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Intervention for co-occurring speech and language difficulties: Addressing the relationship between the two domains

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Abstract
Although many children are referred with difficulties in both their speech and their language, the literature offers relatively little guidance on their therapy. Should clinicians treat these difficulties independently? Or should treatment depend on the potential impact of one domain on the other? This study aimed to investigate the relationship between speech and morphosyntax in treatment for a 5-year-old boy, B, with speech and language difficulties. Therapy targeted the production of regular past tenses and plurals. B had the necessary phonology for the former but not the latter. Therapy therefore directly targeted production of the past tense but targeted plurals by treating the production of the necessary phonology. After therapy, B successfully produced regular past tenses for both treated and untreated verbs. Irregular verbs did not improve. Treatment for production of word-final /s/ was successful and generalized to untreated words but not to the production of /s/ in initial or medial positions. Plurals formed by adding /s/ but not those by adding /z/ benefited. Similar treatment for production of word-final /z/ was also successful and appeared to generalize to words with /z/ in initial and medial positions. However, although plurals were now marked, they were usually realized as [dz]. The results of this single-case study demonstrate that intervention for children with speech and language impairments should take account of the aspects of speech and morphology that are impaired, and the ways these may impact on each other.

Keywords
intervention, co-occurring, speech difficulties, language, morphosyntax, relationship, past tense, plurals, phonology

1 Introduction

Many children who are referred to speech and language therapists have problems with both their speech and their language. Estimates range from 35–77% of referrals (Bishop and Edmundson, 1987;

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Paul and Shriberg, 1982; Shriberg and Austin, 1998; Shriberg et al., 1986, 1999; Tallal et al., 1989) depending on age, cut-off criteria, methods of assessment and the index disorder chosen. Despite their number, there is little consensus on how to treat these children. Should both speech and language receive attention in their own right, or should one be prioritized? Is there evidence to guide intervention or are we just pursuing clinical intuition?

Decisions about therapy might be guided by evidence of co-occurring difficulties in the two areas. However, studies of the relationship between speech and language difficulties reveal a complex picture. Rvachew et al. (2005) studied whether children's errors in expressive morphology reflected their speech production errors. Twenty-three 4-year-old children receiving speech and language therapy participated in a story retelling task. Their production of three grammatical morphemes expressed by /s/ and /z/ (plural, possessive and third person singular) was compared with their production of /s/ and /z/ in different word positions in uninflected words. Overall, the children produced more morpheme errors than would be expected given their production of the associated phonological forms. The frequency of correct production varied for the three morphemes but was significantly lower than the correct production of /s/ and /z/ in uninflected word-final position. The difference was particularly marked for possessives and third person singulars. Rvachew et al. concluded that the children's difficulties with morphology were at least partially independent of their speech problems.

Haskill and Tyler (2007) compared finite and non-finite morpheme production in three groups: children with language impairment only ($n = 23$; mean age = 59.7 months) and children with language and phonological impairment that did ($n = 11$; mean age = 48.4 months) or did not ($n = 29$; mean age = 51.4 months) include final consonant deletion. The language-only group's performance matched that of a younger typically developing control group ($n = 20$; mean age = 36 months) and was significantly better than the groups with language and phonological impairment. Notably, the language-only group's performance on plurals and third person singular was better than that of the children with language and phonological impairment without final consonant deletion. Since these children produced final consonants, their phonological difficulties could not account for their morphological errors. As in Rvachew et al.'s study, phonological difficulties were insufficient to account for their morphological errors. In addition, Haskill and Tyler's study suggests that combined speech and language difficulties have a greater impact on morphological production than difficulties with language only. They conclude that 'for children with a speech component to their impairment, deficits may be compounded in multiple, interacting domains, resulting in their poorer performance relative to peers with LI only' (Haskill and Tyler, 2007: 217).

