JOURNAL OF THE EXPERIMENTAL ANALYSIS OF BEHAVIOR 1978, 30, 97-106 NUMBER 1 (JULY)

THE CONTROL OF RESPONDING BY AUDITORY STIMULI: INTERACTIONS BETWEEN DIFFERENT DIMENSIONS OF THE STIMULI[1]

MARVIN SEGAL[2] AND J. M. HARRISON[3]

BOSTON UNIVERSITY AND NEW ENGLAND REGIONAL PRIMATE RESEARCH CENTER

Sounds have position in addition to other dimensions, such as intensity and frequency. Position rapidly gains control of spatially contiguous responses and this may interfere with control of responding by other acoustic dimensions. These experiments investigated interference of a tone-noise discrimination by the discrimination of acoustic position. Squirrel monkeys were studied when responding was differentially reinforced in the presence of both spectral content (tone-noise) and positional differences between the stimuli, and when responding was differentially reinforced only in the presence of spectral differences. Under the first condition, responding rapidly came under the control of the position of the noise in the two monkeys tested. The position of the tone controlled responding in one monkey; in the second monkey, responding came under the control of the spectral content of the tone. Under the second condition, responding was initially under the control of the noise in all three monkeys tested. This persisted for the duration of the condition for two of the monkeys; in one monkey, responding came under the control of the spectral content of the noise. Under the second condition, responding was also initially under the control of the position of the tone for all monkeys, but control by spectral content of the tone relatively rapidly developed in two of three monkeys.

Key words: auditory discrimination, prepotent stimulus dimensions, stimulus dimension interactions, monkeys

It is well known that certain stimuli or stimulus dimensions more readily gain control of responding than others and that the maintained level of control is higher. For example, in pigeons, visual stimuli that differ in wavelength more readily gain control of responding than those that differ in the angle of a line (Carter and Eckerman, 1975). In experiments with naive animals, it is usual to speak of stimuli as differing in prepotency, or as forming a hierarchy of prepotency ("attending hierarchy" of Baron, 1965). Some believe that certain members of the hierarchy may depend on evolutionary processes (Terrace, 1975); however, since the prepotency hierarchy can be changed (Johnson and Cumming, 1968), it is equally possible that hierarchies of prepotency might be a function of a common ontogeny rather than phylogeny, or a combination of both. Whatever may be the origin of hierarchies of prepotency, there is little doubt that they exist and that they exert an influence in the analysis of discrimination.

The speed with which a stimulus gains control of responding is also dependent on the spatial relation between the response and the stimulus (see Cowey, 1968, for a review of the relevant literature). For example, Lashley (1912) was unable to train rats on a visual form discrimination using the Yerkes-Watson discrimination box in which there was no contiguity between the response and stimulus sites. As the result of this failure, he designed the jumping stand to maximize spatial contiguity of response and stimulus, and he was able to obtain form discrimination (Lashley, 1930). Watson (1914) pointed out that discriminations are formed in many fewer trials when the stimulus spatially coincides with the food (his "instinctive method") than when the Yerkes-Watson box is used. Gellerman (1933) found that chimpanzees did not acquire a visual form discrimination when the stimuli were attached to the front of the food boxes,

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[1] The work reported in this paper was supported in part by grant number GB 43302, the National Science Foundation, and in part by the Graduate School of Boston University.

[2] We thank T. Raslear for his critical reading of the manuscript. Marvin Segal is now at the Department of Psychiatry, the University of Chicago.

[3] Reprints may be obtained from J. M. Harrison, Department of Psychology, Boston University, 64 Cummington St., Boston, Massachusetts 02215.

but did when the stimuli were attached to the front of the lids. Jarvik (1953, 1956) obtained extremely rapid (one error) discriminations of colors in monkeys and chimpanzees using either differently colored peanut shells, shells of only one color containing a peanut, or colored and flavored pieces of bread. These rapidly produced discriminations were a result of the maximum (and natural) contiguity between stimulus, response, and reinforcer. When less contiguous arrangements were used, the animals performed poorly.

Similar phenomena have been found in auditory discriminations. The spatial position of a sound of complex spectral content (clicks and noise bursts, for example) rapidly gains control of responding in monkeys, provided the response is spatially contiguous with the sound source (Downey and Harrison, 1972, 1975; Harrison, Downey, Segal, and Howe, 1971; Harrison, Iversen, and Pratt, 1977). In the absence of such contiguity, stimulus control develops more slowly.

The foregoing considerations raise problems in the study of auditory stimulus control of responding because a sound never has a single dimension. All sounds have a position in space (their point of origin) in addition to other dimensions, such as intensity, spectral content, or duration. Second, position is a highly prepotent dimension of sounds. If it is desired to bring control of responding under a dimension of sound (other than position) by differentially reinforcing responding in the presence of that dimension, it is possible that the development of control may be slowed by the control of responding by the dimension of position, even though responding on the basis of position is not differentially reinforced.

