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Case Study #4: Kirk

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(3) correct /s/ began to emerge in final consonant position, but correct /z/ did not (/z/ was as yet untrained), and (4) his percentage of Unstressed Syllable Deletion was reduced from 23 percent at the outset of management to effectively 0 percent. These data are interesting to pursue from a number of theoretical and applied perspectives. Basically here, we view these generalization probes as supportive of the construct validity of NPA procedures as well as NPA's predictive power for planning systematic management.

Some very important questions in management strategies can be approached only by careful monitoring of continuous speech data—to observe the effects of a change in one area of phonology on another area. For example, effect (2) above (the onset of Stopping of fricatives in initial position) is predicted by developmental data. We noticed also that as Toby began to include rather than delete /k/ and /g/, he sometimes used Velar Fronting (that is, [t] and [d]) for these sounds. Should a clinician allow Stopping or Velar Fronting to continue in a situation such as this, or should all sound changes be consequated? The developmental approach would argue for the former, on the assumption that a period of Stopping of initial fricatives or Velar Fronting may be a stage that is necessary for the child to pass through. Clinicians might argue for the latter, however, because of concern that in accepting the Stopping or Velar Fronting in a management setting, incorrect articulation might be being reinforced. The problem, of course, relates to the more general issue of what should be taught—and when. Our position simply is that empirical answers to such questions—such as whether the child with delayed speech must recapitulate the normal acquisition sequence—can be obtained only by tracking closely the effects of intervention as reflected in continuous speech samples.

Case Study 4: Kirk

Introduction

This last of the four case studies is adapted from a working paper completed by Rhea Paul. It was one of the first attempts to use the NPA procedure as a research tool. This extended case study is more lengthy than the previous three case studies and organized differently. It is included here because it nicely illustrates the discovery procedures that clinical researchers must undertake to more fully understand associations between speech and language.

NPA Summary Sheet

Following (page 116) is the completed NPA Summary Sheet; other data, including a description of Kirk and examples of his speech are presented within the case study.

Background and Brief Case History

Kirk was five years, nine months at the time of this study. Inspection of free speech transcripts indicated that Kirk uses a variety of phonological processes, but that his phonetic inventory is almost complete. In other words, he is not missing whole classes of sounds, but instead appears to use simplifying processes variably on a wide range of

Child Kirk DOB _____
 Age 5-9
 Sampling _____ Analysis _____
 Date _____ Date _____
 Clinician _____

NPA SUMMARY SHEET
 Shriberg and Kwiatkowski
 John Wiley & Sons Copyright 1980 NPA

PROCESS SYMBOLS
 ✓ Always Occurs
 ⊙ Sometimes Occurs
 ○ Never Occurs
 - No Data Available

Total Words _____
 Entered _____
 (A + B + C) _____

Phonetic Inventory	m	n	ŋ	w	j	p	b	t	d	k	g	h	f	v	θ	ð	s	z	ʃ	ʒ	tʃ	dʒ	l	r
Correct Anywhere →			x	x	x		x					x												
Appears Anywhere →	x	x				x		x	x	x	x		x		x	x	x							x
Glossed Never Correct Never Appears →														x				x	x		x		x	
Never Glossed; Never Appears →																				x		x		

1	Final Consonant Deletion →	○	⊙	○		○	-	⊙	⊙	⊙	⊙		✓	⊙	○	-	○	-	-	-	-	-	-	⊙
---	----------------------------	---	---	---	--	---	---	---	---	---	---	--	---	---	---	---	---	---	---	---	---	---	---	---

2	Velar Fronting	Initial →	⊙	⊙
		Final →	⊙	-

6	Progressive Assimilations	Regressive Assimilations
	<i>none</i>	<i>t/w ← d</i>

3	Stopping	Initial →	-	-	-	-	○	-	-		-	-
		Final →	-	-	✓	-	⊙	-	-	-	-	-

4	Palatal Fronting	Initial →	⊙		-	-	-	-
		Final →	-	-	-	-	-	✓

5	Liquid Simplification	⊙
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* 7	Cluster Reduction	Correct	Reduced			
	Initial Clusters →		<i>s/sk</i>	<i>s/st</i>		
	Final Clusters →	<i>st nt</i>	<i>t/st</i>	<i>d/rz</i>	<i>t/lis</i>	<i>ø/nd</i>
			<i>n/ns</i>	<i>d/ʒz</i>	<i>t/lit</i>	<i>ø/nk</i>
					<i>nd/md</i>	