Most intervention studies have treated either language impairment or speech impairment and have used outcome measures recording change only in the treated domain. However, some studies have examined whether the effects of treatment for either speech or language generalize to the other domain. Tyler et al. (2002) compared the efficacy and cross-domain effects of interventions for morphosyntax and for phonology in 27 preschool children with impairments of both speech and language. Children given either intervention improved significantly more than controls in the targeted domain. However, greater cross-domain effects were found from morphosyntax to phonology than from phonology to morphosyntax. In a second study, Tyler et al. (2003) compared four interventions: phonology followed by morphosyntactic, morphosyntactic followed by phonological, alternation between the two and giving the two simultaneously. The alternating condition produced the greatest gains in morphosyntax. With respect to phonology gains, there was no significant difference between conditions.

Findings on cross-domain generalization may depend on the targets selected for interventions and the relation between them. A possible explanation for Tyler et al.'s (2002) finding of a cross-domain effect from morphosyntax to phonology, but not the reverse, could be that phonological intervention focused on the production of initial sounds rather than final sounds where morphosyntax is largely played out. Furthermore, the relation between phonological and morphological targets

may vary between children: there is a difference between a child who consistently omits final /s/ and /z/ or produces them inconsistently (both of which would affect production of the plural), and a child who consistently stops /s/ and /z/ (and therefore has the potential to show plural marking in many contexts). In group studies, goals reflect the needs of the majority and do not take into account possible relations between domains in individual children and their implication for therapy targets (Tyler et al., 2003).

Arguably, then, intervention for children with speech and language impairments should take account of the aspects of speech and morphology that are impaired, and the ways these may impact on each other. Where difficulties with grammatical morphemes cannot be attributed to difficulties with producing the requisite phonology, grammar needs to be treated independently, and the intervention should not impact on the child's phonology. On the other hand, where speech difficulties appear to be implicated in a child's morphological errors, speech may be treated first. If a speech intervention impacts on morphology, it may be inferred that the child's morphology was a direct result of their speech difficulties. An improvement in speech that does not impact on morphology suggests that the difficulties are independent, although continuing difficulties with morphology may be due to a complex interaction between the domains. The latter is consistent with Haskill and Tyler's suggestion that difficulties in phonology and morphology are compounded. In either case, intervention should consider both domains, with specific targets depending on children's individual profiles.

As pointed out above, individual profiles of speech and language difficulties cannot be taken into account in group studies. In single case studies, on the other hand, knowledge of individual profiles allows us to determine whether specific speech difficulties lead to difficulties in grammatical morphology by treating the former and examining generalization to the latter. Where profiles reveal difficulties with grammatical morphology that do not reflect a child's speech difficulties, we would expect intervention targeting morphology directly to be appropriate. The case study reported in this article investigates:

1. the effect of a morphological intervention on a grammatical morpheme where the child can produce the requisite phonology;
2. the effect of a speech intervention on production of a grammatical morpheme that requires the phonology targeted in that intervention.

II The Study

1 Participant

At the beginning of this study, B was 5;1 years of age. He had received intermittent therapy since the age of 3;6 in the form of one-to-one clinic-based sessions and visits to his school. His case notes reveal that, initially, therapy had focused on 'developing speech sounds, while monitoring his language progress'. More recently, therapy targeted 'the use of speech sounds in short words' and 'advising school staff to work on the awareness of the use of grammar'.

Initial assessment results were consistent with a diagnosis of SLI. His non-verbal skills assessed on Wechsler Pre-school and Primary Scale of Intelligence (WPPSI-IIIUK; Wechsler, 2003) were strong (70th percentile) but he showed significant weakness in both speech and language. His results are shown in Table 1. On the Diagnostic Evaluation of Articulation and Phonology (DEAP; Dodd et al., 2002), he scored below the first percentile for percent consonants correct and used several delayed and disordered phonological processes. On a test of auditory discrimination (Vance et al., 2009) he was 1.9 standard deviations below the norm. His overall standard scores for receptive and expressive language on the Clinical Evaluation of Language Fundamentals (CELF; Wiig et al., 1992) were

