]). Articulation errors are due to a peripheral problem where the wrong motor programme for the production of specific speech sounds has been learned (Fey, 1992).
- **Delayed phonological skills**: a phonological system similar to younger, normally developing children. Most phonemes can be articulated, however there is a discrepancy between the phonological simplification processes observed and the child’s chronological age. The reasons for delayed phonological development include an impoverished language learning environment, slower neurological maturation, or general cognitive delay (Powers, 1971).
- **Consistent deviant disorder**: systematic use of deviant phonological rules, i.e. error patterns that are atypical of normal phonological development (e.g. deleting all syllable initial consonants). These errors are thought to be caused by an impaired ability to abstract knowledge about the nature of the phonological system (Dodd and McCormack, 1995).
- **Inconsistent speech disorder**: variable production of the same words or phonological features in the same contexts. Children who make inconsistent errors...
have intact knowledge of the phonological system but find it difficult to plan motor sequences (Bradford and Dodd, 1996).

Bilingual children provide a unique opportunity for testing hypotheses about factors affecting language acquisition (Meisel, 1990; de Houwer, 1995). The various deficits hypothesized as underlying the four subgroups' error patterns can be investigated further by looking at the error patterns of bilingual children. Bilingual children must show error patterns characteristic of the same subgroup of disorder in both of their languages to validate the theory that different surface speech error patterns reflect different underlying deficits. If this were so, then it would provide evidence that there is one mechanism that derives constraints and governs phonological output for both languages in bilingual populations.

The different languages for which phonological acquisition data are available is also limited. This is another factor that limits differentiation of disordered or delayed development. Monolingual acquisition of Italian has been described (Bortolini, 1995). Information is also available about speech disorder in children acquiring Italian (Bortolini and Leonard, 1991). The phonological development of English and Italian is similar; there are normal simplification processes used by children learning both languages (e.g. assimilation, weak syllable deletion). Phoneme acquisition order for each language is also quite similar (comparing norms presented by Grunwell (1982) for English and Bortolini (1995) for Italian). However, two important differences are evident: the phonotactic structures allowed (e.g. lack of final consonants in Italian); and specific error-patterns (e.g. [i] substituted for [t] in Italian rather than the common English substitution of [w] more frequent use of migration and metathesis in Italian due to large number of polysyllabic words). These differences reflect the characteristics of Italian phonology. As well, phonologically disordered monolingual Italian and disordered English-speaking children's errors are similar (Bortolini and Leonard, 1991).

Phonological acquisition has been described as the 'Cinderella of bilingual studies' (Watson, 1991) because it has received the least attention from researchers of language acquisition in comparison to studies of semantics, pragmatics and syntax. Until recently the majority of the evidence concerning phonological acquisition was in the form of anecdotal references to phonological features noticed in longitudinal case studies of individual children. However, the concept of phonological interference, phonological mixing, or what is sometimes referred to as a form of accent, is reported consistently in the bilingual literature. This suggests that bilingual children are making phonological errors that are not typical of monolingual children (cf. Leopold, 1949; Burling, 1959; Fantini, 1985). Hence, two issues are important in research on bilingual children's phonological acquisition:

1. Do bilinguals keep the phonological systems of their two language's separate or do they use a single system to support both languages?; and
2. Do bilinguals acquire phonology in the same way as monolinguals, that is, do they follow the same developmental stages for each of their languages?

Ingram (1981) described the phonological acquisition of a bilingual Italian/English child. The data showed clear evidence of two phonological systems (e.g. the child substituted [I] for [t] in Italian and [w] for [t] in English). More recently, Watson (1991) reviewed the evidence concerning phonological acquisition by bilingual children and concluded that, 'bilinguals may have two systems but which differ in some way from those of monolinguals' (p. 44). Watson suggested that the main differences would probably be evident in the phonetic detail rather than phonological patterns. Fantini (1985) described a child's acquisition of Spanish/English and highlighted phonetic differences in the acquisition process. However, some preliminary group data on the phonological skills of bilingual Cantonese/English speaking children suggests differences in the phonological processes used by normally developing bilingual children.