8	Unstressed Syllable Deletion			
	Two Syllable		Three+ Syllable	
	<i>n</i>	<i>18</i>	<i>n</i>	<i>8</i>
	Deletions	<i>1</i>	Deletions	<i>3</i>
	% Deletions	<i>6</i>	% Deletions	<i>36</i>

Notes:

* These boxes contain only those clusters in which segments do not act as grammatical morphemes. See text, Table 7, for clusters that contain grammatical morphemes.

target sounds. This characteristic of his speech was the main criterion for choosing him as the subject for this study, because it would allow investigation of how grammatical variables interacted with his production of sounds. If he uses phonological processes variably, perhaps some grammatical contexts that increased the probability of process use could be discovered. Another reason for choosing Kirk is that he was enrolled in a speech-language program during the time his most recent speech sample was taken, so that concurrent comprehension and cognitive data were also available. ✓

Records indicated that Kirk was functioning at the late preoperational level of cognitive development at the time of the speech sample. He sorted on two dichotomies without a model, seriated five items, conserved number with a model, counted meaningfully, reproduced circles, squares, and triangles, and sequenced six pictures on a time dimension. This performance for a child of 5–9 indicates that he does not have any significant cognitive delay.

Kirk's language comprehension was tested by means of the *Miller-Yoder (MY) Test of Grammatical Comprehension* (Miller & Yoder, 1980). He responded correctly to all five-year items with the exception of negative/affirmative and singular/plural items. His *Peabody Picture Vocabulary Test* (Dunn, 1965) score yielded a vocabulary age of 6–6.

Program records also indicate that structure and function of the oral mechanism are within normal limits. He was reported to use language for a variety of functions, including commenting, directing, getting information, expressing feelings, pretending, and problem solving. Kirk appears, then, to be a normal five-year old, except in the area of language production.

General Description of Language Production

Two means were used to assess Kirk's productive skills. Miller's procedure (Miller, 1980) was applied to the transcript in order to evaluate Kirk's grammatical development. Shriberg and Kwiatkowski's *NPA* procedure (preliminary version) was used to investigate the general nature of his phonological system.

Kirk's MLU was determined to be 4.75 morphemes per utterance. This places him beyond Brown's Stage V, as one would expect for a child of his age. Structural analysis yielded conflicting results, however. The greatest number of sentences in the sample exemplified structures typical of Stage IV. Miller's mastery criterion would then place Kirk at a Stage IV level of development. This placement represents a significant (more than one stage) discrepancy from MLU. There are a few instances of Stage V structures such as past modals and emphatic *do* in affirmative sentences. He uses a few conjoined and embedded sentences, including relative clauses. No Stage V questions or negations are present. Generally, Kirk makes his sentences long by using prepositional phrases. An analysis of the 14 grammatical morphemes (Brown, 1973; DeVilliers & DeVilliers, 1973) revealed consistent use of *in*, *on*, and *ing*; absences of marking on plurals and possessives; and inconsistent use of regular past-tense morphemes, regular and irregular third-person singular morphemes, and copulas. Irregular past forms were consistently correct, however (see Table 7). Taken in conjunction with the other structural data alone, these results would appear puzzling because Kirk has failed to master some Stage II (plural) and Stage III (possessive) and Stage V morphemes, yet he performs over 80 percent correctly on articles and irregular past tenses that are placed at V. The relation of this performance to his phonological system must, then, be considered.

A Summary Sheet from the *NPA* performed on Kirk's transcription is provided on the facing page. It shows that Kirk's phonetic inventory contains correct tokens of most sounds. The low frequency of occurrence of /v/ and /z/ in initial position, where they are more likely to be correct because Kirk uses Stopping only in final position, may account for the absence of these sounds from the sample.

