Phonological Processes in ESL Five-Year-Olds*

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This paper reports the results of a study investigating the acquisition of the sound system by fifteen ESL five-year-olds. Segmental consonant errors drawn from speech data collected over ten months were categorized according to eight phonological processes in three categories, *assimilation, substitution,* and *syllable structure* changes. Eighty-six percent of the errors corresponded to those identified by Ingram (1979) and others as universal in first language acquisition. The author advises caution in the interpretation of this result, however, since there were certain differences in the particular errors made by the ESL learners within each category as well as processes considered universal among first language learners which were not found among the ESL learners.

INTRODUCTION

Despite the fact that no unified theory of second language acquisition is possible without a phonological component, researchers have been reluctant to study the acquisition of the sound system of a second language. There have been exceptions, of course, such as Walz's (1979) study of Americans acquiring French, Locke's (1969) study of children learning unfamiliar phones in a laboratory situation, Flege's (1980) cross-sectional investigation of adult Arabic speakers' learning of the English stops, and Nemser's (1971) discussion of approximative systems in the developing English phonology of Hungarians learning English. Still compared to the number of studies on syntactic and morphological development, the number of studies, particularly of young children, has been relatively small. There are many reasons for this apparent lack of interest, but perhaps the main one is the sheer tedium of the task. The collection of speech samples at appropriate intervals (once the researcher has determined what those intervals are), and the transcription, classification,

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coding, and analysis of the data for any appreciable number of subjects require thousands of hours of research time. The study reported here began in September of 1980 when the first speech samples were tape-recorded. The gathering of data concluded in June of 1981 and the transcription seven months later. The classification and analyses are by no means complete; preliminary findings are reported in this article.

BACKGROUND

One way of studying children's acquisition of the sound system is to examine the way in which they simplify adult target forms, i.e., how they reduce the large number of different sounds and contrasts to a number which their still-developing cognitive and articulatory systems can manage. Stampe (1969), Ingram (1979) and others, taking this approach to the study of child phonology, have identified three processes as being universal. When children say [di] for *see,* they are substituting a sound they can manage ([d]) for one which they cannot ([s]). This is an example of a *substitution* process. When they pronounce *pig* as [big] or [gig], a different process is involved. In the first case, they change only the voicing of the initial segment to agree with the others in the word and in the second they change the initial segment to match the final one. Both voicing, changing [p] to [b], and consonant harmony, changing [p] to [g] to agree with another consonant in the same word, are examples of the process of *assimilation.*

The third process involves altering the shape of the syllable. When children say [mæ] for *man* or [bok] for *broke,* they have changed the structure of the syllable, from CVC to CV in the first case and from CCVC to CVC in the second. Both the deletion of word-final segments and the reduction of consonant clusters to a single consonant are examples of *syllable structure* processes.

If these processes are truly universal, as seems to be the case (see Ingram, 1979 for a description of evidence from various languages), then it would be reasonable to expect to find them operating in the speech of young children learning a second language. The study reported here investigated the acquisition of the English sound system by fifteen kindergarten-aged children in an attempt to discover whether the patterns they used in simplifying the target language forms were similar to those described above.

Perhaps it is appropriate to add a note here regarding the selection of five-year-olds rather than younger (or older) children for the study. The distinction is often made between the simultaneous and successive acquisi-

tion of two languages. While it is impossible to set with any degree of certainty an age at which children's first language is sufficiently well developed that their learning of a second language is truly distinct from the acquisition of their first, many researchers consider that age to be around three years. McLaughlin, for example, considers the acquisition of two languages to be simultaneous if the second is introduced before the age of three and successive if introduced later (1978, p. 99). It is fairly safe to assume that children of five are truly learning a second language rather than acquiring two languages simultaneously. Nevertheless, as parents and teachers know, five-year-olds have not yet acquired all of the structures of their first language, not even all of those of the sound system. Templin (1957) presents data which indicate that a child's mastery of vowels and diphthongs is virtually complete by the age of three, but that full articulatory control of consonants may not be attained before the age of six. Indeed, there are still certain mismatches with the adult forms apparent in the speech of five-year-olds, indicating that at least some of the earlier used simplification processes may still be in place. Even if they are not, they have only recently been abandoned and might reasonably be expected to reappear as the child takes up the task of learning a new phonological system.