Dodd, So and Li (1996) and Holm and Dodd (1998) found that a group of 56 children showed a pattern of phonological development in bilingual children that differed from monolingual children. The differences occur in each of the bilingual's languages. The children's error patterns were different in each language too, supporting Watson's (1991) claim that bilingual children use separate phonological systems. However, differences also appeared in the types of error patterns that were common across the group. The children used a number of phonological processes that are associated with phonological disorder in monolingual children (e.g. initial consonant deletion, backing, aspiration). The data suggest that exposure to a bilingual Cantonese/English environment results in the development of speech error patterns that are unusual compared to monolingual acquisition.

Another group study of bilingual phonological acquisition was conducted by Navarro, Pearson, Cobo-Lewis and Oller (1995). They analysed the phonology of 11 bilingual Spanish/English children. They also concluded that bilingual and monolingual children 'might be following different paths to reach the same goal' (p. 4). However, the data from the Cantonese/English studies did not find that the bilingual children used unusual error processes. They concluded that the bilingual children in their study were less likely to use uncommon error processes.

The differences between these two studies highlights the need for further group studies across various combinations of languages to examine the effects of factors such as simultaneous versus successive acquisition, and combinations of phonologies on the types of interference or interaction. However, the research so far indicates two interesting findings: bilingual children develop two separate phonological systems; and the stages of normal bilingual development appear to differ from the stages of normal monolingual development.

The literature about bilingual children with phonological disorder is very scarce. This is probably due to the inherent difficulties facing monolingual English-speaking speech-language pathologists required to assess bilingual children: they can only speak one of the child's languages; they have difficulty eliciting important case history information; they lack knowledge about the linguistic structure of the child's other language; there are no norms for monolingual development of many languages; there are no norms for bilingual children acquiring two languages; and there is often minimal knowledge about issues arising from bilingual language development. Romaine (1989) points out for example, 'many professionals such as speech therapists view normal language mixing as harmful and are therefore liable to give advice to parents which is not in keeping with the realities of normal bilingual development' (p. 213).

Dodd, Holm and Li (1997) presented two case studies of bilingual Cantonese/English speaking children with speech disorders. One of these children, JL, had speech errors characteristic of articulation disorder and phonological delay in comparison to his bilingual peers. The other child, CH, had made errors that indicated that he had a consistent deviant phonological disorder. There was also some evidence...
Differential diagnosis of phonological disorder

117

that CH was having difficulty marking the differences between his phonological systems, a characteristic not evident in the larger bilingual group with whom he was compared.

Speech-language pathologists need to be able to identify the subgroup of speech disorder so that they can intervene appropriately. A treatment case study of JL’s speech disorder (Holm, Ozanne and Dodd, 1997) showed that generalization across a bilingual child’s languages depends on the type of speech disorder: articulation errors were remediated in both languages following treatment in only one language; but phonological intervention did not generalize across languages. The subgroup characteristics of a bilingual child’s speech disorder may therefore also affect the choice of service delivery.

The current paper attempts to add to the body of knowledge regarding speech disorders in bilingual children. It presents two case studies of children bilingual in Italian and English. Unlike the Cantonese/English children there are no group data regarding the normal bilingual development of children exposed to Italian and English. However, data are available on standardized assessments for monolingual acquisition of both languages. The questions addressed were:

- Were the speech errors characteristic of a particular subgroup of speech disorder?
- Did the speech errors indicate the same underlying deficit for both languages?
- Was there evidence of differentiation of the phonological systems? and
- Were the error patterns typical of monolingual children in each language?

Case study 1: Giuseppe

Background information

Giuseppe was assessed by the investigating speech pathologist at the age of 4;2 years. His birth history was without incident and he has experienced no major medical problems. Giuseppe’s hearing is within normal limits. His parents reported that his developmental milestones were normal. No family history of speech, language or academic problems were reported. Giuseppe’s parents are fluent speakers of both Italian and English. Giuseppe was exposed to both Italian and English from birth. His grandparents who live in the family home only speak Italian. Until he started attending kindergarten at age 3;8 years Giuseppe’s grandmother cared for him during the day while his parents worked. The kindergarten language environment was English. Giuseppe’s parents estimated that equal proportions of English and Italian are used at home. Giuseppe has a 7 year old sister with whom he always speaks English. Giuseppe’s parents are not concerned about his language comprehension in either language, however, they find that most people outside the family have difficulty understanding his speech in either Italian or English.