An organism's response also has a position in space. Whether or not the response and sound positions coincide may also affect the control of responding by a dimension of sound other than position. When the response and sound positions coincide, control by position develops rapidly and control by a nonpositional acoustic dimension may be interfered with. On the other hand, if the response and sound positions do not coincide, control by position develops slowly, and there may be little or no interference with control by a nonpositional acoustic dimension.

The experiments reported here investigated whether the discrimination of nonpositional dimensions of sounds is interfered with by the development of control by the positions of sounds. The experiments also investigated the degree to which such interference is a function of spatial contiguity between the sites of the responses and sound sources. Animals were trained in a spectral content (tone *versus* noise) discrimination under conditions in which control by both position and spectral content differences could be analyzed.

METHOD

Subjects

Three experimentally naive adult male squirrel monkeys were maintained at approximately 80% of their free-feeding body weights.

Apparatus

The experimental chamber was a wire-mesh enclosure 35 cm by 35 cm by 40 cm high, suspended on aluminum rods above the floor of a room (2.5 m by 2.5 m by 3 m high). The floor of the room was concrete, the ceiling fiberboard, and the walls fiberboard covered with acoustic tile, with a 25-cm by 25-cm glass observation window cut into one wall. One wall of the wire-mesh enclosure contained a liquid food dispenser centered between two response levers. The levers were 25 cm apart center to center and 10 cm above the cage floor. Mounted above each lever was a red light, 1.5 cm in diameter. Also mounted above and as near as possible to each lever was a Grason-Stadler headphone (Model TDH 49), which was used as a speaker. On the roof of the cage was a 5-W houselight. Events in the experimental chamber were controlled by relay circuits and timers and recorded on magnetic counters and cumulative recorders, all located in a separate room.

Stimuli were broad-band noise bursts (4 kHz to 12 kHz bandwidth) and 5-kHz tone bursts of 0.2 sec duration, occurring at the rate of two per second and having a rise-decay time of 25 msec. Signals from a noise generator were fed to an electronic switch and from there to one channel of a dual channel power amplifier for generating the noise bursts. Signals from a sine wave tone generator were also fed to the electronic switch and from there to the second channel of the power amplifier for generating the tone bursts. The electronic switch was used to turn the signals on and off and was programmed by the relay circuitry.

Nominal sound-intensity levels were measured at a standard position in the wire-mesh cage equidistant from the two speakers. Levels were measured with a General Radio sound level meter (Model 1551 C) set to weighting scale A. The meter was connected to a microphone placed in the standard position in the wire-mesh cage. The intensities of the stimuli were set between 66 and 68 dB, reference level 20 uN/m^2. The ambient noise level was 54 dB (measured using weighting scale A).

Procedure

Preliminary training. The purpose of the preliminary training was to train the animals to respond on a schedule that was essentially the same as that used during stimulus control training, but with the stimuli absent. Each monkey was trained to press both levers using 0.1 cc of liquid food (special SKF formula powder mixed 2:1 with water) as the reinforcer. Water was freely available in the experimental chamber. After initial lever-press training, food was available following a response on either lever on a 30-sec variable-interval schedule. When responding stabilized (judged by inspection of the records) on the VI 30-sec schedule, a 30-sec limited hold was instituted. This meant that after the scheduled interval had elapsed, reinforcement was available on either lever for 30 sec; if a response was not made during that 30-sec period, reinforcement availability ended, and the next scheduled interval began. When behavior stabilized under these conditions, reinforcement was made available on only one of the two levers at the end of a given scheduled interval. The order of availability of reinforcement on the two levers was 1122122112212112, and the sequence repeated. A response on the appropriate lever during a limited-hold period produced food and began the next scheduled interval. A response on the other lever during the limited hold merely began the next interval. When responding was judged to be stable and about equally frequent on both levers under these conditions, the auditory stimuli were introduced during the limited-hold periods, and the limited hold was reduced to 10 sec. Thus, when the auditory stimuli were introduced, the onset of a trial was scheduled to occur on the average of once every 30 sec according to a variable-time 30-sec schedule. Spurious correlation between a response and the onset of the sound was prevented by introducing a 3-sec interval between a response and a trial onset.

Stimulus control was studied under four conditions. (I) Reinforcement was paired with both the spectral content and position differences of the stimuli. Sounds were presented throughout a trial from one or the other of the two speakers (S1 or S2) in the following order, 1122122112212112 (the sequence repeating). S1 stimuli were the 5-kHz tone bursts and S2 stimuli were the broad-band noise bursts described above. In the presence of S1, a response on R1 was reinforced (correct response) and the trial terminated; a response on R2 (incorrect response) terminated the trial. In the presence of S2, a response on R2 was reinforced (correct response) and the trial terminated; a response on R1 (incorrect response) terminated the trial. In the absence of responding, a trial terminated at the end of the limited-hold interval (10 sec).

To determine whether spectral content or position was controlling responding, each animal was given six randomly spaced test trials (three noise and three tone) within each of three sessions after responding had stabilized. In these test trials, the positions of the noise and the tone were reversed (tone presented through S2 and noise through S1). None of the responses in the test trials was reinforced.