Table 1 Initial assessment results

Assessment	Results
Speech-related skills:	
DEAP phonology subtest	• Percentage consonants correct: 54% (ss 3, < 1 percentile) • Percentage vowels correct: 97% (ss 5, 5th percentile) • Delayed processes: Cluster reduction, fronting of velars, weak syllable deletion, stopping of fricatives • Disordered processes: a number of sound preference substitutions e.g. [d] for /r/, [j] for /z/ or /ð/
DEAP articulation subtest	Unable to produce /s, z, tʃ, dʒ, θ, ð/
Auditory discrimination XAB task (nonwords) (Vance et al., 2009)	• SD = –1.9 Specific difficulties with: • word final position: t/k, f/s • word initial position: t/p, d/g, k/g, z/s, n/d, m/n, b/s • clusters: st/sp, sw/sl
Language-related skills:	
CELF receptive language	• Linguistic concepts: 5th percentile • Basic concepts: 25th percentile • Sentence structure: 16th percentile • Receptive language SS: 77
CELF expressive language	• Recalling sentences in context: 1st percentile • Formulating labels: 50th percentile • Word structure: 5th percentile • Expressive language SS: 75

77 and 75 (placing him in the bottom 7% and 6% respectively). He showed relative strengths on the basic concepts and formulating labels subtests but his expressive morphosyntactic skills were weak. On the Bus Story (Renfrew, 1997) he omitted determiners, made pronoun errors and omissions, and made regular and irregular past tense errors.

This profile is similar to that of children described in the introduction with weaknesses in both speech and language. Two interventions were undertaken based on his specific profile of speech and morphological difficulties. The first targeted B's problems producing regular past tenses. B could produce /t/ and /d/ but failed to do so when past tenses were required. Here, therefore, he had the appropriate phoneme but not the morpheme. The second intervention targeted plurals. B could not produce /s/ or /z/, nor could he use plural nouns. In this case, therefore, he had neither the phoneme nor the morpheme. The two interventions were carried out consecutively.

2 *Past tense*

The past tense requires final consonants /t/ and /d/. B was able to produce these on the DEAP, implying that his omission of past tense was not due to difficulties with the target phonology, at least where the past tense does not create a cluster. Therapy therefore targeted past tense marking rather than speech.

Thirty-five regular past tense verbs were selected that could easily be illustrated. B could recognize the verbs correctly in a picture-pointing task and produce the appropriate verb for each picture in an

Table 2 Production of past tense at T1, T2 and T3

	Total	Score		
		T1	T2	T3
Regular verbs: treated	25	2	20	18
Regular verbs: untreated	10	1	7	8
Irregular verbs: controls	10	1	2	4

expressive task. These verbs included 9 with vowel-final stems (e.g. *pour)*, 19 with consonant-final stems (where the past tense creates a cluster, e.g. *kick*), and 7 with stems ending in /t/ (where the past tense is the full syllable /ɪd/, e.g. *point*) (see Appendix 1). These verbs were randomly assigned to two groups: 25 in the treated group and 10 untreated. The larger treatment group was to ensure variety during the intervention. Ten irregular past tense verbs acted as controls. All but two are single syllable.

At initial assessment (T1), B produced only 3 regular past tense verbs (two with stems ending in /t, d/, one ending in /ʃ/) and 1 irregular past tense verb correctly (see Table 2), confirming his difficulty with past tense marking.

a Intervention 1: Intervention consisted of a 30-minute session each week for 10 weeks. In addition B's mother carried out one activity at home at least twice between sessions and, after the initial 5 weeks, the school carried out two activities per week.

The following intervention strategies were employed during the sessions:

1. Demonstration with role-playing of actions and visual cues (e.g. using a coloured block or hand gesture) to show that 'something' is joined to the end of a word when an action has already occurred.
2. Bombardment: Regular past tenses were used within the context of short stories read at the beginning of the first two sessions.
3. Judgment: In later sessions, role play and sentence judgment tasks were used where B had to say whether the therapist had produced the sentence correctly.
4. Production activities were used to elicit at least 20 examples of the target morpheme per session. The therapist provided a hierarchy of support (modified from Tyler et al., 2003). Initially a choice of two responses was given, e.g. *The boy jump* or *The boy jumped*. Later B was required to complete sentences started by the therapist, e.g. *The children went on holiday and … in the sand*. Finally, the therapist used the target morpheme in a sentence before asking B to use it in similar sentence, e.g. the therapist and B took turns to find hidden cards and to describe an activity that had been carried out.

