SOCIAL LEARNING AND THE TRANSITION FROM BABBLING TO INITIAL WORDS*

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SUMMARY

The effect of four social learning conditions on early language development were explored, along with comparisons between learning whole words and learning the component sounds of the words.

Twenty male and female infants at the age of transition from babbling to initial word usage (9-15 months) were assigned to one of four learning conditions or a control group. Training on vowel and consonant sounds and short words formed from the sounds resulted in performance gains in three conditions involving vocal modeling by the E, but no gains in an operant conditioning procedure. Increased word usage occurred in the first few sessions, with no indication that this increase was preceded by improvements in utterance of the component sounds during the study.

A. INTRODUCTION

Writers on language development have emphasized several different processes to account for the infant's transition from babbling to initial word usage. Selective reinforcement of the infant's babbling sounds that resemble words or parts of words has been described as a principal learning process by several writers (e.g., 8, 10). While this impression has been based primarily on naturalistic observations of infant-adult interactions, it gains support from operant conditioning studies of younger, 3-month-old infants demonstrating that reinforcement, such as an adult's smile, touch, and vocal response contingent on the infant's vocalization, increases the rate of infant vocalization (1, 9, 11, 12, 13).

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A variation on this operant conditioning pattern occurs when an adult immediately imitates the vocalization that the infant has uttered, with the adult's response sometimes changed slightly toward adult language use. Writers such as Olmsted have described this process and have suggested that it both reinforces the infant's vocalization and provides him with an example to imitate. With 3- to 6-month-old infants, Haugan and McIntire (3) found this procedure increased vocalization rates more than the use of touch or food reinforcement did.

Apparently every student of language development attributes some influence to imitative learning, although the degree of influence varies considerably for different writers. The role of imitative learning is stressed by writers with a learning orientation and minimized by more mentalistic writers.

In one of the very few experimental studies of imitative learning in early language development, Dodd (2) modeled consonant phonemes paired with vowels for 9- to 12-month-old infants in a 15-minute presentation. Spontaneous vocalization was recorded for 15 minutes before and after the presentation. In the 15-minute period following the presentation there was an increase in the number of spontaneously uttered consonants but not in the number of different consonants. Thus, there was little indication of a modeling influence on babbling of these syllables, but a 15-minute presentation of 14 different consonants paired with three vowels constitutes a minimal training period.

Another point on which learning theorists have differed from the mentalistic theorists concerns the role of babbling in initial speech development. While the former see initial words as evolving from babbling sounds through the effects of the learning processes described above, writers such as McNeill (7), Lenneberg (5), Jakobson (4), and MacNamara (6) emphasize innate and maturational aspects of babbling and tend to view initial words as resulting from the child's abstraction of semantic and phonological aspects implicit in language, rather than viewing words as having developed from the individual sounds in babbling.

While the transition from babbling to initial word use is a unique stage in language development, there is minimal experimental research to complement the naturalistic observations of this stage. The present study was intended to demonstrate the effects of operant conditioning, vocal imitation, modeling, and modeling plus reinforcement as learning strategies for increasing the use of consonant and vowel sounds and simple words formed from these sounds.

A second purpose of the present study was to compare the learning of consonant or vowel sounds and the learning of simple words. While current theories don't make clear predictions possible, learning oriented writers imply that the infant's progress in vocalizing particular sounds should precede and facilitate the use of words formed from those sounds. The more mentalistic writers imply that vocalization of particular sounds by the infant would be of little relevance, but the infant should be influenced by the presentation of words, because words are more meaningful and language use begins as an effort at meaningful communication.

B. Method

1. Subjects

The Ss were 20 infants, 10 between 9 and 12 months of age at the beginning of the study, and 10 between 12 and 15 months. Half of each age group was male and the other half was female. The infants were studied at one of three urban day care centers, or in a research trailer located near their home in a married student housing complex. The Ss were from middle and lower socioeconomic status families. The infants were screened in order to match those with atypical births, poor health, bilingualism, or non-English speaking families. One male and one female (ages 9-12 months) and one male and one female (ages 12-15 months) were assigned to each of the four experimental groups and one control group before they were seen. Each of the E's who worked with different infants was an adult female.

2. Procedure

Familiarization of infants with E's was arranged to precede the beginning of actual research. The E visited the infants' play area several times, held them, and smiled at them. This period ended with the E taking the infant on one or more preliminary visits to the research room.