(II) The broad-band noise bursts were presented through either S1 or S2, and responding on the lever contiguous with the sounding speaker was reinforced (identical to the procedure used by Downey and Harrison, 1972). In the presence of S1, a response on R1 was reinforced (correct response) and the trial terminated; a response on R2 (incorrect response) terminated the trial. In the presence of S2, a response on R2 was reinforced (correct response) and terminated the trial; a response on R1 (incorrect response) terminated the trial. In the absence of a response, a trial terminated at the end of the limited-hold interval (10 sec).

(III) This was the same as Condition II except that the 5-kHz tone bursts were used in place of the noise bursts.

(IV) The noise or the tone bursts could be presented through either speaker and responses appropriate to the spectral content differences of the stimuli were differentially reinforced. This procedure involved four kinds of trials as follows: tone through S1, tone through S2, noise through S1, and noise through S2. The order of presentation of these trials was (T, tone; N, noise): NS1, TS1, TS2, NS2, TS1, NS2, TS2, TS1, NS1, NS2, TS2, NS1, NS2, TS1, NS1, TS2 (repeated). Responding on R1 was reinforced in the presence of the tone (from either S1 or S2) and responding on R2 was reinforced in the presence of the noise (from either S1 or S2). This procedure used two classes of trials with respect to the relative positions of the stimulus and the response. There were two kinds of trials in which a response adjacent to the stimulus was correct (TS1-R1 and NS2-R2) and two kinds of trials in which a response not adjacent to the stimulus was correct (TS2-R1 and NS1-R2). Thus, involved in this procedure were adjacent and nonadjacent conditions similar to those investigated by Downey and Harrison (1972).

Animals SM 61 and SM 514 were studied in Conditions I, II, III, and IV, in that order. SM 71 was studied only on Condition IV.

RESULTS

Conditions I, II, and III. The development of stimulus control in Condition I is shown in Figure IA. For both animals, control by the noise was present initially (first session) at about the 95% correct response level, and this ultimately increased to a level of between 95% and 100% correct responses. For both animals, control by the tone developed more slowly. By the seventh session for SM 61 and the eighth session for SM 514, control had reached its asymptote. The results of the test sessions are shown in the inset tables in Figure 1A. Both animals responded on the lever contiguous with the noise on 100% of the test trials. SM 514 responded on the lever contiguous with the tone in 100% of the trials and SM 61 responded on the lever appropriate for the spectral content dimension of the tone eight out of nine times (89%).

In Condition II (Figure 1B), both animals were controlled by the position of the noise at the 100% correct response level. In Condition III, both animals showed control by the position of the tone, but the level of control was lower than for the noise (Condition II). This difference in level of control is shown in Table 1 and in Figure 1C.

Condition IV. The development of control of responding by the spectral content differences of the noise and the tone is shown in Figure 2. Responding in SM 61 (A) and SM 514 (C) came under the control of the spectral content of the tone, the asymptotic level being between 95% and 100% correct responses. Control of responding by the spectral content of the noise developed in SM 61, but remained at approximately the 50% correct response level in SM 514. SM 71 died before the development of the control of responding by the spectral content differences between the stimuli.

An analysis of the data in terms of the responses on the lever contiguous with the sounding speaker (Figures 3 and 4) shows that errors were not random and that for all animals and both stimuli, responding was initially under the control of the positions of tone and noise. The failure of control of responding by the spectral content of the noise in SM 514 (Figure 2C) was not because the animal was making random errors but because control by position persisted (Figure 3A). Virtually all responses were made on the lever contiguous with the sounding speaker. Control of responding by the spectral content of the tone developed more rapidly in SM 61 (Figure 4) and SM 514 (Figure 3) than in the naive animal, SM 71 (Figure 4) (which died before control by spectral content developed). It can be seen for SM 71 that control of responding by the position of the tone was weaker than by the position of the noise (Table 1), in agreement with SM 61 and SM 514.

DISCUSSION

In Condition I, responding was controlled by the position of the noise in both animals,

Table 1

Asymptotic level of percentage of correct responses in Conditions II (noise position) and III (tone position).

	Percentage of Correct Responses	
Animal	*Noise*	*Tone*
SM 61	100%	87.9%*
SM 514	100%	91.5%*
SM 71[1]	96.3%	83.7%*

*Based on last five sessions.

[1]Based on Condition IV.