Table 7 Analysis of the 14 grammatical morphemes as they occurred in free speech

Stage	Morpheme	Obligatory Form	Realization	Percent Realized	
II	-ing	riding	[raɪɪŋ]	100	
II	in	in	[ɪn]	100	
		in	[ɪn]	100	
II	plurals	cheerios	[tʃeɪɪʊ]	0	
		spaghettios	[ətʃeɪɪʊ]		
		spaghettios	[ətʃeɪɪʊ]		
III	on	on	[ɔn]	100	
		on	[ɔn]		
		on	[ɔ]		
III	possessive	dad's	[dæ]	0	
		dad's	[dæ]		
V	irregular past	got	[gɒt]	100	
		did	[dɪd]		
V	article	27 instances	22 realizations	81	
		regular past	named		[neɪnd]
			turned		[tɜː]
steered	[siə]				
V	regular third person singular	makes	[meɪt]	0	
		puts	[pɪt]		
		puts	[pʊt]		
		melts	[mɛt]		
		hates	[heɪt]		
V	contractible copulas	there's	[eəd]	22	
		that's	[tæt]		
		am	∅		
		am	∅		
		am	∅		
		That's	[ɑ]		
		there's	[ɪ]		
		that's	[tæpə]		
		what's	[wʌts]		
V+	irregular third-person singular	doesn't	[dʌvnt]	0	

Kirk does make use of a wide range of simplifying processes. He sometimes deletes final /n/, /t/, /d/, /k/, /g/, /r/ and always deletes final /f/ and /v/. He sometimes uses Velar Fronting for /k/ in both initial and final position, and for /g/ in initial position. He always stops final /θ/ and sometimes stops final /s/. Few data were available for initial fricatives; Palatal Fronting sometimes operates on initial /ʃ/. Liquid Simplification occurs sometimes on final /r/ and always on final /l/. Initial sounds are infrequently replaced due to Regressive Assimilation. Initial clusters are often simplified and final clusters often undergo reduction. Six percent of Kirk's two-syllable words are subject to Unstressed Syllable Deletion, while 36 percent of the few three-plus-syllable words are reduced.

Using the NPA to Illuminate the 14 Grammatical Morpheme Analysis

One possible extension of the NPA is to use it as a tool for investigating the relation between the phonological and linguistic constraints operating on Kirk's syntactic system. The 14 grammatical morphemes provide a convenient index for studying this relationship. The question often arises in the clinic as to whether children with production problems are failing to use the grammatical morphemes because they have not yet mastered the syntactic rules for generating them or because their phonological system prohibits the morphemes from being realized. An attempt was made to use the NPA information to address this question in Kirk's speech sample.

Given Kirk's MLU and his overall level of structural development, it is not surprising that he uses the morphemes placed in Stages V and V+ with less than 90 percent accuracy. His failure to use the Stage II plural and Stage III possessive morphemes is puzzling, however, and one might be tempted to attribute the problem to the phonological rather than the linguistic system. But examining the particular phonological contexts for the morphemes in question leads one to a different conclusion.

Two contexts appear for the plural: "cheerios" [tʃi:ɔ:] and two instances of "spaghettios" [ətʃi:ɔ:]. Both are polysyllabic words and both require the /z/ form of the plural morpheme. Because /z/ is not present in the inventory, and the NPA deals with consonant deletion only in monosyllabic words, the answer to the question of phonological versus linguistic constraint on morphological development can not be determined from these instances alone. It is certainly possible that whatever Kirk is able to do with monosyllabic words might break down as the words become longer. NPA data show an increase in Unstressed Syllable Deletion from 6 percent in two-syllable words to 36 percent in polysyllables. This suggests that Kirk has trouble with phonological processing as words get longer. So the information from the plural contexts is still ambiguous with regard to the question of the primary limiting factor.

