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ABSTRACT

This study compared the reinforcement effects of imitation to the elicitation effects of noncontingent maternal vocal stimulation. Subjects were 17 three- to six-month-old infants and their mothers. Irfants received three successive experimental conditions: contingent imitation B1, noncontingent elicitations, and contingent imitation B2. Under the contingent imitation conditions mothers imitated the topography of their infants' vocal responses immediately after their emission. Under the noncontingent yoked-control condition, mothers responded in a pattern of duration and topography identical to the previous pattern (B1), but with a pause following the infant vocalization. Analysis showed that 15 of the 17 infants emitted higher vocalization frequencies under the contingent imitation conditions than under the yoked-control condition. It is concluded that mothers' imitative vocal responses can function as effective reinforcers for infant vocalizations. (MM)

MOTHERS' CONTINGENT IMITATION INCREASES INFANT VOCALIZATIONS

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ABSTRACT

The present experiment is a functional analysis of mothers' imitative vocal responses contingent on infant vocalizations. The study compares the reinforcement effects of imitation to the elicitation effects of noncontingent maternal vocal stimulation. Seventeen 3- to-6-mo.-old infants received three successive experimental conditions: contingent imitation (B1), noncontingent elicitation (A) and contingent imitation (B2). Each condition lasted 3 min. Under the contingent imitation conditions (B1 and B2) the mothers imitated the topography of their infants' vocal responses immediately after their emission. Under the noncontingent yoked-control condition (A) the mothers responded in a pattern of duration and topography identical to her previous pattern (B1) but never within 4 sec. after any infant vocalization. The results showed that 15 out of the 17 babies produced higher frequencies of vocalizations under the two contingent imitation conditions compared to their frequencies under the noncontingent-yoked-control condition (Chi-square = 9.94, 1 df, $p < .005$). The number of maternal vocal responses were controlled and were equal or greater under the noncontingent condition than under the contingent conditions for all 17 subjects. By controlling for density of maternal vocal stimulation the study demonstrates that maternal vocal stimulation alone (elicitation) could not have accounted for the higher vocalization rates obtained under the contingent imitation conditions. The authors concluded that mothers' contingent imitative vocal responses reinforced and produced the higher rates of infant vocalizations obtained.

INTRODUCTION

Infant vocalizations are precursors of later language development. This experiment asks if infant vocalizations can be conditioned in an operant manner by maternal verbal imitation contingent on those vocalizations. A demonstration of an increase in prelinguistic vocalizations rates of 3- to-6-mo.-old due to contingent maternal vocal imitation would lend support to the view of early vocalizations as *operants*. It would also lend support to the assumption that the sound of maternal matching/ mimicking infant vocal response (infants "perceiving" similarity) can function effectively as a reinforcer for those infant responses.

The conditioning of infant vocalizations has been widely investigated. In several studies, a number of social and nonsocial reinforcing stimuli were employed: tactile stimulation (e.g., light rubbing the infant's abdomen with the palm of the hand); eye contact, smiles; auditory stimulation such as the human voice (e.g., saying "tsk," "tsk," "tsk,", or repeating the phrases "Hi baby", "Nice baby") contingent on the infant emitting vocal responses.

Problems:

(1) Most experiments on infant vocal conditioning have contrasted experimentally contingent reinforcement of infant vocalization rate to extinction rate (or to nonreinforced baseline) conditions. In this way they have failed to implement an adequate control procedure for their demonstration of reinforcement contingencies. That is because they have not separated the reinforcing effects of contingent maternal vocal imitation from the possible elicitation effects of maternal vocal stimulation.

(2) Two major problems exists with the use of *extinction* as a control condition in infant vocal conditioning studies:

(a) A high incidence of infant emotional behavior can result from extinction procedures. (b) Extinction does not separate contingency effects from elicitation effects of the social stimulation episodes used as reinforcers.

The advantage of using a noncontingent schedule over extinction is that it rules out the interpretation that higher vocalization rates observed under continuous reinforcement schedules results from higher stimulation density compared to extinction.

Purpose: This study examines the reinforcement effect of contingent maternal imitative behavior on infant vocalizations, controlling for a possible elicitation effect due to maternal vocal stimulation.