Speech therapy history

Giuseppe was first referred to a speech-language pathologist when he was aged 3;2 years because of his unintelligible speech. The initial assessment of Giuseppe’s English phonology showed that he used mainly the sounds /p, b, m, n/ and a range of vowels. The speech-language pathologist was concerned that exposure to two languages might be confusing Giuseppe and suggested that the

Italian. Giuseppe’s parents were not prepared to do this as Giuseppe’s grandparents do not speak English. They were angered by the speech pathologist’s response to the difficulties Giuseppe was having and decided not to continue attending the clinic.

Giuseppe started attending kindergarten at age 3;8 years. The teacher was very concerned about Giuseppe’s speech and referred him to another speech-language pathologist. Assessment at this stage showed that Giuseppe had added the consonants /t, d, l, j/ to his phoneme repertoire. The speech-language pathologist was concerned about his variable productions of words (e.g. Giuseppe pronounced his own name as /depi/, /epi/, /bspi/ within the same session). The speech-language pathologist only assessed Giuseppe’s English speech, however, she was aware that he was also unintelligible in Italian. She encouraged Giuseppe’s parents to maintain his Italian because they thought he was more confident in Italian.

Intervention concentrated on introducing some of Giuseppe’s missing phonemes. Intervention was provided only in English. Articulation of /s, k, w/ was targeted as well as the phonological process of final consonant deletion. The speech-language pathologist was concerned that Giuseppe remained very unintelligible after 6 months of weekly therapy, although he had started using the additional phonemes. She referred Giuseppe for assessment by the investigating speech-language pathologist (the first author) at age 4;2 years.

Assessment

Language screen

The Test of Auditory Comprehension of Language-Revised (Carrow-Woolfolk, 1985) was given to measure Giuseppe’s understanding of English. The results indicated that his receptive language skills were within normal limits. Expressive language was difficult to assess because of the unintelligibility of Giuseppe’s speech. Giuseppe’s Italian language comprehension was not assessed formally, although neither his parents nor the Italian-speaking speech-language pathologist who transcribed his speech were specifically concerned about his language comprehension.

Oro-motor skills

Performance on an informal oro-motor assessment suggested age-appropriate oro-motor skills. No struggle or groping behaviour was observed during spontaneous speech.

Speech assessment

Giuseppe was assessed in his home by a fluent Italian speaking speech-language pathology assistant and an English-speaking speech-language pathologist. Spontaneous speech samples were elicited in both languages but Giuseppe was mainly unintelligible in connected speech so most of the connected speech data could not be analysed. Single word responses were needed to ensure that the target word was identifiable. The Prove per la Valutazione Fonologica del Linguaggio Infantile (PFLI; Bertolini, 1995) that samples all phonemes in Italian was administered to assess his Italian phonological system. The Goldman Fristoe Test of Articulation (GFTA; Goldman and Fristoe, 1986) was given in English. The assessors attempted to repeat what Giuseppe said for transcription purposes and to check their understanding. Giuseppe was not frustrated by his unintelligibility and would often repeat the words until the right word was interpreted.
Differential diagnosis of phonological disorder

The assessment session with Giuseppe was recorded using a Marantz CP130 audio cassette recorder and a Sony lapel microphone. A bilingual Italian-English speaking speech-language pathologist transcribed both the English and Italian speech samples collected. The English-speaking speech-language pathologist also transcribed the English speech elicited. The few differences in the transcription were discussed and consensus reached between the two transcribers. A phoneme was considered to be absent if it was not produced in either elicited, spontaneous or imitated speech contexts in any word position. Phonological processes were considered present if there were at least five examples of the process in the speech sample.

Results

Italian phonological error data

Intelligibility of single words was fair, however, connected speech was very difficult to understand. Giuseppe had a wide range of phonotactic structures. His phonetic inventory included 15 of the 23 consonants. The phonemes missing from his phonetic inventory were those that usually develop later in monolingual children: /dz, ts, ð, tf, r, p, ŋ, w/. Giuseppe also used a bilabial fricative, a non-Italian phoneme, on a number of occasions.

Phonological analysis of Giuseppe’s speech was difficult due to his unpredictable error pattern. However, inspection of the speech data revealed the inconsistent use of the following phonological processes: stopping, voicing, devoicing, assimilation, openness, weak syllable deletion, backing, fronting, and liquid deviation. Exceptions to all error patterns were evident in Giuseppe’s speech. There were also numerous examples of contradictory substitutions (e.g. /t/-/l/) and /kl/-/l/). Cluster reduction was the only phonological process applied consistently. Giuseppe’s speech contained no clusters, however, the way that he simplified the clusters varied.