In both familiarization and experimental sessions the research room was equipped with colorful toys (plastic rings which stack around a pole, small plush milk bottles, a ball with fingerlike projections) to which the E handed the infant noncontingently in order to minimize restlessness and distress. The E remained close to and generally in front of the infant if it moved about the room. If an infant was fussy, the sessions were discontinued briefly or postponed until a different day. Sessions were conducted at times when the infant was not typically hungry or sleepy. With these exceptions the E responded to the infant only as required by differing experimental treat-
ments. The sessions were spread over at least a five-week period, and the time span was lengthened in some cases by temporary illnesses of the infant.

a. Beginning rates. Fourteen-minute samples of the infant's vocalizations were tape-recorded over three occasions on at least two separate days.

b. Learning sessions. The vocalization of consonant sounds, vowel sounds, and words (Table 1) was observed in four learning groups and a control group. An infant who failed to emit at least 10 sounds from those listed in the beginning 42 minutes of recording would have been omitted from the study, although none of the infants failed to meet this criterion. The learning sessions generally occurred over a three-week period with three 14-minute sessions per week on at least two separate days.

(1). Operant conditioning. For the four infants in this condition each utterance of the listed phonemes or words by themselves or as part of other sounds was followed by the E's immediate reaction with the simultaneous response of a broad smile, and a verbal response (that's good, good baby, clever boy or girl). This procedure is similar to that of Rheingold et al. except that touching was omitted in the present procedure in order to increase comparability of learning treatments.

(2). Vocal imitation. In this condition each utterance of the phonemes or words was followed by the E's immediate imitation of the infant's response. If the infant's vocalization was a compound one, only the listed sounds were imitated by the E. To avoid a circular reaction pattern the E did not imitate any repetition of a sound by the infant that occurred within 15 seconds of the E's previous imitation of that particular sound.

(3). Modeling. In this condition the E modeled each of the phonemes and words seven times during each session, allowing a pause of at least five seconds between utterances. The E selected from left to right as she modeled the listed sounds, so that the infant heard first the consonant sound, then the vowel sound, and then the combination of this into the simple word of two identical syllables.

<table>
<thead>
<tr>
<th>Consonants</th>
<th>Vowels</th>
<th>Words</th>
</tr>
</thead>
<tbody>
<tr>
<td>(d)</td>
<td>(oe)</td>
<td>da-da</td>
</tr>
<tr>
<td>(b)</td>
<td>(ai)</td>
<td>by-by</td>
</tr>
<tr>
<td>(m)</td>
<td>(a)</td>
<td>ma-ma</td>
</tr>
<tr>
<td>(g)</td>
<td>(o)</td>
<td>go-go</td>
</tr>
<tr>
<td>(p)</td>
<td>(u)</td>
<td>up-up</td>
</tr>
<tr>
<td>(h)</td>
<td>(ie)</td>
<td>he-he</td>
</tr>
</tbody>
</table>

(4). Modeling and social reinforcement. In this condition the procedure was the same as for the modeling condition, except that each instance of the infant imitating the E during the pause immediately following her vocalization was followed by the E smilingly repeating the vocalization and adding a comment of verbal praise as in the operant conditioning group.

(5). Control group. The procedure for this group was identical to that of the learning groups, except that instrumental music was played in a one-minute-on, one-minute-off pattern during each “treatment” session in place of any reinforcing or modeling response from the E.

c. Ending rates. The procedure described above for beginning rates was repeated.

C. Results

The mean rates with which the infants in the learning conditions and the control group uttered the consonants, vowels, and words initially and during training are shown in Table 2. Also shown are the mean ranges of sounds used by the infants, out of the 18 possible sounds, during the initial three sessions and during the last three training sessions.

Comparisons (independent t tests) between the training session performances of the infants in the operant conditioning group and those in the control group did not indicate any significant differences between the two groups or the total number of utterances. This held true whether the comparisons were based on the total utterances of vowels, consonants, or words from the 18 sounds under study. In the range of different sounds used, there was not a statistically significant increase from the three base-rate sessions to the last three training sessions for vowels, consonants, or words (dependent t tests). Comparisons between beginning, training (last three sessions), and ending rates of utterances did not yield significant differences.

Comparisons between the training session performances of the infants in the vocal imitation group and those in the control group did not indicate any significant differences in the utterances of vowels, consonants, or words. In the range of different sounds used, there was a significant increase in words used: $t = 2.61, 3 df, p < .05$ from the base-rate sessions to the last three training sessions, but the increases for vowels and consonants were not significant. Comparisons between beginning, training, and ending rates of utterances did not yield significant differences.