Both instances for the possessive morpheme are the word "dad's," which is simplified to [dæ]. Inspection of the NPA data reveals that most final clusters are reduced and that all final clusters containing /s/ are reduced with the exception of the words "last" and "what's." But these examples show that Kirk is capable of producing a final cluster containing /s/. Kirk's articulation of "there's" [ɛəd] is also instructive. Here he has deleted the morpheme final /r/, a process he sometimes uses in other final /r/ contexts in CVC's, and added a copula morpheme realized as Stopped [d]. There is nothing in the transcript to indicate that Kirk ever replaces /r/ with [d]. But there is ample evidence that he often stops fricatives in the final position. This example, too, implies that even if Kirk had used Final Consonant Deletion to omit the /d/ of "dad," he is still capable of adding a morpheme after the process had taken place. (Although if this had been the sequence of operations it would have produced [dæd], which would have appeared to be unmarked). Formally, NPA does not allow for rule ordering, however this kind of analysis is quite within the scope of additional context-function analyses. This sort of reasoning from the evidence is necessary to attack questions of language/speech interaction, because they are so difficult to answer directly.

A conclusion from this analysis would be that, at least in the case of monosyllabic words Kirk's phonological system would allow him to mark plural and possessives in some way. This is based on evidence from his marking of copulas with similar phonological contexts. It would seem that there is at least an interaction between the limits placed on production by the phonological and the syntactic systems. Examinations of phonological processes and morphological contexts leads to the conclusion that it is not only Kirk's phonology that keeps him from realizing early grammatical morphemes. There appears to be a linguistic constraint, as well.

The regular third-person provides a similar example. Kirk sometimes supplies the /s, z/ morpheme when a copula is required, but never adds it for the third person

singular, although the phonological contexts are exactly analogous. He realizes "what's" as [wʌts], but "puts," "makes," and "hates" are never-marked. Again it appears that there is at least an interaction between phonological and grammatical constraints, because Kirk's phonology alone does not preclude the production of marked third person singular forms.

It is also worth noting that of the copula forms that do appear, all involve some marking of the 's or *is*, while the phonologically simpler *am* never appears. This fact adds additional strength to the argument that it is grammatical, not phonological forms that Kirk is in the process of mastering.

This analysis of the relation between Kirk's phonological and linguistic system leads to the conclusion that it is not only the phonological disorder that limits Kirk's use of grammatical morphemes. Taken together with the relatively simple structure of most of his sentences, and the fact that he missed singular/plural items on the MY comprehension test, it is possible to argue that Kirk has a syntactic delay that interacts with his phonological problem to restrict his ability to generate grammatical morphemes. Using the NPA to examine the particular phonological contexts for these morphemes appears to be a very promising approach to illuminating the interaction.

Comparing Grammatical Complexity and Phonological Process Use

Another way of looking at the interaction between language and speech development is suggested by the DeVilliers and DeVilliers (1978) study of processes used in the one- and two-word stage. Their results showed that as words for which simplification processes had ceased to operate in single-word utterances were first used in two-word combinations, the old simplifying processes functioned again on words in the new structural context. One way to look at the relation between syntactic and phonological development is to examine whether the same principle applies at later stages in a phonologically disordered child. The hypothesis would be that the more complex sentences would require a greater number of simplification processes than would simple sentences. Because this study is cross-sectional rather than longitudinal, as was the DeVilliers', a distinction between *old* and *new* surface forms cannot be made. Each sentence was assigned to the highest grammatical stage that the structures within it indicated and the percentage of words in the sentence that underwent simplification processes was counted. Sentences that could not be assigned reliably were excluded. The results are summarized in Table 8. Apparently, increasing complexity of the sentence is not associated with an overall increase in the number of words that are reduced by simplification processes. An average of 51 percent of the words in Stage II sentences and 49 percent of the words in Stage III sentences were simplified while an average of only 34 percent of the words in Stage IV sentences and 29 percent of the words in Stage V sentences were simplified. It appears, then, that for Kirk, the clear sacrifice of phonological accuracy in the service of recent syntactic acquisitions does

Table 8 Analysis of grammatical complexity and simplification processes

Structural Stage	Number of Sentences	Average Percentage of Words in the Sentence That Underwent Simplification
II	9	51
III	15	43
IV	26	34
V	7	29

not operate at this later stage of language production, at least not at the rather crude level of this analysis.