The percentage of consonants, vowels and phonemes produced correctly in the two speech assessments are presented in Table 1.

<table>
<thead>
<tr>
<th></th>
<th>Consonants</th>
<th>Vowels</th>
<th>Total phonemes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Giuseppe</td>
<td>42</td>
<td>90</td>
<td>63</td>
</tr>
<tr>
<td>PFLI: Italian</td>
<td>42</td>
<td>90</td>
<td>63</td>
</tr>
<tr>
<td>GFTA: English</td>
<td>40</td>
<td>92</td>
<td>58</td>
</tr>
</tbody>
</table>

The inconsistency of Giuseppe’s errors was extreme. For example, of the eight words elicited with word initial /kl/, 4 words started with /kl/, 2 with /l/, 1 with /l/ and the other with /pl/. Another example of inconsistency appeared in words containing the phoneme /l/. For example, Giuseppe produced 18 words with word medial /l/: 11 of these words had a correct /l/ production, three were replaced with /ml/, 2 with /l/, and two with /bl/. The only consistent substitution pattern in the data was /l/ for /l/. All of the other phonemes had at least two different substitutions; no sound was consistently produced correctly.

Giuseppe produced 18 words in the sample more than once. Across his productions of the same word his speech was also inconsistent. Each of the 18 words was produced differently, however, this data may be misleading because Giuseppe repeated the word when the assessor had mistaken the word he was targeting: possibly he was changing his production because he had been misunderstood. When

Giuseppe imitated words his production was closer to the target word than his spontaneous production had been.

Comparison with monolingual Italian-speaking children

The Prove per la Valutazione Fonologica del Linguaggio Infantile (Bortolini, 1995) provides information about the normal acquisition of Italian phonology. A normally developing child has usually acquired all but three of the 23 phonemes of Italian at Giuseppe’s age. Giuseppe’s phoneme inventory was made up of the earliest developing sounds.

It is difficult to compare Giuseppe’s phonology with the normative data because of his inconsistency. Bortolini (1995) indicated that by 4 years of age only the developmental phonological process of consonant harmony is still commonly used by normally developing children. The other processes commonly used by children at age 3:6 years include weak syllable deletion, metathesis, epenthesis, vowel harmony, backing and devoicing. Most of the processes that Giuseppe applied inconsistently were developmental. For example, Giuseppe most commonly substituted a nasal for the phoneme /l/. Bortolini and Leonard (1991) found that normally developing children usually substitute either /t/ or /l/ for /l/. However, there was also evidence of atypical processes. For example, Giuseppe often omitted the stop rather than the sibilant from clusters. Bortolini and Leonard found that only children with disordered phonology reduced clusters in this way. They also cited contradictory processes as indicative of disorder in Italian children. Giuseppe had a number of contradictory processes: backing and fronting; voicing and devoicing; substitution of /l/–/l/; yet /l/–/l/.

The key indicator of disorder in Giuseppe’s speech was his inconsistency. Even though the general order of phoneme acquisition and the application of generally developmental phonological processes were similar to normally developing children, inconsistency of the severity and nature evident in Giuseppe’s speech is not a characteristic of normal development (Bortolini, 1995). Improvement in production under an imitation condition has also been shown to be a characteristic of inconsistent deviant speech disorder (Bradford-Heit, 1996). As stated earlier, Giuseppe’s speech was closer to the target when he imitated the assessor.

English phonological error data

Giuseppe’s English phonetic inventory contained 16 of the 24 consonants. The phonemes missing were /l/, v, ð, ò, ð, tʃ, ðs/. He was using all of the vowels of English. He also had a wide range of phonotactic structures.

Giuseppe’s connected speech was very rapid and his unintelligibility made accurate phonological analysis difficult. For this reason the data presented will be from his productions on the GFTA. Giuseppe was less willing to repeat his production of the target words in the GFTA than he was while doing the PFLI. Possibly his reluctance was due to there being only one item to be named on each page and therefore it was obvious what he was trying to say. There were also a number of items in the GFTA that Giuseppe did not know so a number of his responses were imitations of the assessor.

Giuseppe inconsistently applied the following phonological processes in his English speech: stopping, fronting, gliding, assimilation, weak syllable deletion, and final consonant deletion. As in Giuseppe’s Italian phonology there were exceptions to all error patterns were evident in Giuseppe’s speech.
to all the error processes evident. Cluster reduction was consistent, however, the way the clusters were reduced varied (e.g. /skwl→[b]/ /st→[k]/ /sl→[l]/).