Assumptions: The present experiment was based on two assumptions:

(1) Although maternal vocal stimulation may have eliciting effects on infant vocalization rates, when made contingent, those maternal vocal responses also have reinforcing properties for vocalization rates.

(2) The reinforcing effects of contingent maternal vocal stimulation are *greater* than the possible effects of elicitation alone.

METHOD

Subjects and Design. Seventeen 3- to-6-mo.-old white, black, and hispanic infants (eight females and nine males) were subjected to a repeated-measures within-subjects BAB reversal experimental design. Each infant served as his or her own control, experiencing each condition in the following order: contingent-noncontingent-contingent. Each condition lasted 3-min and was separated by a 1-min intercondition interval. Infants and mothers were recruited for this experiment as they sat in the waiting room of an infant pediatric clinic for regular check up. The experimental session with each infant lasted 11-min.

Setting and Apparatus. The subject sat in an infant seat, facing the mother, throughout the session. Two television cameras monitored the expressions and behavior of the infant and concurrently of the mother. In a room adjacent to the experimental room, the responses of the mother and infant in interaction were displayed on a video

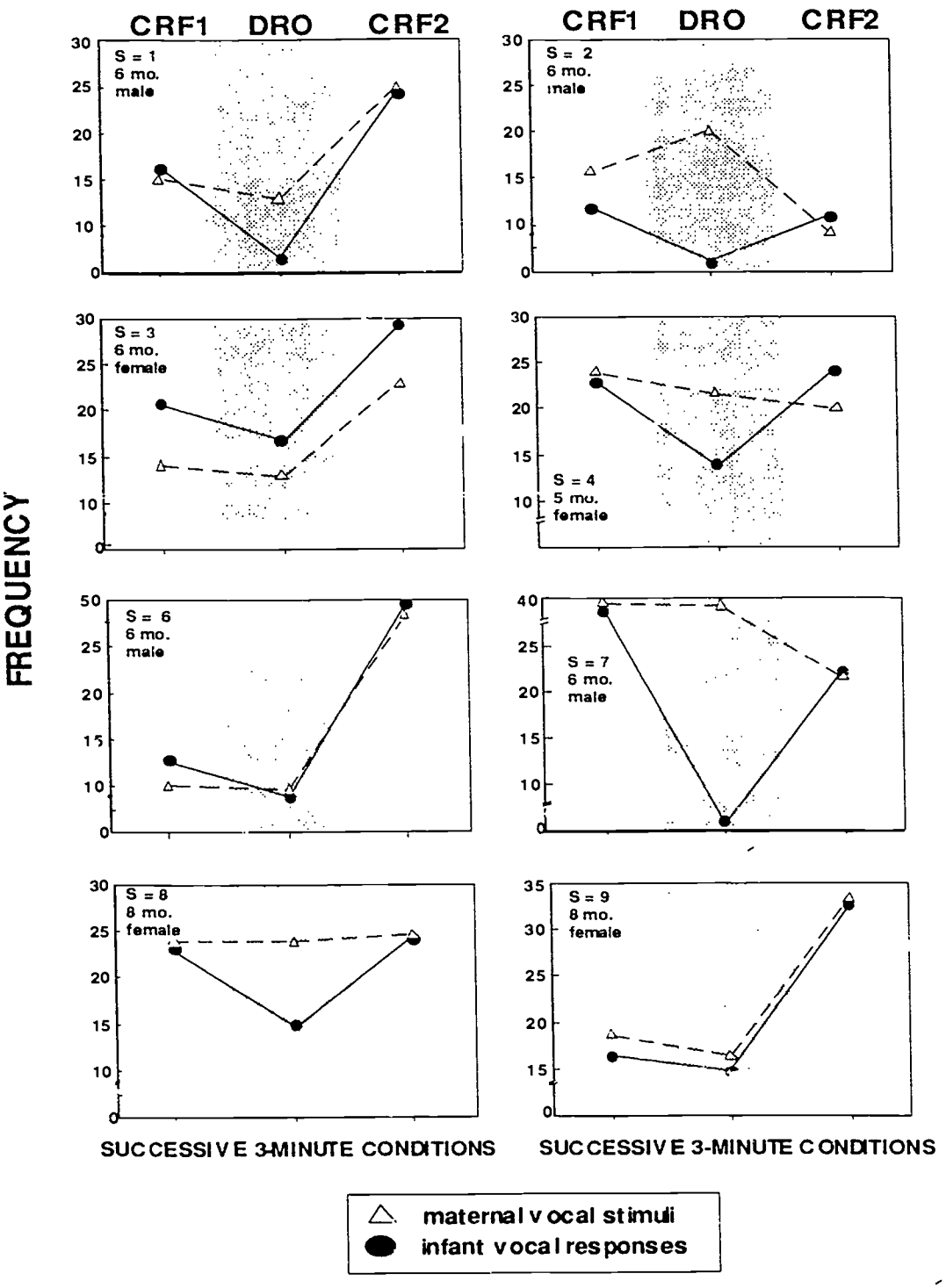
monitor in split-screen format, and recorded on video tape for further scoring and reliability measures. Infants' vocalizations and mother's imitative vocal responses were recorded via a portable cassette tape recorder. A second cassette tape recorder and earphone were used to signal the mother on when to begin and end presenting vocal stimulation to their infants.