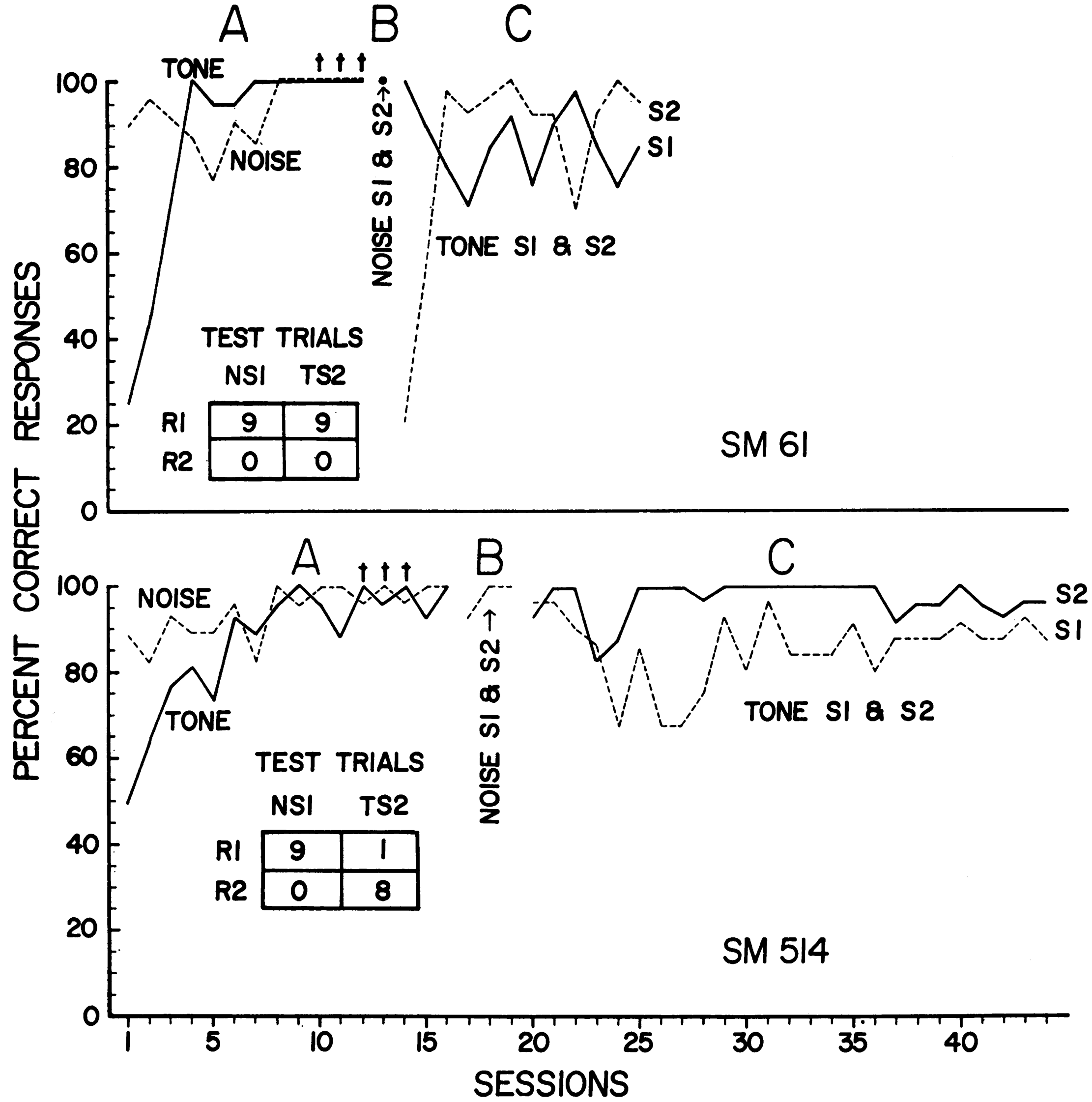

Fig. 1. Results under Conditions I, II, and III for SM 61 and SM 514. The percentage of correct responses in the presence of each sounding speaker (S1 and S2) have been plotted separately. A. Condition I. Crosses indicate sessions during which test trials were conducted. The results of the test trials are shown in the inset tables (NS1, noise presented through S1; TS2, tone presented through speaker S2; R1, response on left lever; R2, response on right lever). B. Condition II. Noise was presented through both S1 and S2. C. Condition III. Tone was presented through both S1 and S2.

as shown by the results of the test trials. As the correct response was contiguous with the sounding speaker, this is what would have been expected on the basis of prior data (Beecher and Harrison, 1971; Downey and Harrison, 1972, 1975; Harrison and Beecher, 1969; Harrison, Downey, Segal, and Howe, 1971; Harrison, Iversen, and Pratt, 1977). In Condition IV, responding was also initially under the control of the position of the noise in all three animals, the responses being made on the lever spatially contiguous with the noise source. Two of the animals persisted in responding on the lever contiguous with the noise source, and control by spectral content differences between the noise and the tone never developed. In the third animal (SM 61), control by spectral content differences between