Table 1 presents the per cent consonants, vowels and phonemes correct. Considering the high number of consonants in error the low number of vowel errors is significant.

The inconsistency evident in Giuseppe’s Italian was also evident in his English phonology. Most of the phonemes had a range of up to four different realizations. For example, /l/→/b/, /b/, or /w/ or /l/ which was absent from his inventory was replaced by [s], [p], [b], [l] and [z]. Not all of Giuseppe’s phonemes had such a wide variability; the phonemes that Giuseppe acquired first tended to be more stable than recently acquired phonemes. However, only /d/, /w/ and /l/ were correct in all positions targeted.

Unlike the sample of Giuseppe’s Italian speech there were only a few English words that he said more than once so it was difficult to determine the consistency of his productions across the same lexical item. Seven words were said twice: only two of the words were said exactly the same way each time. This limited data suggests that Giuseppe’s English phonology reflected the variable productions of the repeated words evident in his Italian.

Comparison with monolingual English-speaking children

Grunwell (1982) and Dodd (1995) described the normal developmental process of English phonological acquisition. A normally developing child of 4 years of age would have acquired most of the phonemes except /θ, ð, t/. Giuseppe should have acquired /l/, /v/, /z/, /j/ by age 4; 2 years. The information from his previous assessments suggests that he acquired the phonemes in a similar order to normally developing children, but that his acquisition was delayed. The phonemes /w/, /k/, /s/ were specifically taught to him in speech therapy.

The phonological processes that Giuseppe was using were all normal developmental processes. Grunwell (1982) indicated that the processes still common in the speech of a 4 year old are stopping and gliding. The other processes that Giuseppe was using are appropriate for younger children (e.g. assimilation is usually suppressed by age 3).

Comparison of Giuseppe’s Italian and English phonological patterns

Across his two languages Giuseppe had a total phonemic inventory of 16 phonemes. Table 2 presents the distribution across both languages. There were three phonemes present in one language but absent in the other: /l/, /l/ and /w/ present only in Italian; and /w/ present only in English. It is possible that /w/ was part of his inventory in Italian but because it only occurs as the second element in a cluster Giuseppe might have always simplified the cluster by omitting the /w/. He was missing 14 phonemes. Of these 11 phonemes, nine of the phonemes were specific to one of the languages (i.e. not shared phonemes), and the other two phonemes were missing in both languages: /t/ and /d/.

The data presented in table 1 shows that Giuseppe was having equal difficulty with the consonantal system in both languages. He was very difficult to understand in either language.

The phonological processes that Giuseppe was using in his two languages were similar. Table 2 shows there were six phonological processes that were the same in both languages and four that were specific to only one language. Even though some of the processes were the same the errors were not necessarily identical in each language. For example, in Italian, Giuseppe substituted [l] or [n] for /l/ because of liquid deviation. In English, however, Giuseppe substituted /l/ with [w] under the process of gliding. Giuseppe, therefore, used different substitution patterns, that reflected the ambient phonology, in each of his languages. These error differences also indicate that Giuseppe had two separate phonological systems.

Four phonological processes were apparent in only one language. Their presence may also relate to the ambient phonology: for example, final consonant deletion was evident only in English, however, Italian doesn’t have final consonants (except in occasional loan words). One possibility is that final consonant deletion may be prevalent in many bilingual Italian/English speaking children as a normal interaction between the two phonologies but without normative bilingual data this cannot be determined.

The other, very significant pattern in both of Giuseppe’s languages was its inconsistency. In both languages he was inconsistent across phonemes and across repeated word productions. Inconsistent deviant speech disorder is thought to be caused by a phonological planning deficit. The phonological plans that these children store may be incorrect or underspecified: ‘although they may be able to physically produce the required phonological string, they do not appropriately specify the sequence in the lexicon for later production’ (Bradford-Heit, 1996, p. 205). A phonological planning deficit may underlie Giuseppe’s inconsistent speech in each of his languages.