b Outcomes 1: The past tense assessment was re-administered after the 10-week intervention period (T2), and again after 8 weeks without intervention (T3). The results are presented in Table 2. McNemar tests were used to compare the post-therapy and follow-up scores with those before therapy. B's ability to produce regular past tenses of treated verbs improved significantly post-therapy (chi square = 16.05, $p < .001$) and at follow-up (chi square = 14.06, $p < .001$). At T2 and T3, most verbs ending in vowels and consonants were correctly inflected, but there was no change on the verbs ending in /t, d/, which require past tense /ɪd/. Hence, most errors involved verbs ending in /t, d/, and at T3 verbs ending in /p/ were also vulnerable (see Table 3).

Table 3 Past tense errors at T2 and T3

	T2 errors	T3 errors
Regular verbs: treated	point, paint, whisper, walk, pat	point, paint, whisper, pat, clap, sail, skip
Regular verbs: untreated	plant, count, tickle	plant, count
Irregular verbs: control	Regularized 2	Regularized 2

B's scores also improved significantly for the regular untreated verbs at post-therapy (chi square = 4.02, $p < .05$) and follow-up (chi square = 5.14, $p < .05$). This shows that B had learned the rule for the regular past tense, generalized it to untreated verbs and maintained it at follow-up. He also used past tense verbs spontaneously both in and out of the therapy environment according to his teacher and his mother.

B's production of the control irregular verbs improved slightly but not significantly after therapy and at follow-up. At T2 and T3 assessments, two irregular verbs were regularized (*falled* and *blowed*).

c *Discussion*: B learned regular past tenses quite easily and this generalized to untreated verbs. Anecdotal reports suggest that he could apply the rule in non-clinical contexts. Hence, the morphological intervention was effective. Interestingly, B only generalized the past tense to two of the 10 irregular verbs (compared with 7 of the untreated regular verbs), and produced marginally more irregular forms correctly at T3. Other irregular verbs were unmarked.

His errors on regular verbs, shown in Table 3, are suggestive. Five of 8 errors at T2 and 5 of 9 at T3 occurred in verbs ending in /t/, requiring the past tense ending /ɪd/, which is developmentally the last past tense allomorph to be consolidated (Owens, 1996).

B's response to therapy suggests that his difficulties were morphosyntactic. Prior to therapy, he produced the target phonology; his speech difficulties could therefore not account for the omission of the past tense marker. Following therapy he produced untreated regular verbs correctly and spontaneously. However, an explanation based entirely on difficulties with morphosyntax is insufficient. First, the finding that he did not generalize the learned rule to irregular verbs suggests that he already knew something about their distinctive past tense marking. Second, most errors after therapy were on verbs ending in /t/. This suggests that his marking of past tense was influenced by phonological factors. Furthermore, B made the comment that *walk* and *clap* already had a /t/ and did not need another, suggesting that he was treating these like /t/ (in line with his observed difficulties in discriminating these).

3 Plural

In contrast to the past tense, the DEAP showed that B had problems with the phonology required for marking plurals. He omitted final /s/ in *house*; he also omitted final /z/ targets, but these occurred as plural markers in *gloves*, *legs*. For *scissors*, he produced [ʃɪdə], palatalizing initial /s/, stopping medial /z/, and omitting final /z/. To assess further his speech difficulties with alveolar fricatives, 54 easily illustrated nouns were selected (see Appendix 2). B was able to recognize these correctly in a picture-pointing task. While most plurals are marked by /z/, this phoneme rarely appears in any position within words. For this reason, items containing /s/ were selected for this assessment, with 24 in initial position, 6 in medial position and 24 in final position. As shown in Table 4, B approximated initial /s/ in three items, but otherwise stopped or palatalized initial and medial /s/, and consistently omitted /s/ in final position.