In studying the acquisition of the English sound system by five-year-old children with various first languages, several questions were posed (see Piper, 1983). Three are addressed in this article:

1. What kinds of mismatches occur between the pronunciation of ESL learners and that of native English speakers?
2. Do these mismatches correspond to those of children learning their first language?
3. Do the types of mismatches change over time, i.e., as the learners improve, do their patterns of simplification change?

METHOD

Subjects

Fifteen children about to enter kindergarten were selected according to the following criteria:

1. No English was spoken by the parents;
2. The child scored 3 or less on the *Bilingual Syntax Measure* (BSM) (Burt, Dulay, and Hernandez, 1975);
3. The child was willing to participate, i.e., to wear the Lavallier microphone.

The subjects represented six first language backgrounds including Por-

tuguese (4), Vietnamese (2), Chinese (5), Punjabi (2), Serbo-Croatian (1), and Italian (1). The children attended a non-ESL kindergarten for two hours each day and spent an additional 45 minutes with an ESL teacher who worked on oral language development through songs and games but did no formal, structured language activities. Children ranged in age from 4:6 to 5:2 when the investigation began in September.

Procedure

Subjects were tape-recorded once every two to three weeks from the first week in September until mid-June. Each taping session after the first was a combination of conversation with the investigator (including answering questions from the BSM) and free speech recorded as the children went about their normal kindergarten activities wearing the Lavallier microphones. Because most of the children were true beginners in English when the study began, the initial sessions sometimes yielded only about 50-100 words, but this amount of data contained a great deal of information about the child's developing phonological system.

Organization of data

The cassette tapes for each session were re-recorded onto reel-to-reel tape for ease of transcription and to provide an easily accessible chronological record for each child. Two paid assistants transcribed the tapes into standard orthography and a trained phonetician, working from the tapes and orthographic data, transcribed them into close phonetic notation.

The phonetic transcripts and tapes were examined for deviance from the target forms. Since children normally have little difficulty with vowels (Templin, 1957; Locke, 1969), and because preliminary analysis of these data showed that subjects had little difficulty with English vowels, only the consonant sounds were categorized. Pronunciation which matched any known dialect of English was accepted as conforming to the target because of the wide variety of North American and British dialects with which the children came into contact within their community. Each mismatch was categorized first according to the target sound affected and then according to the phonological process which seemed to be involved (listed in Table 1). These processes were those identified by Ingram (1979).

ANALYSIS

The number of mismatches attributable to each phonological process was counted and then calculated as a percentage of the total mismatches

which occurred during the entire sampling period. In addition, the mismatches for the first month of sampling and for the last month were computed separately and then compared using *t*-tests on means and chi-square tests on proportions. These latter measures were taken to assure that the patterns of error production had not changed over time and that it was safe to consider developmental data as essentially static.

RESULTS

All *t*-tests and chi-square tests were statistically non-significant as expected, suggesting that most processes operating in September were still operating in June. The findings are, therefore, described and discussed in terms of the entire body of data collapsed over time.

A total of 3293 segmental consonant errors were identified and categorized. Table 1 shows the percentage of errors falling into the three major categories of phonological processes described above and the breakdown for each subcategory. These three processes accounted for 86% of the errors identified.

Assimilation

Assimilation was the most common process describing the subjects' simplification of the target forms. Of the 43% of mismatches resulting from assimilation, nearly all involved devoicing (40% of the total errors). The segments most often devoiced were fricatives in the word-final position. Thirty-six percent of all errors fell into this category. Most were devoiced [z] ([s]) but devoiced [v] ([f]) occurred in most subjects as well. Voicing, consonant harmony, and idiosyncratic assimilation processes accounted for the remaining 3% of errors attributable to assimilation.