Case study 2: Stephanie

Background information

Stephanie was assessed by the investigating speech-language pathologist at the age of 4; 4 years. Stephanie’s birth and medical histories were without incident and early...
Differential diagnosis of phonological disorder

A. Holm and B. Dodd

123

Table 3. Per cent correct in Italian and English: Stephanie

<table>
<thead>
<tr>
<th>Assessments</th>
<th>Italian</th>
<th>English</th>
<th>Total phonemes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consonants</td>
<td>68</td>
<td>61</td>
<td>78</td>
</tr>
<tr>
<td>Vowels</td>
<td>91</td>
<td>93</td>
<td>73</td>
</tr>
</tbody>
</table>

Consonants were missing from Stephanie’s phonetic inventory. The two phonemes that were missing from Stephanie’s phonemic inventory were ‘r’ and ‘l’, which is often missing in a child her age, but she was still missing ‘tl’, ‘d3’ which she should have acquired.

The phonological processes that Stephanie was using were all normal developmental processes. Grunwell (1992) indicated that the processes still common in the speech of a 4 year old are stopping and gliding. The other processes that Stephanie was using are appropriate for younger children.

Comparison of Stephanie’s Italian and English phonological patterns

Stephanie had delayed phonological development in both languages. Her phonetic inventories and phonological processes in both languages were similar to younger, normally developing monolingual children. Across her two languages Stephanie was

developmental milestones were reached at appropriate ages. Her hearing was within normal limits. Two of Stephanie’s five sisters were seen for speech therapy when they were preschoolers. Stephanie’s mother was not overly concerned about her speech because it was not severe in comparison to the difficulties her sisters had experienced. Stephanie’s mother is a fluent speaker of Italian and English. Stephanie’s father does not speak Italian. Stephanie’s parents separated when she was 6 months old. Her primary care givers, in addition to her mother, were her older sisters (aged 12, 15, 18, 20 and 21 years), and her grandmother.

Stephanie was exposed to both Italian and English from birth. Stephanie’s mother estimated that 50% of the language spoken in the home is Italian. Stephanie mainly speaks Italian with her mother and grandmother and English with her sisters. Stephanie started attending kindergarten at age 3.6 years. The kindergarten language environment is English. Neither her mother nor her teacher were concerned about Stephanie’s language comprehension or speech. Stephanie had not been referred to a speech pathologist. She was assessed as part of a larger research project assessing bilingual children’s phonological development.

Assessment

Language screen
The Test of Auditory Comprehension of Language-Revised was given to measure Stephanie’s understanding of English. Results indicated receptive language skills within normal limits. Informal analysis of a spontaneous language sample indicated age appropriate expressive language. Stephanie’s Italian language skills were not assessed formally although neither her mother nor the Italian-speaking speech-language pathologist who transcribed her speech were specifically concerned about her language development.

Oro-motor skills
Performance on an informal oro-motor assessment suggested age-appropriate oro-motor skills. No struggle or groping behaviour was observed during spontaneous speech.

Speech assessment
The same assessment procedure that was used with Giuseppe was used to assess Stephanie’s speech.

Results

Italian phonological error data
Intelligibility of connected speech and of single words was good. Stephanie had a wide range of phonotactic structures. Her phonetic inventory included 21 of the 23 consonants. The phonemes missing from her phonetic inventory were the later developing phonemes ‘tʃ’, ‘dʒ’. Stephanie also had a consistent phoneme distortion: the ‘l’ was not trilled as is required in Italian.

Phonological analysis of Stephanie’s speech revealed the use of the following phonological processes: stopping, epenthesis, weak syllable deletion, fronting, cluster reduction, and liquid deviation. All of the errors in Stephanie’s speech were attributable to the phonological processes present. However, apart from cluster reduction there were examples of correct productions of all phonemes in all positions apart from the two missing phonemes.

The percentage of consonants, vowels and phonemes produced correctly in the two speech assessments are presented in table 3.

Comparison with monolingual Italian-speaking children

The two phonemes that were missing from Stephanie’s phonemic inventory were the phonemes that are usually acquired last in normally developing monolingual children. All of the phonological processes that Stephanie was using were developmental. For example, Stephanie reduced most of her clusters in ways typical of normally developing children or she added an epenthetic vowel between the cluster elements.

English phonological error data
Stephanie’s English phonetic inventory contained 20 of the 24 consonants. The phonemes missing were ‘θ’, ‘ð’, ‘ʃ’, ‘ʒ’. She was using all of the vowels of English. She also had a wide range of phonotactic structures.

Stephanie was using the following phonological processes in her English speech: stopping, fronting, gliding, cluster reduction, weak syllable deletion, and final consonant deletion. As in her Italian phonology, Stephanie had examples of correct production of all of the phonemes apart from the ones absent from her inventory. When applying the processes Stephanie consistently substituted the same phoneme for another (e.g. ‘k’—‘f’ if in error). Table 3 presents the per cent consonants, vowels and phonemes correct.

