Speech as Reinforcing Stimulation for Infants

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Infants 5 to 15 weeks of age were exposed to one of four experimental conditions that involved (a) the presentation of natural speech stimuli contingent on the infants' nonnutritive sucking, (b) the withdrawal of speech stimuli contingent on the infants' nonnutritive sucking, (c) the noncontingent presentation of speech stimuli, and (d) no speech stimuli. Only the presentation of speech stimulation contingent on the infants' nonnutritive sucking resulted in a significant change in the rate of such sucking compared to infants receiving no sound stimulation.

On the basis of Siqueland and DeLucia's (1969) demonstration that visual feedback of nonnutritive sucking was effective in supporting motivated exploratory behavior with young infants, Eimas, Siqueland, Jusczyk, and Vigorito (1971) adapted the paradigm for use with auditory stimulation. Since then, the technique, termed the high-amplitude sucking paradigm, has been used increasingly to assess infants' discrimination of speech stimuli.

The observed increase in infants' nonnutritive sucking following the introduction of response-contingent stimulus presentation is thought to be attributable to the reinforcing properties of the speech stimulus, and the subsequent decrease in sucking to the eventual attenuation of these reinforcing properties through repeated exposure of the stimuli (Eimas et al., 1971). Nevertheless, it has not been possible to evaluate these claims adequately within the context of the discrimination experiments. Accordingly, the present investigation sought to clarify the role of reinforcement and contingency in the auditory application of the high-amplitude sucking paradigm. The investigation was modeled after the conditioning procedures of Siqueland and DeLucia (1969).

Thirty-two infants 5 to 15 weeks of age (mean age = 8.7 weeks) were randomly assigned to four independent groups, each with eight subjects. The testing session consisted of 17 minutes divided into a 1-min baseline period, a 6-min conditioning period, a 4-min extinction period, and a 6-min reconditioning period. For all four groups, the baseline as well as the extinction periods were identical in that no sound was presented. During the conditioning and reconditioning periods, however, the following conditions prevailed. For the sound initiation group each high-amplitude suck provoked the occurrence of a single speech sound, provided that a sound was not already playing. The sound initiation group was thus modeled on the contingency conditions of the high-amplitude sucking paradigm and could be expected to increase its rate of sucking if the sounds were reinforcing. For the sound termination group, stimuli were presented except when the infant emitted a high-amplitude suck, in which case a 2-sec period of silence ensued followed by a resumption of the sound. If the sounds were reinforcing, then this group could be expected to reduce its rate of sucking compared to baseline levels. The sounds heard by the first four subjects in the sound initiation and sound termination conditions were recorded and replayed to a third group of subjects, the yoked control group. Thus for these subjects the presentation of sound was independent of their sucking behavior. To obtain information about sucking behavior in the experimental environment, a fourth group of subjects, the no-sound control group, received no sound at all for the entire testing session. Natural speech stimuli were used, with half of the subjects in the sound termination and sound initiation groups receiving ba throughout the testing session, the other half receiving pa. The speech stimuli, each 500 msec in duration with 500-msec interstimulus intervals, were played at 65–68 dB (A) against a background noise level of 35 dB.

The apparatus was similar to that described by Trehub and Rabinovitch (1972), consisting of a blind nipple attached to a pressure transducer that fed into a polygraph recorder. A criterion level on the polygraph was adjusted individually so that each infant's rate of high-amplitude suck-
Infants' high-amplitude sucking regulated the output of a tape recorder in accordance with the appropriate experimental condition. A second tape recorder was used to furnish yoked tapes for the yoked control group.

The mean number of sucks per minute across the 17 minutes for each of the four conditions is shown in Figure 1. Since 3 of the 32 subjects only completed 15 of the 17 minutes, data analysis was restricted to 15 minutes for all subjects. A two-way analysis of variance (Group x Minute) revealed a significant group effect $F(3, 28) = 3.73, p < .05$, but neither the minute effect $F(14, 392) = 1.07, p > .25$, nor the Group x Minute interaction, $F(42, 392) = 1.24, p > .10$, was significant. Linear comparisons based on the average sucking score for each infant over the 15 minutes revealed that the sucking scores of the sound initiation group were significantly higher than the average of the sound termination, yoked control, and no-sound groups, $t(28) = 2.46, p < .05$, which did not differ significantly from each other. Separate trend analyses for each group during the conditioning, extinction, and reconditioning periods revealed a significant linear trend for the sound initiation group during the conditioning period, $F(1, 28) = 14.7, p < .01$, but no other significant trends.

It is clear that the presentation of natural speech sounds contingent on the infant's nonnutritive sucking results in an elevated level of sucking compared to sound interruption contingent on nonnutritive sucking, noncontingent presentation of sound, or no sound at all. Although the significant linear trend for the sound initiation group lends support to the notion of conditioned response acquisition advanced by Eimas et al. (1971), the absence of extinction and reconditioning trends weakens this interpretation. Thus the present results are in marked contrast with the clear-cut evidence of stimulus control obtained with newborns (Butterfield & Siperstein, 1972) using a response measure of suck duration and a stimulus of vocal–instrumental music.

Despite the ambiguities of the present results, the fact remains that the presentation of speech sounds contingent on infants' nonnutritive sucking does result in a significant increase in the rate of such sucking. The next step is to determine whether the magnitude of this increase in sucking is differentially related to the nature of the auditory stimuli. Should this be the case then the relative salience of various auditory events in the early months of life could be ascertained.

REFERENCES

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