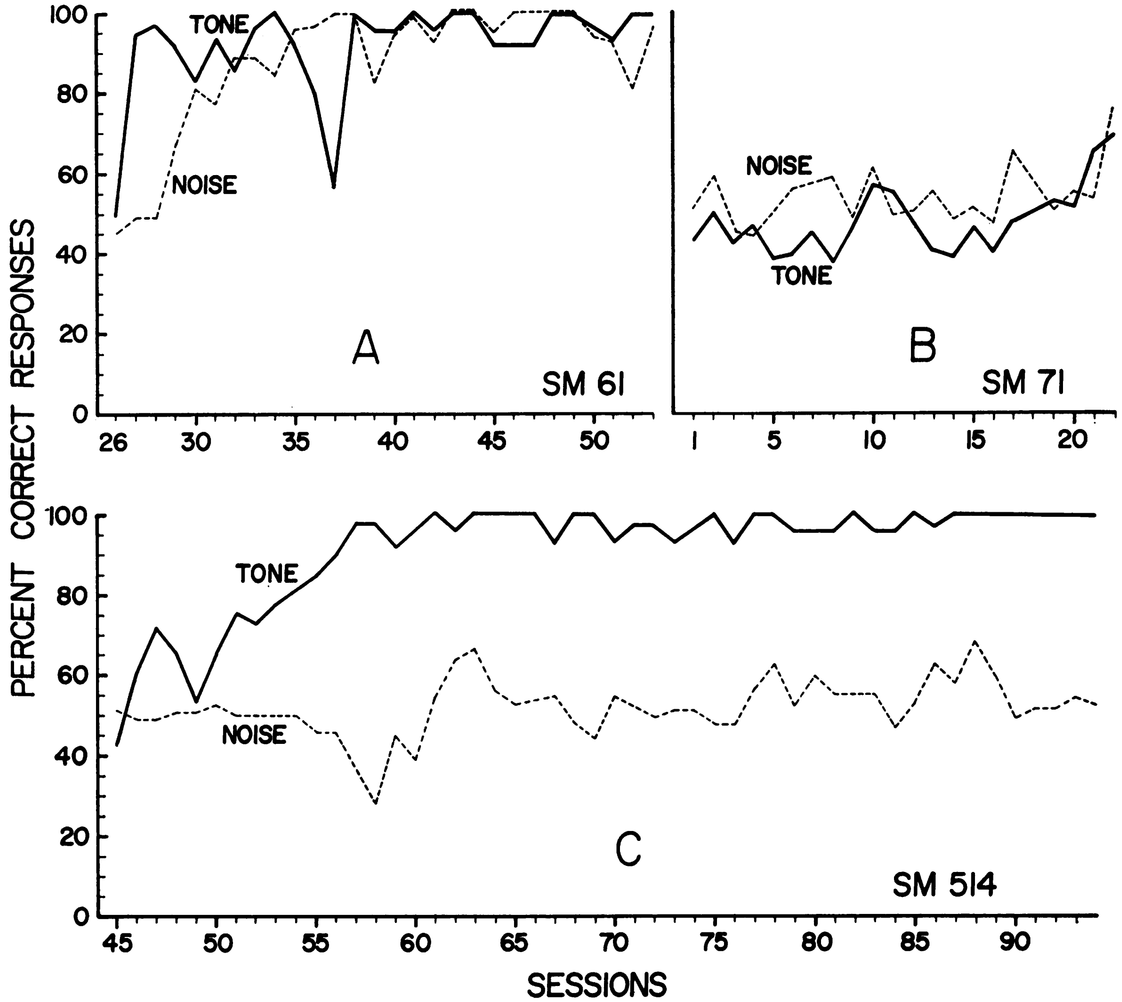

Fig. 2. Results under Condition IV for SM 61 (A), SM 71 (B), and SM 514 (C). The percentages of correct responses in the presence of the tone and noise are plotted separately.

the tone and the noise developed, but responding on the lever spatially contiguous with the noise source was not completely abolished, all errors (Figure 4A) being response configurations of this type. Thus, the experiments showed that the tendency of monkeys to respond on a lever contiguous with a stimulus of complex spectral content interfered with or completely prevented the control of responding by spectral content differences between the noise and the tone.

The position of pure tones (rise-decay times of 25 to 50 msec) controls responding less readily than the position of sounds of complex spectral content (Beecher and Harrison, 1971; Casseday and Neff, 1973; Harrison and Beecher, 1969; Harrison and Briggs, 1977, Stevens and Davis, 1938, p. 179; Terhune, 1974). This can be seen in the present experiment by comparing the percentage of correct responses (100% for SM 61 and SM 514) in Condition II (noise) with the percentage of correct responses (87.9% for SM 61 and 91.5% for SM 514) in the last session of Condition III. A similar difference between the control of responding by the positions of noise (100% correct responses) and tone (81% correct responses) can be seen for SM 71 in the last session of Condition IV. Since pure tones control responding less well than stimuli of complex content, it might be expected that control by the position of the tone would interfere less with control by spectral content differences between the tone and noise than