Comparison with monolingual English-speaking children

The phonemes missing from Stephanie’s phonemic inventory were later developing phonemes in normal monolingual development (Grunwell, 1982). Stephanie had acquired ‘l’ if, which is often missing in a child her age, but she was still missing ‘tl’, ‘dʒ’ which she should have acquired.

The phonological processes that Stephanie was using were all normal developmental processes. Grunwell (1992) indicated that the processes still common in the speech of a 4 year old are stopping and gliding. The other processes that Stephanie was using are appropriate for younger children.

Comparison of Stephanie’s Italian and English phonological patterns

Stephanie had delayed phonological development in both languages. Her phonetic inventories and phonological processes in both languages were similar to younger, normally developing monolingual children. Across her two languages Stephanie was
Differential diagnosis of phonological disorder

Table 4. Comparison of Stephanie’s phoneme inventory and phonological processes in Italian and English

<table>
<thead>
<tr>
<th>Phoneme Inventory</th>
<th>Italian</th>
<th>English</th>
</tr>
</thead>
<tbody>
<tr>
<td>Present—shared m, n, p, b, t, d, k, g, s, z, l, j, f, v, r, w, ´</td>
<td>m, n, p, b, t, d, k, g, s, z, l, j, f, v, r, w, ´</td>
<td></td>
</tr>
<tr>
<td>Absent—shared</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Present—specific dz, ts, p</td>
<td>t, z</td>
<td></td>
</tr>
<tr>
<td>Absent—specific</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Processes

<table>
<thead>
<tr>
<th>Shared</th>
<th>Cluster reduction</th>
<th>Cluster reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Stopping</td>
<td>Stopping</td>
</tr>
<tr>
<td></td>
<td>Froning</td>
<td>Froning</td>
</tr>
<tr>
<td></td>
<td>Weak syllable deletion</td>
<td>Weak syllable deletion</td>
</tr>
<tr>
<td></td>
<td>Liquid deviation</td>
<td>Liquid gliding</td>
</tr>
<tr>
<td>Specific</td>
<td>Epenthesis</td>
<td>Final consonant deletion</td>
</tr>
</tbody>
</table>

The error patterns were different to monolingual children of the same age in both languages; separate phonological systems existed for their two languages; Giuseppe’s speech was characterized by inconsistency in both languages; and Stephanie’s speech was characterized by delayed development in both languages.

These findings have implications for our understanding of bilingual language acquisition and the differential diagnosis of phonological impairment. There are also clinical implications for speech-language pathologists working with bilingual children.

Bilingual language acquisition

The results indicated that each of the bilingual children had language-specific phonological systems. Evidence that their two phonologies were distinct was provided by two phenomena:

1. Each child used a phoneme in only one language that should occur in both languages. For example, while Giuseppe was producing /f/ and /v/ in Italian, these phonemes were absent from his English phonemic repertoire. Similarly, /ʃ/ was part of Stephanie’s English phonemic repertoire but was absent from her Italian.

2. Analysis of the error patterns revealed that while several patterns were shared across their two languages, each child had language-specific error patterns. For example, Giuseppe made voicing, epenthetic and backing errors in Italian that were not observed in English. Another example of distinct error patterns was the substitution of [w] for /l/ in English, but [l] or [n] for /l/ in Italian by both children. Bortolini and Leonard (1991) discussed the influence of the ambient phonology on the ways that children acquire liquids. In English, liquids are often replaced with glides (e.g. /ʃl/→[ʃw]). In Italian, where /ʃ/ and /vl/ occur only in a limited number of contexts, children substitute [l] for /ʃl/. The substitution of /vl/→[v] was also documented by Bortolini and Leonard.

Another study, of Cantonese-English bilingual children with speech disorder, reported similar findings: the children were disordered in both languages; and the error patterns were language-specific (Dodd et al., 1997). The disordered children’s findings suggest that bilingual children have two distinct phonological systems irrespective of whether the two phonologies learned are similar (e.g. Italian-English) or very different (e.g. Cantonese-English).