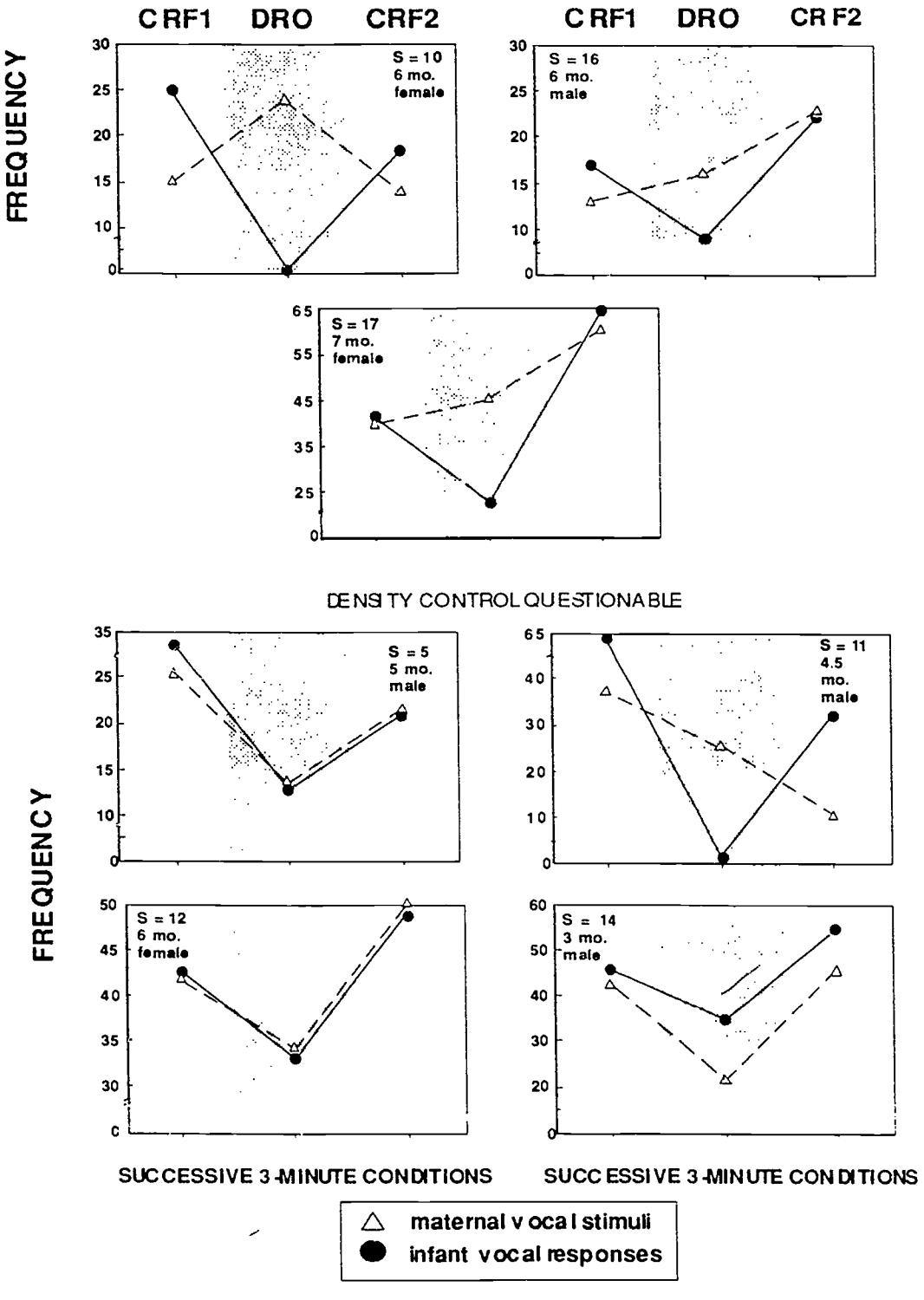
Procedure. Under the continuous-reinforcement conditions (B1 and B2), a mother was instructed to imitate the topography of each of her infant's vocal responses immediately contingent on their emission. Under the noncontingent yoked-control condition, a mother was instructed to respond in a pattern of duration and topography identical to her pattern under the contingent imitation condition (B1), but never within 4 sec. of any one of her infant's vocal responses (to preclude adventitious reinforcement effects). Thus, density of maternal vocal stimulation during the contingent condition was equated to the density of maternal stimulation provided on the first (B1) condition, but not to stimulus density of the second (B2) condition.