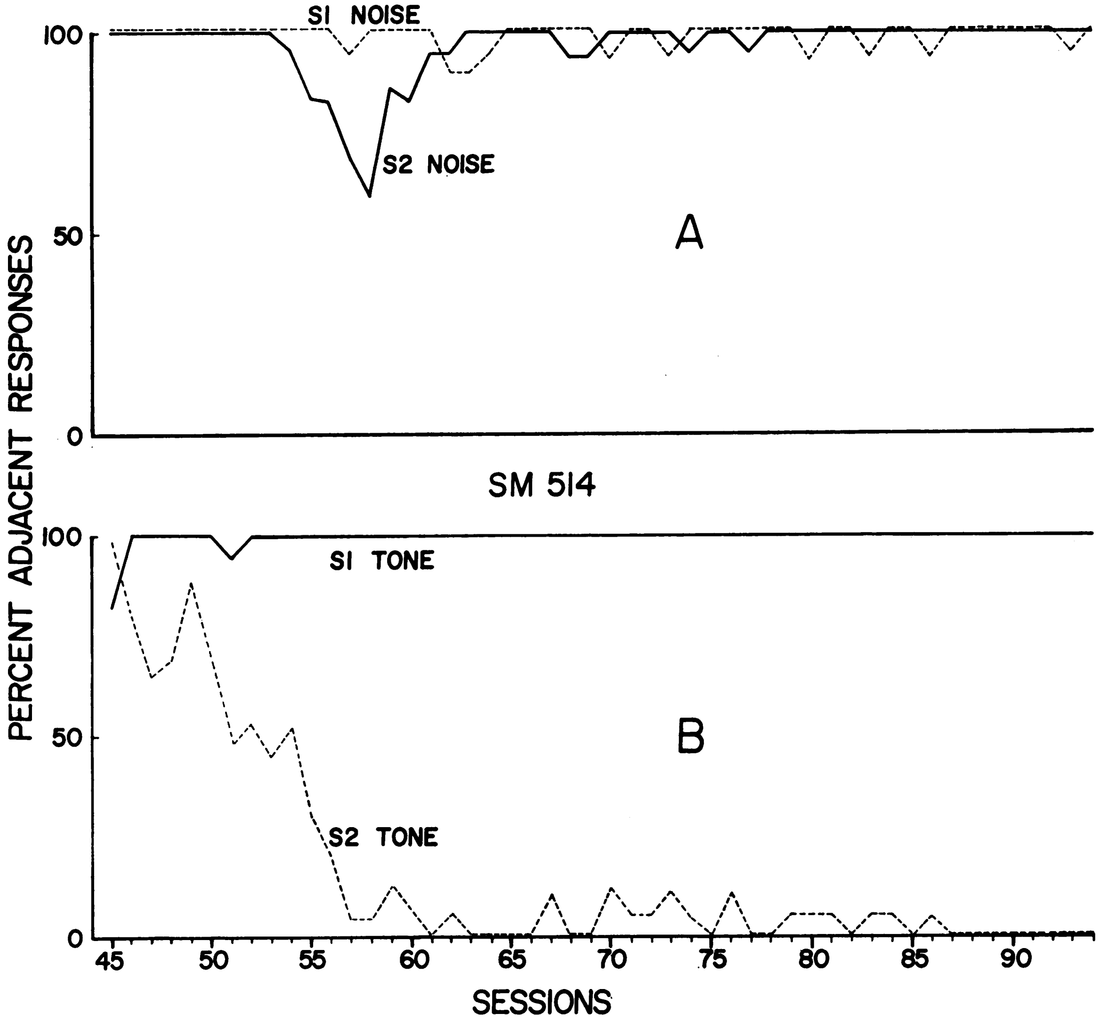

Fig. 3. The percentage of responses on the lever adjacent to the sounding speaker for the noise (A) and the tone (B). Animal SM 514.

would control by the position of the noise. It might also be expected that control by the position of the tone would develop more slowly than control by the position of the noise. The present data indicate that both these possibilities are true.

In Condition I, control of responding by the tone developed more slowly than control by the noise (Figure 1A). The slow development of control by the tone could represent either the relatively slow development of control by the position of the tone (the position of the tone being of lower prepotency than the position of the noise), or the development of the control of responding by the spectral content differences between the tone and the noise. The test trials showed that for SM 514 (Figure 1A), responding was under control of the position of the tone (89% of the responses were on the lever contiguous with the tone). The percentage of contiguous responses was less than for the noise (100%) for reasons already outlined. The test trials for SM 61 showed that all responses were made on R1 when the tone was presented through S2. One interpretation of these data is that the control of responding was by the spectral content differences between the tone and the noise. A second interpretation is that the animal was simply showing a response position preference, giving only R1 responses. This latter interpretation is considered unlikely