Syllable Structure Processes

Syllable structure processes accounted for 26% of the subjects' mismatches. The most common syllable structure process found was the deletion of word-final consonants. All subjects exhibited this behaviour and it accounted for more than 20% of the total errors. The sounds most often dropped in the word-final position were stops, as in [hæ] for *hat,* but fricatives, as in [no] for *nose,* and resonants, as in (ba:) for *ball* were also affected.

Cluster reduction occurred in all subjects and accounted for 4% of total errors. The common pattern of reduction was to drop the resonant in clusters such as *gl-* or *sn-* and the stop in clusters such as *sk-*. Thus *glow* and *snake* became [go] and [sek] while *skate* became [set]. Three-consonant clusters were relatively rare in the corpus, but the general pattern was to delete the middle segment, thus producing, for example, [hols] for *holds*.

Table 1

Percentage of Errors by Phonological Process

PROCESSES	NUMBER OF SUBJECTS	NUMBER OF INCIDENTS	% OF TOTAL ERRORS
Assimilation			
1. devoicing	15	1311	40
2. voicing	11	26	1
3. consonant harmony	7	16	1
4. miscellaneous	8	27	1
TOTAL		1380	43
Syllable Structure			
1. WF deletion	15	656	20
2. cluster reduction	15	129	4
3. miscellaneous deletion	15	77	2
TOTAL		862	26
Substitution			
1. stopping	15	411	12
2. fronting	15	143	4
3. gliding	13	22	1
TOTAL		576	17
Miscellaneous	15	475	14
		3293	100

Substitutions

Substitutions accounted for 24% of subjects' mismatches with target forms. The majority of these substitutions involved stopping and the most frequently affected segments were the interdentals. Thus [θ] and [ð] were realized as [t] or [t̪] and [d] or [d̪]. Only 5% of all stopping mismatches involved segments other than the interdentals, and fewer than half the subjects made such errors.

A second substitution process exhibited by all subjects was fronting. Fronting involves a child's replacing a velar consonant with an alveo-palatal or alveolar consonant or, less often, an alveolar with a labial. The segments most often affected were [g] (pronounced [d]) and [k] (pronounced [t]).

Gliding, i.e., the substitution of [w] or [j] for [l] or [r], was not a common process among the subjects, accounting for less than 1% of the mismatches. Substitution of [w] for [r] was slightly more common than for [l], and there was very little substitution of [r] for [l] or vice versa.

Included in the miscellaneous category were those mismatches which did not fit into the categories listed above and did not occur with any degree of consistency among subjects. These idiosyncratic mismatches accounted for only 14% of all errors identified.

DISCUSSION

Perhaps the most compelling result was the small number of errors made by the children. Throughout the study, everyone involved in the research commented on the native-like pronunciation of most of the young subjects. The analysis of their speech confirmed these observations and those of educators and parents that children of five and six are excellent mimics. The mismatches which did occur, however, offer some intriguing insights into the acquisition of a second language phonology and its relationship to first language acquisition. They also raise questions which must be addressed by this researcher using these data and by other researchers in other studies.

On the surface, it would appear that the processes governing the phonological development of five-year-old ESL children and of younger native-language learners are essentially the same since 86% of the errors made by the former group are known to characterize the speech of the latter. This interpretation, however, must be accepted with caution for there are certain differences in the particular processes within each major category. Moreover, there are processes considered universal in first language learners which were not found with the ESL children.

Ingram considers the processes of voicing and devoicing under the same heading, "Voicing," and notes that "consonants tend to be voiced when preceding a vowel, and devoiced at the end of a syllable" (Ingram, 1979, p. 137). The ESL children exhibited both processes, but the overwhelming majority of mismatches occurred because of the devoicing of word-final fricatives. It seems to be the case that first language learners normally devoice stops as well as fricatives (Ingram, 1979, p. 137). To claim, then, that the voicing assimilation behaviour of the ESL and the first language learner is isomorphic would be a misinterpretation of the data, particularly as the devoicing of word-final fricatives is a feature of the adult speech of some dialects of English (Nemser, 1971, p. 121).