Table 4 Production of /s/ at T1

Word position	Total	Score	Error type
/s/ initial	24	3	all [ʃ]
/s/ medial	6	0	Stopped or [ʃ]
/s/ final	24	0	Omitted

Table 5 Production of /s/ at T1 and T2 according to treatment groups

	n	T1	T2	Error type
Final /s/: treated	22	0	22	
Final /s/: untreated	12	0	12	
Initial /s/: untreated	24	3	3	all [ʃ]
Medial /s/: untreated	6	0	0	(stopped or [ʃ])

Given his difficulties producing /s/, especially in final position, B would be expected to have difficulties with plural markers. In an initial assessment (T1), 34 familiar, easily illustrated nouns were used to elicit plurals. Twenty-four had vowel-final stems (e.g. *shoes*), and six had stems ending in voiced consonants (e.g. *dolls*), all requiring plural /z/. Four had stems ending in a voiceless consonant (e.g. *books*), requiring plural /s/. The list of plurals is in Appendix 3. B consistently omitted the plural marker (see Table 6 below).

It was evident that B lacked the phonology required for the plural, and his attempts at /s/ in initial position showed that he was struggling with articulation of this target. Therapy targeted the production of /s/, assuming that improved production of the sibilant would affect voiced as well as voiceless targets. If successful, plurals would be marked despite not being targeted by the intervention.

a Intervention 2: Since B was attempting /s/ in initial position but having difficulty with accurate production, it was decided to employ traditional articulation-type intervention techniques targeting the production of /s/ in isolation, and then in word-final position. The 24 nouns containing /s/ in word-final position in the assessment and 12 more nouns that B understood on a picture-pointing task were randomly assigned to two groups: 24 to be treated and 12 untreated. As previously, the larger treatment group was used to add variety during therapy. Intervention consisted of one 30-minute session per week for 5 weeks. Again, B's mother and school carried out one and two activities respectively during the week.

b Outcomes 2: Reassessment of /s/ in word-final position was carried out in a confrontation naming task and in an analysis of spontaneous speech after the intervention (T2) and again 5 weeks later (T3). In addition, the production of /s/ in word-initial and word-medial positions was reassessed at T2. As shown in Table 5, B produced all word-final /s/ targets correctly at T2, showing generalization to untreated items. The success of this articulatory intervention supported the decision to work on articulation. However, his production of word-initial and medial targets remained unchanged. Hence, his ability to produce /s/ accurately in word-final position did not generalize to targets in other word positions.

Table 6 Production of plural marker at T1 and T2 (after intervention for word-final /s/)

	n	T1	T2	
			Score	Errors
Stem ending with a vowel requiring /z/	24	0	3	20 marked with [d], 1 omission
Stem ending in /l/ requiring /z/	6	0	1	5 marked with [d]
Stem ending in voiceless consonant requiring /s/	4	0	4	4 marked with [s]

Table 7 /z/ production at T1

Word position	Total	Score	Error type
/z/ initial	3	1	1 marked with [d]; 1 marked with [ð]
/z/ medial	7	2	4 marked with [d]; 1 marked with [ð]
/z/ final	10	3	5 marked with [d]; 2 marked with [ð];

Since B could now produce word-final /s/, would this lead to marking of plurals? The 34 items in the plural assessment (see above) were re-administered at T2. As Table 6 shows, B now marked 33 of 34 plurals, but only 8 were phonologically correct. In the others, with one exception /z/ was stopped to [d]. Intriguingly, then, therapy targeting final /s/ had led B to mark virtually all plurals, whether these required /s/ or /z/, but correct production of /s/ had not generalized to /z/ as assumed when devising the therapy. It appears that intervention must directly target /z/ to do this.

c Intervention 3: To further assess B's ability to produce /z/, 20 nouns were selected that B recognized in a picture-pointing task. Three contained /z/ in initial position, 7 in medial position, and 10 in final position. The small number reflects the restricted use of /z/ in all positions in English (see Appendix 4). Asked to name the pictures, B marked /z/ in all word positions, but most were either stopped to [d] or fronted to [ð] (see Table 7).