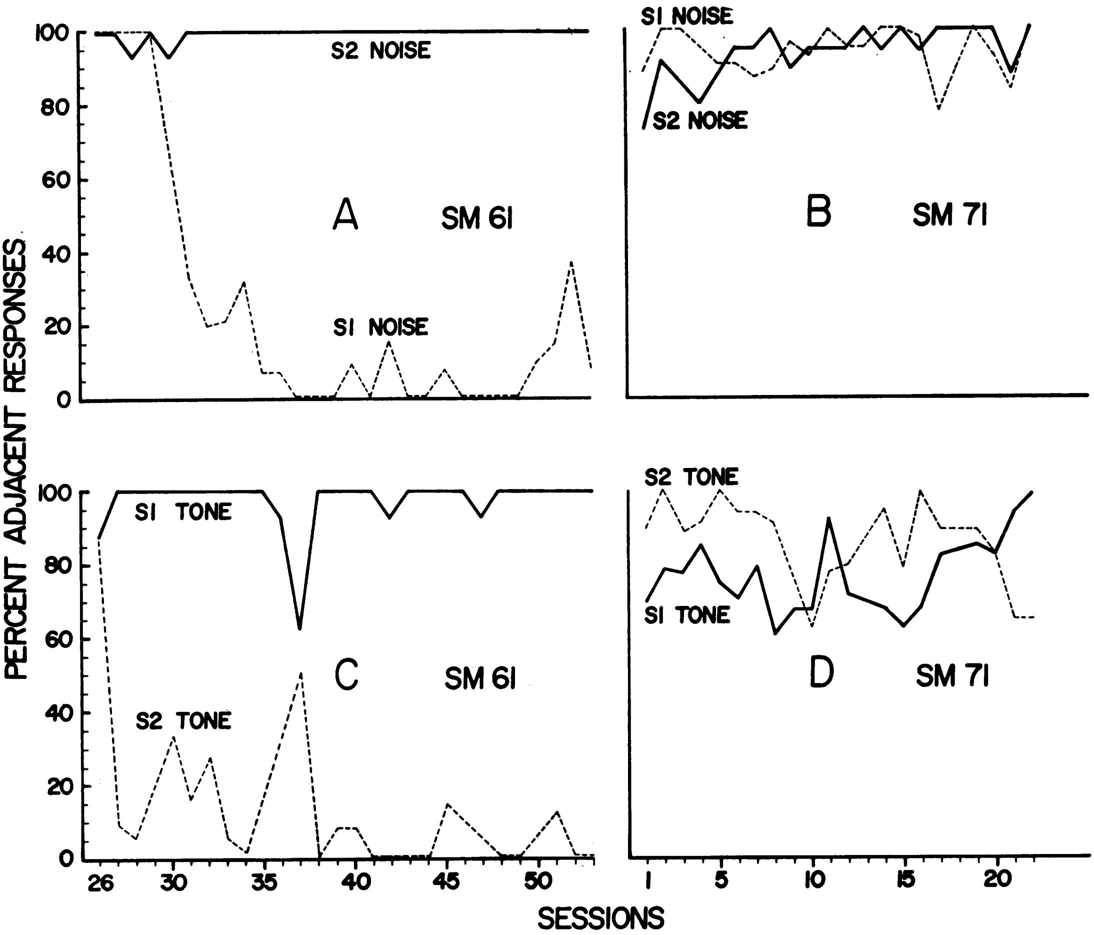

Fig. 4. The percentage of responses on the lever adjacent to the sounding speaker for the noise (A. SM 61; B. SM 71) and the tone (C. SM 61; D. SM 71).

because there was no evidence of position preferences at any point in any of the conditions, and also response position preferences have not occurred in prior work in this laboratory on auditory discriminations using squirrel monkeys. Thus, we interpret the test trial data of SM 61 as indicating control by spectral content differences.

It is well known that monkeys are difficult to train in even apparently simple auditory discriminations (Cowey, 1968; Wegener, 1964). Typically, it requires many more trials to train a monkey in an apparently simple auditory discrimination than in an apparently equally simple visual discrimination.

Don and Starr (1972) trained squirrel monkeys to press one key when clicks were presented to the left ear (through fitted earphones) and to press a second key when identical clicks were presented to the right ear. The animals required an averaged of 2909 trials to reach criterion. In this experiment, the clicks were located at the right and left ears, while the levers were located in front of the animals and hence not spatially contiguous with the positions of the sounds. This is essentially similar to the training of the animal in a position discrimination using noncontiguous sources and levers, a condition in which the development of stimulus control is slow (Downey and Harrison, 1972), and it would be expected that the animal would require a large number of trials.

Dewson, Pribram, and Lynch (1969) using operant conditioning methods trained monkeys on a tone-noise discrimination in which the stimuli were presented through a single speaker. The animals were required to make one response in the presence of the tone (800 Hz, 25 msec rise-decay time) and a different response in the presence of a broad-band noise. Neither manipulandum was spatially contiguous with the speaker. The animals required an average of 1365 trials to make this apparently simple discrimination. Development of control would be expected to be slow for two reasons. First, under the nonspatially contiguous conditions, the development of control by any stimulus dimension is probably slow, and second, control by the (identical) positions of the stimuli may initially develop, resulting in 50% correct responses. It is only after the decay of this control by stimulus position that control by spectral content can develop.

There is no reason for believing that the slowness with which monkeys have been reported to acquire such simple auditory discriminations represents a fundamental deficiency in monkey hearing. The cochlea and auditory system are well developed and electrophysiological studies of hearing do not reveal any special weaknesses or differences compared with such frequently used species as the cat (Harrison, 1976; Harrison and Howe, 1974*a*, *b*). This, then, suggests that the difficulties must be due to the use of inappropriate behavioral procedures and apparatus in auditory discrimination experiments. The present data suggest that two factors may be responsible for these difficulties: (1) control of responding by any acoustic stimulus dimension develops slowly unless the response and sound-source sites are contiguous, and (2) control of responding by the position of the stimuli is highly prepotent when response and sound-source sites are spatially contiguous. Future studies of primate auditory discriminations should consider carefully the two factors of spatial relation of sound source to response site and relative prepotency of stimuli or stimulus dimensions.