An obvious question arises concerning the relationship of devoicing behaviour to the acquisition of the plural and possessive morphemes. While much work remains to be done in this area, initial examination of the data reveals little interaction. The devoicing of word-final [z] occurred in most subjects before the appearance of plural morphology and was generalized to the plural marker once it appeared. Thus *nose* was commonly pronounced as [nos] at a stage when *birds* was [bə^d] or [bə^t]. The plural marker appeared, in some subjects at least, first as [z] but very shortly became [s], suggesting that the phonological process may have dominated the morphological and not vice versa.

Consonant harmony is an assimilation process which is common in first language learners but was found only rarely in ESL learners, a finding which may be related to the stage at which certain consonants are acquired. Menn (1975) suggests that consonant harmony may be related to a strength hierarchy in which weaker consonants in the child's repertoire assimilate to stronger ones. If so, then it would be reasonable to expect less incidence of consonant harmony in children who had already acquired a large number of consonant sounds. In other words, there are for the ESL children fewer weak consonants to become homorganic with the stronger ones. Other linguists have suggested that consonant harmony is related to individual phonological preferences and may, therefore, differ among language groups or even individual children. This view certainly must be considered in evaluating the data reported here.

Certain phonological processes are employed by children to simplify syllable structure. Ingram reports, of first language learners, that "the reduction of clusters is one of the most widespread processes observed" (1979, p. 140). Cluster reduction was not, however, a widespread process among the ESL learners. Far more common was the deletion of final consonants, reducing a CVC syllable to CV. Moreover, deletion of unstressed syllables and reduplication, both widely found in first language learners, were absent in the ESL children. Because the ESL children are

older than the first language learners, it is to be expected that they will exhibit less syllable simplification since they are capable of producing more complex forms. The reasons for their particular type of syllable simplification are less clear. The pronunciation of *sleep* was quite regularly [sli] and *broke* became [bro]. These examples suggest that clusters are easier to produce than syllable-final consonants, a notion which runs counter to intuition and to most first language data. It is possible that the problem is perceptual rather than productive, i.e., that because of the normal tendency of native speakers to devoice word-final consonants, they are simply not heard by the children. Another possibility relates to the syllabic structures of the children's native languages. Both possibilities require further investigation.

While the substitution of stops for fricatives was fairly common among the ESL learners, the process was limited mainly to the articulation of [ð] as [d]. Few instances of stopping for [š], [s], [f] or other fricatives were found, probably because [ð], which occurs relatively rarely in languages of the world, is acquired rather late. Another possibility is that a different phonological process is involved. Closer examination of the data revealed that many subjects who substituted [t] or [d] for [θ] and [ð] did so following an interim period during which they substituted [t̪] and [d̪] or [θ] and [ð]. They seemed to move away from the target sound systematically according to the place of articulation rather than manner (see Piper, 1982 and Piper, 1983 for a full discussion of this process). Further support for this interpretation is given by the fact that some subjects substituted [s] and [z] for the interdentals. A more tenable interpretation of the data might be that the process involved in substituting dental or alveolar stops for interdental fricatives is "dentalization" rather than stopping.

Gliding, the substitution of [w] or [j] for [l] or [r], was found only occasionally in the data, but there is some doubt about the universality of this process. Although the process is common among first language English learners, Ingram reports that an examination of data from seven French first language learners revealed no instances of it, suggesting "that the substitutions are significantly influenced by the child's phonological system, not just by universal tendencies" (1979, p. 136).

While Ingram was referring only to the child's native language phonology, his point has particular relevance for the interpretation of these results. The children in this study had not one, but two phonological systems. In examining the universality of the processes involved in the acquisition of the second language phonology, I have necessarily ignored the influence of the first language phonology. Future research, however, will have to at some point examine *both* the L1 and the L2 sound systems as well as universal tendencies in order to better understand the L2 child's

deviation from the English target forms. Only then will the relationship between the acquisition of the first and the second language phonology become clear.

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