Word-final /z/ was targeted in intervention as it is involved in the production of the plural. As previously, therapy consisted of one 30-minute session per week for 5 weeks, and B's mother and school carried out one and two activities respectively during the week. Initially, a minimal-pair approach was employed to highlight the contrast between /d/ and /z/ in input. During the production phase of this approach, B usually substituted [ð] for /z/. Since he rarely produced a sound that was perceived as a /z/ even in isolation, again it seemed that he had difficulty with articulation of this sound. For this reason, intervention switched to articulation of /z/ using the techniques employed with word-final /s/. After one session, B could produce /z/ in isolation but the transition to word-final /z/ proved challenging. Here B would insert /d/ before /z/. The following two sessions focused on facilitating this transition. For example, the word *rose* was broken down to *row* + *z*, and incrementally blended to form *rose*.

d Outcomes 3: B was re-assessed on the 20-word production task 7 weeks after the first assessment. As shown in Table 8, he produced word-initial and word-final /z/ correctly in every instance. His production of word-medial /z/ also improved. Again, this supported the choice of articulatory intervention.

Table 8 /z/ production at T2

Word position	*n*	Score	Error type
/z/ initial	3	3	
/z/ medial	7	5	2 marked with [d]
/z/ final	10	10	

Table 9 Production of plural marker after intervention for word-final /z/

Plural contexts	*n*	Score	Error type
Vowel-final stem requiring /z/	24	0	24 marked with [dz]
Stem ending in /l/ requiring /z/	6	0	5 marked with [d], 1 marked with [dz]
Stem ending in voiceless consonant requiring /s/	4	4	

Since B could now produce word-final /z/, would he correctly produce plurals? The plural assessment was re-administered. B's production of final /z/ did not generalize to plural markers, which continued to be stopped or realized as /dz/; see Table 9. Intriguingly, the successful therapy targeting /z/ influenced B's production of the plural inflection (it was largely now realized as /dz/), yet did not result in the fully correct production of /z/ achieved in monomorphemic targets.

III Discussion

In this article, we have described a child with deficits in both speech and language. Such children are common and it is natural that speech-language therapists should wonder about the relationship between these deficits and be concerned as to the best strategy for their treatment. Single case studies such as this one cannot solve these problems, but they can give us further insight regarding the relationship between the deficits and provide clues about possible therapies.

B could produce /t/ and /d/, but did not use them to form the past tense of verbs. In this respect, he was similar to many of the children described in Rvachew et al. (2005). Here, there appears little dilemma as to the appropriate therapy. Intervention must raise B's awareness of the past tense and his ability to use the phonological targets he already possesses to realize it. This approach was successful. After therapy, B produced the past tense of regular verbs targeted in therapy and of other untreated regular verbs and was observed using the past tense correctly in school and at home. Irregular verbs used as a control showed only a slight change.

This outcome was welcome if unsurprising. Therapy successfully linked an existing ability to produce /t/ and /d/ with a previous inability to realize the past tense. However, there are suggestions that this interpretation may be too simple as some omissions still occurred. These were mainly on verbs requiring the ending /ɪd/, which suggests that his production of the past tense remains to some extent influenced by phonology (see also Marshall and van der Lely, 2007; Song et al., 2009). His performance on irregular verbs after therapy is also curious. The occurrence of some regularization errors is consistent with his having learned a rule for the past tense and mirrors its normal acquisition (Owens, 1996). More frequently, however, he fails to mark the past tense of irregular verbs. This may reflect some latent knowledge of the exceptional nature of the past tense of these verbs despite his previous inability to realize the past tense itself.

B's difficulties with production of /s/ and /z/ were independent of morphology. In particular, he consistently omitted final /s/ and /z/. Here, the decision about therapy is less straightforward. Does

he, as with the past tense, have a morphological deficit or is this a reflection of his speech difficulty? Or do the deficits merely co-occur? An articulatory approach was chosen but was complicated because, while /z/ is the most frequent form of the plural, its occurrence is otherwise infrequent in any word position, making it difficult to work on its production. For this reason, articulation therapy targeted final /s/, assuming this would generalize to /z/. The treatment of final /s/ was effective and generalized to those plurals with the allomorph /s/. Although this did not generalize to the production of the plural allomorph /z/ as hoped, it did lead to the marking of these plurals with [d]. As with his performance with irregular verbs there is a suggestion that B knows more than we think he knows and that work on /s/ and its spontaneous generalization to use as a plural form has also prompted him to indicate, though not correctly, that a plural form was required.