REFERENCES

Baron, M. R. The stimulus, stimulus control and stimulus generalization. In D. I. Mostovsky (Ed), *Stimulus generalization*. Stanford: Stanford University Press, 1965. Pp. 62-71.

Beecher, M. D. and Harrison, J. M. Rapid acquisition of auditory localization discrimination by rats. *Journal of the Experimental Analysis of Behavior,* 1971, **16,** 193-200.

Casseday, J. H. and Neff, W. D. Localization of pure tones. *Journal of the Acoustical Society of America,* 1973, **54,** 365-372.

Carter, D. E. and Eckerman, D. A. Symbolic matching by pigeons: rate of learning complex discriminations predicted from simple discriminations. *Science,* 1975, **187,** 662-664.

Cowey, A. Discrimination. In L. Weiskrantz (Ed), *Analysis of behavioral change.* New York: Harper & Row, 1968. Pp. 189-238.

Dewsen, J. H., Pribram, K. H., and Lynch, J. C. Effects of ablation of temporal cortex upon speech discrimination in the monkey. *Experimental Neurology,* 1969, **14,** 579-591.

Don, M. and Starr, A. Lateralization performance of squirrel monkeys to binaural click stimuli. *Journal of Neurophysiology,* 1972, **35,** 493-500.

Downey, P. and Harrison, J. M. Control of responding by location of auditory stimuli: role of differential and nondifferential reinforcement. *Journal of the Experimental Analysis of Behavior,* 1972, **18,** 453-463.

Downey, P. and Harrison, J. M. Control of responding by sound location in monkeys: rapid acquisition in darkness. *Journal of the Experimental Analysis of Behavior,* 1975, **23,** 265-270.

Gellerman, L. W. Form discrimination in chimpanzees and two year old children. I. Form triangularity *per se. Journal of Genetic Psychology,* 1933, **42,** 3-27.

Harrison, J. M. The auditory system of the medulla. In R. B. Masterton (Ed), *Handbook of behavioral neurobiology.* New York: 1976 (*in press*).

Harrison, J. M. and Beecher, M. D. Control of responding by the location of an auditory stimulus. The role of rise time. *Journal of the Experimental Analysis of Behavior,* 1969, **12,** 217-227.

Harrison, J. M., Downey, P., Segal, M., and Howe, M. Control of responding by the location of auditory stimuli: rapid acquisition in monkeys and rats. *Journal of the Experimental Analysis of Behavior,* 1971, **15,** 379-386.

Harrison, J. M. and Howe, M. E. Anatomy of the ascending auditory nervous system of mammals. In W. D. Neff and W. D. Keidel (Eds), *Handbook of sensory physiology, Volume V/1.* Heidelberg: Springer-Verlag, 1974. Pp. 283-336. (*a*)

Harrison, J. M. and Howe, M. E. Anatomy of the descending auditory system (Mammalian). In W. D. Neff and W. D. Keidel (Eds), *Handbook of sensory physiology, Volume V/1.* Heidelberg: Springer-Verlag, 1974. Pp. 363-388. (*b*)

Harrison, J. M. and Briggs, R. Orientation and lever responding in auditory discriminations in squirrel monkeys. *Journal of the Experimental Analysis of Behavior,* 1977, **28,** 233-241.

Harrison, J. M., Iverson, S., and Pratt, R. Control of responding by location of auditory stimuli: adjacency of sound and response. *Journal of the Experimental Analysis of Behavior,* 1977, **28,** 243-251.

Jarvik, M. E. Discrimination of colored food and food signs by primates. *Journal of Comparative and Physiological Psychology,* 1953, **46,** 390-392.

Jarvik, M. E. Simple color discriminations in chimpanzees. *Journal of Comparative and Physiological Psychology,* 1956, **49,** 492-495.

Johnson, D. F. and Cumming, W. W. Some determinants of attention. *Journal of the Experimental Analysis of Behavior,* 1968, **11,** 157-166.

Lashley, K. S. Visual discrimination of size and form in the albino rat. *Journal of Animal Behavior,* 1912, **2,** 310-331.

Lashley, K. S. The mechanism of vision. I. A method for rapid analysis of pattern vision in the rat. *Journal of Genetic Psychology,* 1930, **37,** 453-460.

Stevens, S. S. and Davis, H. *Hearing.* New York: Wiley, 1938.

Terhune, J. M. Sound localization abilities of untrained humans using complex and sinusoidal sounds. *Scandanavian Acoustics,* 1974, **3,** 115-120.

Terrace, H. Evidence of the innate basis of the hue dimension in the duckling. *Journal of the Experimental Analysis of Behavior,* 1975, **24,** 79-88.

Watson, J. B. *Behavior: an introduction to comparative psychology.* New York: Henry Holt and Co., 1914.

Wegener, J. G. Auditory discrimination behavior of normal monkeys. *Journal of Auditory Research,* 1964, **4,** 81-106.

Received 27 February 1975.
(*Final acceptance 8 February 1978.*)