

Reinforcement control of "autistic" verbalization in the mynah bird¹

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In an attempt to provide suggestive support for Mowrer's "autistic" theory of imitative speech, food reward was differentially paired with taped presentations of verbal phrases (response-correlated stimuli) from the vocabularies of two talking mynah birds. Monitoring of free speech subsequent to daily experimental sessions indicated that verbal response hierarchies were changed from baseline in the predicted direction of a secondary reinforcement effect for both Ss in the first training phase, and for one bird in an attempted replication.

Of the learning theory analyses of imitative speech development, Mowrer's (1950, 1960) autistic theory has probably received most attention. The central concept in Mowrer's interpretation is secondary reinforcement; imitative utterances are presumed to "sound good" (be secondarily reinforcing) to birds and infants as a result of previous associations with primary reinforcement.

The distinction between response-independent and response-correlated reinforcing stimuli is critical to Mowrer's hypothesis. Briefly, response-correlated stimuli are produced by and contained in the act of responding (e.g., proprioceptive feedback); response-independent stimuli, on the other hand, are external to the response and may be manipulated independently of it. The secondary reinforcing function of response-correlated stimuli provides a conceptual framework for understanding the apparent autistic (self-reinforcing) characteristic of imitative verbalization. Auditory stimuli similar to those associated with the speech of "reinforcing agents" in the environment take on learned reward properties and thereby strengthen instrumental responses of the vocal apparatus which produce them.

A dramatic demonstration of the validity of such an interpretation would consist of producing imitative speech in previously naive animal Ss using training procedures whereby primary reinforcement is paired with only experimenter presentations of the speech phrase to be imitated (no instrumentality of verbalization for primary reinforcement). Foss (1964) adopted this general strategy but was unable to obtain experimental-control acquisition differences in mynah bird whistle mimicry.

An alternative approach, yet one still consistent with demonstrating the conditioned reinforcement effect, would involve modification of verbal behavior already in the response repertoire of the S. Thus, if talking in birds occurs because the auditory

stimuli involved have acquired reinforcing properties, it would be expected that the relative emission frequencies of particular phrases in a bird's repertoire are directly related to the relative amount of conditioned reward value attendant upon each phrase. The purpose of the present research was to produce changes in the verbal response hierarchies of two mynah birds through differential pairing of food reward with taped broadcasts of speech phrases from their verbal repertoires.

Method. Two sophisticated (talking) Greater Indian Hill Mynah birds (*Gracula religiosa*) were maintained throughout the experiment in sound restricted chambers (described by Grosslight et al, 1962). Birds A and B had six and four verbal phrases in their respective verbal repertoires.

The experiment extended over 57 days and consisted of four phases: Baseline I (18 days); V₂ Training I (12 days); Baseline II (12 days); and V₂ Training II (15 days). Verbal response hierarchies were established on the basis of emission frequencies during the Baseline I phase. Three verbals were then selected from the vocabulary of each S (Bird A: "Hello, Charlie"; "Hello"; and "Aw, shut up"; and Bird B: "I talk"; "Hello"; and "Aw, shut up") and designated as V₁, V₂, and V₃ in order of emission frequency.

All days had essentially the same format, except that stimulus presentations (taped reproductions of V₁, V₂, and V₃) occurred only on Training days. Each Baseline day commenced with a 20-min "experimental period" during which food (dry pellets) was presented once per min, via a mechanical feeder. Verbal output was then monitored during the 2½ h following the experimental period, and emission frequencies for the several phrases were tabulated. Experimental periods typically began at 10:00 AM, and verbal emission was sampled during the following intervals: 10:20 - 11:00 AM, 11:20 - 11:40 AM, and 12:20 - 12:40 PM. Daily response totals therefore represent a total sampling time of 80 min.

On Training days, taped reproductions of V₁, V₂, and V₃ were broadcast into the chambers throughout the 20-min experimental period at 20-sec intervals (three inputs/min). These stimulus presentations were randomly ordered with the restriction that each of the three phrases occurred once in a given minute. Feeder presentation (access to food) immediately followed broadcasts of V₂, but never followed broadcasts of V₁ or V₃. In this fashion, primary reinforcement was differentially paired with auditory stimulation (the taped input). As in the Baseline phases, speech was monitored during the 2-1/3 h following the experimental periods. Although Ss often mimicked the stimulus input during the experimental periods, it is important to emphasize that verbal emission frequencies during the monitored intervals alone were the primary data of the experiment.