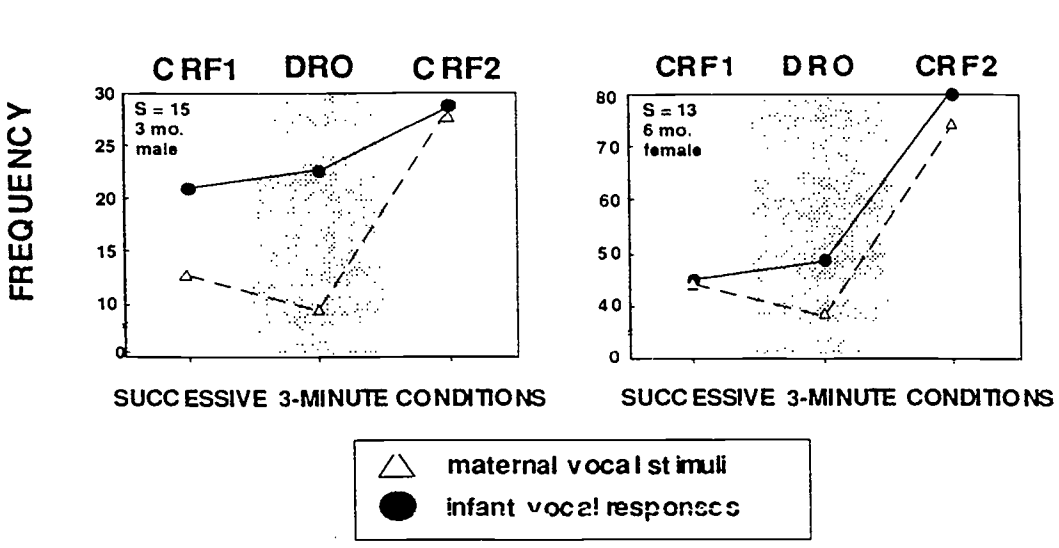
The yoked control was possible by instructing the mothers to repeat/imitate their own vocal responses that were previously emitted and recorded under the first B1 condition and that they were now hearing through an earphone.