In contrast to Giuseppe and Stephanie who were simultaneous bilinguals, the Cantonese-English cases reported were of children who had learned their two languages sequentially. Therefore, Watson’s (1991) conclusion, that bilingual children have two separate phonological systems, seems true irrespective of whether the two languages are learned simultaneously or successively. The separate phonological systems discussed by Watson were of normally developing bilingual children. The Cantonese-English and Italian-English cases presented show that children with disorder also have separate phonological systems.

Discussion

The disordered speech of two Italian-English bilingual children was assessed. The results of the phonological analyses showed that:

- Only missing three phonemes (/I, 0, θ/). She also had three phonemes present in one language but not in the other: /ʃ/ present only in English; /ʃl/ dz/ present only in Italian. Table 4 presents the distribution across both languages.
- The data presented in table 3 shows that Stephanie was having equal difficulty with the consonantal system in both languages.
- The phonological processes that Stephanie was using in her two languages were similar. As table 4 shows there were five phonological processes that were the same in both languages and two that were specific to only one language. The processes often realised similar error patterns in each language (e.g. /kI/→[k] in both English and Italian). Unlike Giuseppe, who had different error patterns for his errors for the phoneme /l/, Stephanie substituted [w] for /l/ on two occasions in her Italian speech sample. It is possible that this error was due to Stephanie’s inability to distinguish phonetically between the Italian trilled /l/ and the English /l/. She used the same phone for both languages and when it was in error she used the same substitution. Bortolini and Leonard (1991) might consider her non-differentiation as an indication that she was unaware of the ambient phonology, however, it is likely that this is simply an example of under differentiation across her two phonologies. It is interesting to note that final consonant deletion was evident in Stephanie’s speech also for the reasons mentioned earlier.
- The data from Stephanie’s phonology in Italian and English indicate that she had delayed phonological development. Bradford-Heit (1996) suggested that no specific deficit underlies delayed phonological development. However, one would expect the cause of the delay to affect both of a bilingual child’s languages. Evidence suggested that, generally, Stephanie had differentiated her phonological systems; phonemes acquired in one language were not used in the other. However, there were great similarities between the simplification processes and errors in both languages.

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Differential diagnosis of phonological disorder

Despite the fact that bilingual children have separate phonological systems, the characteristics of their error patterns in each system appear the same. Giuseppe made inconsistent errors in both English and Italian. Both of Stephanie’s phonological systems were delayed. The Cantonese-English children with speech disorder (Dodd et al., 1997) also had identical characteristics of disorder in their two systems: one child had articulation errors and delayed phonological development; the other consistently used non-developmental phonological processes in both languages. Therefore, all four of the error patterns characteristic of the subgroups proposed by Dodd (1995) for monolingual children, have also been identified within the speech of bilingual children with speech disorder.

The existence of subgroups in the bilingual population might be expected given that the four characteristic error patterns have been observed not only in monolingual children speaking English (Dodd, Leaky and Hambly, 1989), but also in Cantonese (So and Dodd, 1994) and Turkish children (Topbas and Konrot, 1996). Experimental evidence suggests that different underlying deficits are associated with each of the four subgroups. For example, inconsistent errors are associated with a deficit in phonological planning (Bradford-Heit, 1996). It was argued in the introduction that bilingual children should show error patterns characteristic of the same subgroup of disorder in both of their languages to validate the theory that different surface speech error patterns reflect different underlying deficits. The finding that the children’s error patterns were identified with the same subgroup in both of their languages validates the hypothesis that a single deficit underlies disorder in the two phonological systems of each child.

Clinical implications

Any conclusions drawn from limited case data must be extremely tentative. However, the two case studies presented suggest important clinical implications for speech-language pathologists:

- Bilingual children appear to have two separate phonological systems, one for each language.
- Bilingual children’s speech needs to be assessed in both of their languages for a clear profile of the nature of their errors.
- The deficits underlying various speech disorders will result in both of their languages as the same type of errors (e.g. articulation disorder, phonological delay, consistent atypical phonological errors, or inconsistent phonological errors) in both languages, but not necessarily the same errors.

The nature of phonological development and disorder of bilingual children requires further research. In particular, group studies of various language combinations are required to explore further the possibility that normally developing bilingual children have a different acquisition path to monolingual children. Further descriptions of assessment results and intervention studies of bilingual children with speech disorder are also required to confirm the existence of subgroups of children with speech disorder within the bilingual population and determine how best to remediate their disorders.

References


Holm, A., OZANNE, A. and DODD, B., 1997, Efficiency of intervention for a bilingual child