In all phases, classical music was played into the chambers for the 2½ h during which speech was sampled (no music input during experimental periods). This was intended to stimulate general vocal activity. Near the end of each day, a food dish was placed in the cage of each S for approximately 2 h.

Results. Figures 1 and 2 show mean daily response totals by 3-day blocks for the two Ss². V₂ dominance ratios (V₂ emissions

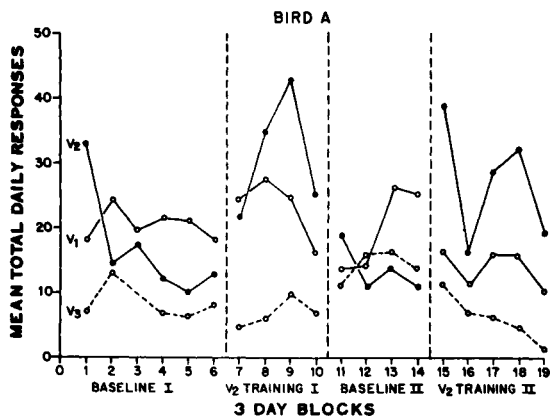


Fig. 1. Mean daily response totals by 3-day blocks. Bird A.

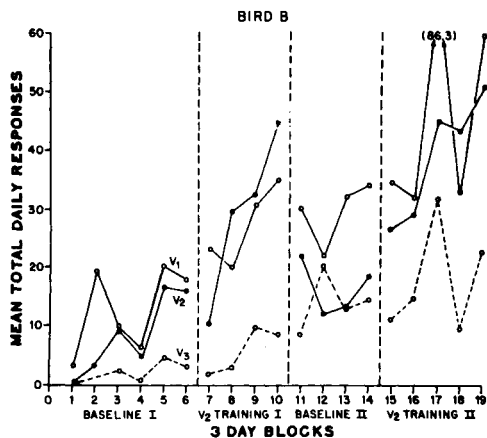


Fig. 2. Mean daily response totals by 3-day blocks. Bird B.

divided by the sum of V_1 , V_2 , and V_3 emissions) were calculated for each of the last 10 days of Baseline I, V_2 Training I, Baseline II, and V_2 Training II. One-tailed Mann-Whitney U comparisons indicated that V_2 dominance increased for Bird A from Baseline I to V_2 Training I ($p < .01$) and from Baseline II to V_2 Training II ($p < .01$). The responding of Bird B also showed a shift toward V_2 dominance in the first Training phase ($p < .05$), but not in the attempted replication ($p > .10$).

Discussion. The results provide at least partial support for the hypothesis that relative verbal emission frequency is dependent upon the relative self-reinforcing (autistic) value of emitted verbals. The frequency ordering of Verbals 1, 2, and 3 was altered from Baseline I days to V_2 Training I days in accordance with the reinforcement paired with V_2 broadcasts, Bird A, as shown in Fig. 1, performed as predicted in the first Training phase but not in the second. There was marked progressive increase in the total number of all verbals for Bird B, however, and this may represent some form of stimulus-response generalization which obscured the main treatment effect.

A striking feature of the data is the return of both Ss to their original (Baseline I) response hierarchies early in the Baseline II phase. This transiency (rapid extinction) of the secondary reinforcement effect is not surprising in view of the fact that occurrence of response-correlated reinforcement cannot be experimenter-controlled unless the response itself is controlled. In terms of the autistic hypothesis, the birds were able to reinforce themselves at any time and may have "overused" the reinforcing phrase prior to subsequent monitoring sessions.

Finally, it is of interest that both Ss had prior experience in auditory discrimination learning and that Bird A was typically the better performer. Consequently, the magnitude of the conditioned reinforcement effect in a situation which requires discrimination of auditory input may be to some extent a function of differential reinforcement history. If the present procedure were modified such that an increase in *general* verbal activity was the expected consequence of input-food pairing, the reinforcing characteristic of response-correlated auditory stimulation might be more readily demonstrated.

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NOTES

1. The authors wish to recognize the major assistance of Mrs. Fred Coulter in this research.
2. V_2 Training II was extended for an additional 9 days in the case of Bird B. The data showed no essential change and are not included.