The infants in the modeling group performed at a significantly higher level than the control group in utterances of vowels ($t = 2.15, 6 df, p < .05$), consonants ($t = 2.26, 6 df, p < .05$), and nearly so for words ($t = 1.95, 6 df, p = .11$). In addition, the infants in the modeling condition showed a sig-
significant increase in the range of words \( t = 2.35, 3 \, df, p < .05 \), vowels \( t = 3.66, 3 \, df, p < .05 \), and consonants \( t = 3.3, 3 \, df, p < .05 \) used, from the base-rate sessions to the last three training sessions. Comparisons between beginning, training, and ending rates of utterances did not yield significant differences.

The infants in the modeling and social reinforcement group performed at a significantly higher level than the control group in utterances of words \( t = 3.83, 6 \, df, p < .05 \) but not in utterances of vowels, or consonants. The infants in this condition did not show a significant increase in the range of words, vowels, or consonants used. In comparisons between beginning, training, and ending rates of utterances the only significant result was that the ending rate of vowel utterances for this group was lower than the beginning rate \( t = 11, 3 \, df, p < .05 \).

As is clear from Table 2 the performance of the infants in the vocal imitation condition was comparable to that of the modeling condition infants. However, there was less variability within and between infants in the modeling condition, making it easier to demonstrate statistically significant effects in that group. Despite the precautions taken, considerable variability within and between infants was quite evident during the weeks of the study.

In comparing the utterances of consonant and vowel sounds to the utterances of words, different trends are evident during training. Across the four learning conditions there was an increased use of consonants from a mean total of 52 utterances per infant for the first three training sessions to a mean total of 68 for the last three training sessions. [The modeling plus social reinforcement condition provided an exception with a decrease \( t = 3.03, 3 \, df, p < .05 \) in consonant utterances from the first three to the last three sessions.] Vowel utterance increased in all but the modeling plus social reinforcement condition, with the mean across the four learning conditions increasing slightly from 88 utterances per infant for the first three training sessions to 99 for the last three training sessions. Word usage followed a different pattern. In all four learning conditions the highest rate of word usage occurred across the first three training sessions, with a mean total of 45 words per infant, and a lower rate occurred across the last three sessions, with a mean total of 29 words. This was statistically significant for the modeling plus social reinforcement condition, where the rate of word usage increased \( t = 9.80, 3 \, df, p < .05 \) from a mean of 14 per infant for the beginning rate sessions to a mean of 34 for the first three training sessions, and then decreased \( t = 3.32, 3 \, df, p < .05 \) to 18 for the last three training sessions.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Base rate</th>
<th>Training</th>
<th>Base rate</th>
<th>Training</th>
<th>Base rate</th>
<th>Training</th>
<th>Base rate</th>
<th>Training</th>
<th>Base rate</th>
<th>Training</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operant conditioning</td>
<td>16.2</td>
<td>18.8</td>
<td>54.7</td>
<td>34.2</td>
<td>52</td>
<td>32.7</td>
<td>85.0</td>
<td>10.0</td>
<td>111</td>
<td>11.1</td>
</tr>
<tr>
<td>Vocal imitation</td>
<td>10.5</td>
<td>11.5</td>
<td>51.5</td>
<td>81.5</td>
<td>32.2</td>
<td>85.4</td>
<td>11.4</td>
<td>11.4</td>
<td>108.9</td>
<td>11.1</td>
</tr>
<tr>
<td>Modeling and social</td>
<td>13.2</td>
<td>16.4</td>
<td>68.6</td>
<td>68.6</td>
<td>35.2</td>
<td>35.2</td>
<td>28.8</td>
<td>28.8</td>
<td>24.5</td>
<td>23.8</td>
</tr>
<tr>
<td>Reinforcement</td>
<td>14.2</td>
<td>24.0</td>
<td>81.2</td>
<td>91.2</td>
<td>24.5</td>
<td>24.5</td>
<td>55.5</td>
<td>55.5</td>
<td>35.2</td>
<td>35.2</td>
</tr>
<tr>
<td>Comparison group</td>
<td>7.0</td>
<td>6.2</td>
<td>70.5</td>
<td>70.5</td>
<td>23.8</td>
<td>23.8</td>
<td>6.8</td>
<td>6.8</td>
<td>32.2</td>
<td>32.2</td>
</tr>
</tbody>
</table>
Summing the data across learning conditions and comparing the training session performances of males and females did not yield any indications of sex differences for words, consonants, or vowels (independent t tests). An identical comparison of the performances of 9- to 12-month-old infants with the performances of 12- to 15-month-old infants indicated that the older infants tended to utter more vowels ($t = 1.43$, $14 df$, $p < .10$) and consonants ($t = 1.52$, $14 df$, $p < .10$), but there was little difference for words ($t = .01$).