The final stage of the study repeated the articulatory intervention, this time with /z/. As previously, work on final /z/ was effective and generalized to initial /z/ but unusually did not fully generalize to the plural allomorph /z/, which was now usually realized as [dz]. The failure of treatment on /s/ to generalize to the production of /z/ including plurals was unexpected; that plural /z/ was only partially responsive when /z/ was treated successfully is puzzling. On both occasions B marks the plurals showing that he knows something is required, yet neither treatment allows him to produce the fully correct form of /z/. Here difficulties with speech and morphosyntax appear to be confounded, pointing to an interaction between these.

The present investigation has been experimental but the intervention has been clinical. While single case studies do not allow us to generalize to other children, they do let us investigate the idiosyncrasies of individual cases. This study has revealed the subtle nature of the interaction of speech and language, which may vary between children with co-occurring difficulties. In these circumstances, intervention studies of groups of children may fail to detect or to allow for these differences and may hence fail to point up therapy approaches that benefit all or many of the children studied. Rather, clinicians should adapt their therapies to individual circumstances, assessing their effects as they proceed. In some cases, the choice of approach may be straightforward. Here, B responded well to the past tense intervention with generalization to other contexts. The effects of speech intervention on his use of plurals were more circumscribed, and even the gains that were achieved pose further questions about the nature of the relationship between speech and language and about the appropriate treatment in instances where both domains are impaired.

The outcomes of this study beg further questions. First, we did not investigate the effects of morphological intervention on speech: would targeting of plural markers have been effective and would it have generalized to the production of /s/ and /z/ in other contexts? Second, we suggest that further insight into the limited nature of the generalizations B made would require comprehensive in-depth assessment of B's phonological discrimination as well as speech production, and possible effects of these on his morphology. It may furthermore require longitudinal investigation of these relationships. Such research will inform the process of intervention. However, the relationship is reciprocal: outcomes of targeted intervention play a key role in understanding the 'dance' between speech and morphology in children with speech and language difficulties. The outcomes in this single-case study demonstrate that the issue of generalization is more complex than previously considered. Even when effects of intervention cross between the domains of speech and morphology, generalization may be limited in unexpected ways, and further intervention may need to target context-specific generalization both within and between domains.

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Appendix 1 Past tense verbs

Regular verbs	Irregular verbs
brush	blow
count	brake
crawl	eat
cry	fall
drop	forget
dry	make
hop	sing
jump	sit
kick	sleep
laugh	swim
melt	
paint	
pat	
pat	
peel	
play	
point	
pour	
pull	
roll	
row	
sail	
shout	
skip	
smile	
spill	
stir	
tickle	
tie	
walk	
water	
whisper	

Appendix 2 /s/ in all words positions

/s/ word-initial	/s/ word-medial	/s/ word-final
sad	dinosaur	box
salad	exercise	bus
salt	medicine	case
sandpit	princess	chase
sandwich	sausage	class
saw	trousers	dice
sea		dress
seal		face
seven		fence
sew		glass
silly		goose
sing		grass
sink		house
sit		juice
sofa		kiss
soldier		miss
soup		mouse
sour		nurse
suit		pass
suitcase		purse
summer		race
sunny		rice
supper		sauce
surf		tennis

Appendix 3 Plurals

Vowel final stems	Voiceless consonant stems
bananas	books
bees	boots
cars	chips
caterpillars	grapes
cherries	
computers	Voiced consonant stems
cows	balls
eyes	bubbles
fingers	dolls
flowers	tools
pears	whales
peas	
potatoes	
puppies	
shoes	
slippers	
strawberries	
tissues	
toes	
tomatoes	
toys	
trainers	
trees	
windows	

Appendix 4 /z/ in all word positions

/z/ word-initial	/z/ word-medial	/z/ word-final
zed	easy	buzz
zoo	crazy	cheese
zoom	dizzy	choose
	lazy	close
	magazine	hose
	puzzle	nose
		rose
		size
		sneeze
		surprise