An attempt was made to find a more sensitive measure with which to investigate the relation between Kirk's language and the sound system. Each word (type) in the transcript and each appearance of the word (token) was scored both for whether it underwent some simplification process (regardless of which process it was), and for the stage assignment of the sentence in which the token appeared. This method would hopefully reveal whether the articulation of particular words was vulnerable to the effects of grammatical complexity of the ambient sentence.

Preliminary inspection of the data revealed that the overwhelming majority of the tokens (92 percent) were either always right or always wrong for a particular type. This was true when the tokens appeared in a variety of sentences with a range of complexity. Again it seemed that it was not the syntax of the sentences that was controlling phonological production. A search then was made for some other explanation. The types were classified by the canonical structures utilized in the NPA and the percentage of simplification within each category was examined. Table 9 summarizes the results of this analysis.

Effect of Canonical Structure

Canonical structure may have some effect on the probability of the use of simplification process, but not as much effect as do the particular target sounds. The CV syllable, considered by Jakobson (1968) to be the most basic, is never simplified in 81 percent of the words with that structure. Of the three words (19 percent) in this category that are simplified, one contains a velar ("go") and another a fricative ("she"). Both these

Table 9 Associations among canonical structures and phonological simplifications

Canonical Structure	Number of Types	Percentage of Types Simplified		
		"Never"	"Always"	"Sometimes"
CV (all CV's)	16	81	19	0
(including only front stops, nasals, and glides)	14	93	7	0
(including velars and fricatives)	2	0	100	0
VC (all VC's)	10	40	50	10
(including only front stops and nasals)	6	67	17	17
(including fricatives and liquids)	4	0	100	0
CVC (all CVC's)	42	38	52	10
(including only front stops and nasals)	8	75	25	0
(including velar, fricative, and liquids)	34	29	59	12
clusters (in monosyllables)	23	0	87	13
polysyllabic words	18	11	78	11

sounds are variably correct, according to Kirk's NPA. The words that are always correct contain only front stops, nasals, and glides. In the case of VC's, only 40 percent of the total are never simplified. However, when these are divided into words that contain only front stops and nasals, sounds on which Kirk's simplifying processes rarely operate—versus those that contain fricatives—clearer results emerge. Of those VC's containing only front stops and nasals, 67 percent are never simplified. Of those containing fricatives, or liquids, *all* are *always* simplified. A similar finding emerges for CVC's. When taken together only 38 percent of the CVC's are never simplified. But grouping the words by the type of sounds they contain again reveals differences. The CVC's containing only front stops and nasals are much more likely never to be simplified (75 percent of the words in this group) than are those containing the velars, fricatives, and liquids (29 percent of these words are never simplified).

Monosyllable types containing clusters are always simplified in at least some of their tokens. Only 11 percent of the polysyllable words are never simplified in Kirk's transcript. It appears then that those processes that Kirk uses, Velar Fronting, Stopping, Liquid Simplification, and Cluster Reduction, operate across canonical types. Neither syntactic or syllable structure has a very powerful affect on Kirk's use of simplification.

Conclusions

This analysis shows Kirk to be a child who makes heavy use of simplification processes that operate on velar, fricative, and liquid phonemes. Neither grammatical or canonical structures interact very strongly with process use. But the phonological analysis also helps to highlight Kirk's language problems. Comparison of his 14 morpheme analysis with the NPA data indicates that he is capable of producing sound combinations similar to those required in the morphological contexts. Therefore his phonological system is not the only factor limiting the production of grammatical morphemes. This fact, combined with a structural analysis of his sentences, implies that Kirk has a productive language delay in addition to his phonological disorder.

There is no reason to believe that Kirk's pattern will be typical of all children with phonological disorders. For some children, the interactions between language and speech development, and between process use and canonical structure, may be more powerful than they are for Kirk. The purpose of this study has been to explore the use of phonological process analysis as a tool for clarifying some of the questions that arise in the clinical evaluation of children suspected of having language and speech disorders. It seems that the NPA and inferences made from it provides a very promising instrument for examining relations between and among speech and language skills—and for diagnosing language delay with greater confidence in children whose phonological disabilities make such diagnosis difficult.

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