RESULTS

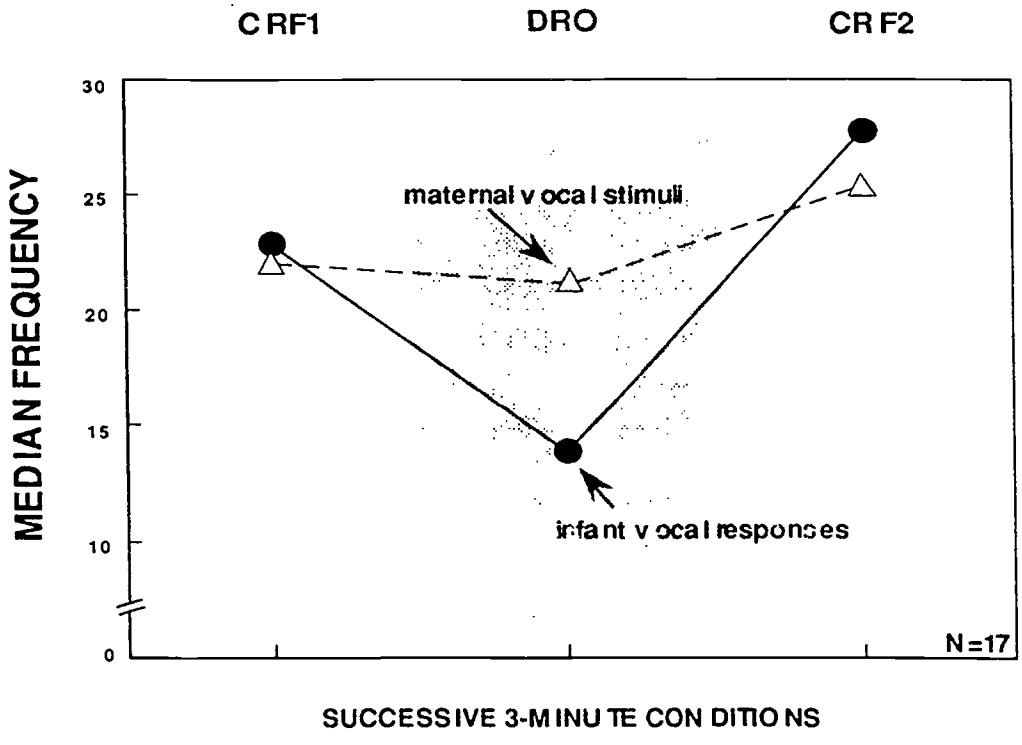
The results showed that 15 out of 17 babies emitted higher vocalization frequencies under the contingent imitation conditions than under yoked-control condition (Chi-square = 9.94, 1 df, $p < .005$):


Mothers' Imitative Behavior on Infants' Vocalizations
CRF1 DRO CRF2
CRF1 DRO CRF2
S = 1
6 mo.
male
S = 2
6 mo.
male
S = 3
6 mo.
female
S = 4
5 mo.
female
S = 6
6 mo.
male
S = 7
6 mo.
male
S = 8
8 mo.
female
S = 9
8 mo.
female
FREQUENCY
SUCCESSIVE 3-MINUTE CONDITIONS
SUCCESSIVE 3-MINUTE CONDITIONS
maternal vocal stimuli
infant vocal responses


CRF1
DRO
CRF2
FREQUENCY
S = 10
6 mo.
female
S = 16
6 mo.
male
S = 17
7 mo.
female
DENSITY CONTROL QUESTIONABLE
S = 5
5 mo.
male
S = 11
4.5
mo.
male
S = 12
6 mo.
female
S = 14
3 mo.
male
SUCCESSIVE 3-MINUTE CONDITIONS
maternal vocal stimuli
infant vocal responses



The median score pattern was higher under the contingent imitation condition than under the noncontingent-yoked condition, as indicated in the Median figure.



Frequencies of maternal vocal stimuli provided were almost identical under the nonimitative and under the contingent imitative conditions, for every one of the 17 subjects. Thus, elicitation or stimulation alone could not have accounted for the higher vocalization rate obtained under the contingent conditions.

CONCLUSION

The patterns of higher individual infants' vocalization rates obtained under contingent than under noncontingent yoked conditions indicate that mothers' imitative vocal responses can function as effective reinforcers for infant vocalizations. The results of this study suggests that as early as 3 mos. the behavioral similarity perceived by the infant between his/her own behavior and that of the mother can function as a potent social reinforcer for the infant's behavior. Infants are able to learn that their own vocal responses can alter and control the contingencies of their environment. In this study they learned to control the rate of their mothers' vocal responses.