D. Discussion

The results of the present study provide several implications regarding the learning strategies considered as influences in initial language development. A somewhat surprising finding is the minimal effectiveness of the operant conditioning procedure. The present study differs from the conditioning studies with 3-month-old infants in several ways that may account for the different results. One difference is that the present procedure involved a greater time span than any of the previous studies. A consistent social reinforcement procedure may be more effective in the 20 minutes or so of training used in some of the previous studies than it is in a longer procedure. The present Es sometimes commented on decreasing interest in some infants, an effect that might partially counteract the advantages of longer training. It may be that the more varied and intermittent responses of adults in natural situations would not be as likely to decrease in effectiveness. Along with this are evident differences in what may hold the interest of a 3-month-old in a crib as compared to a 9- to 15-month-old more able to move about and actively choose his activities. Finally, the present results focus on the effect of contingent social reinforcement on particular sounds, while the earlier studies looked only at increased rates of vocalization.

It was possible to show some statistically significant training session increases in either rate of use of the 18 monitored sounds or the range of these sounds used, in each of the three learning conditions involving imitation or modeling by the E. There are at least two aspects of these conditions which differ from the operant conditioning procedure, in addition to the obvious procedural differences. The verbalizations of the $E$ range up to 18 different sounds as compared to the two or three in operant conditioning. In addition several writers have pointed to indications that infants have some difficulty in discriminating between sounds and sometimes utter different sounds interchangeably as if they were equivalent. It may be that the vocal imitation, modeling, and modeling plus social reinforcement conditions, each of which involved over 1000 vocalizations of the monitored sounds by the $E$ may assist the infant in discriminating these sounds from others. These effects would occur as well in typical adult-infant interaction in home or infant care settings, although the range of sounds would be wider and the sounds would not be repeated as often or as distinctly.

While comparisons between conditions are not well justified without more closely equating the procedures, it is interesting that the mean performances in the vocal imitation condition were comparable to those of the modeling condition, even though vocal imitation involves imitating the sounds used first by the infant rather than the presentation of all 18 sounds. It is surprising also that the modeling and social reinforcement condition yielded fewer significant improvements in performance than did modeling only. Additional comparisons among these learning strategies are needed.

In comparing the training session performances of words, vowels, and consonants, there is no indication that increases in the rate or range of vowel or consonant sounds preceded increases in the words formed from the sounds. Instead increased word usage was most evident in the first three training sessions. It is quite possible of course that most of the infants had already uttered the sounds involved, so that they were ready to say the words with minimal training. A few of the infants were known to have said a few of the words in the presence of their parents or teachers prior to the study, while some infants began to use their first words during the weeks of the study. The early increase in the use of words, as compared to the more simple vowel and consonant sounds, provides tentative support for the reasoning of the mentalistic theorists that the meaningfulness of words is significant, to the infant in the transitional stage, beyond the influence of the learning conditions involved in the present study. This assumes, of course, that the infants had already learned something of the meaning of the simple words included in the study.

References

COGNITIVE STYLE IN RURAL PRESCHOOL GUATEMALAN CHILDREN: A SERENDIPITOUS FINDING*1

Dartmouth College, Institute of Nutrition of Central America and Panama, and University of California, Santa Barbara

FREDERICK J. MORRISON, CHARLES YARBOROUGH, ROBERT E. KLEIN, AND ROBERT LASKY

SUMMARY

The present study was designed originally to investigate the nature and distribution of impulsive versus reflective conceptual tempo in a sample of rural preschool Guatemalan children. Accordingly, a total of 1484 children three to seven-years-old were administered age- and culture-appropriate versions of the Matching Familiar Figures Test (MFF) and the Embedded Figures Test (EFT). Surprisingly, it was found that response time correlated more highly with the difficulty level of items within a test than with accuracy. This response-time-item difficulty correlation, termed "MODIFIABILITY," was a better predictor of accuracy than was response time alone. The previously reported stability of conceptual tempo was re-examined and it was suggested that the tendency to be impulsive or reflective may be more dependent on task or other situational variables than on some enduring stylistic disposition.

A. INTRODUCTION

Over the last decade, a large body of work has emerged documenting the importance of stylistic or tempo variables on cognitive performance. (1). One of the most widely used senses of the term "cognitive style" refers to the tendencies of "impulsivity-reflectivity," specifically the tendency for children when faced with stimulus or response uncertainty to respond quickly and make many errors (impulsivity) or to respond slowly and make fewer errors (reflectivity). It has been reported that children aged 5 to 11 show...