JOURNAL OF APPLIED BEHAVIOR ANALYSIS 1971, 4, 37-44 NUMBER 1 (SPRING 1971)

VOLUNTARY CONTROL OF EROTICISM[1]

DONALD E. HENSON AND H. B. RUBIN

SOUTHERN ILLINOIS UNIVERSITY AND ANNA STATE HOSPITAL

A recent study reported that motivated human male subjects were able voluntarily to inhibit penile erection in the presence of effective erotic stimulation (Laws and Rubin, 1969). However, because this study required attendance only to the display area of erotic stimuli, there was a possibility that inhibition resulted from their subjects not attending to the content of the stimuli. The present study utilized a procedure that guaranteed subjects' attendance to the content of the erotic stimulation, *i.e.*, a description of the behavioral content of the erotic stimulus film. Nevertheless, every subject was able to inhibit penile erection almost as effectively as when no film description was required. Furthermore, the verbal description prevented the production of competing asexual stimuli; a technique that all subjects, in both the Laws and Rubin study (1969) and the present study, reported using to inhibit penile erection when no description was required. This suggests that although concentration on asexual stimuli may be the preferred method of reducing sexual arousal to erotic stimulation, penile erection can be inhibited by other methods.

There is an extensive literature demonstrating that human subjects can exert voluntary control over such autonomic responses as the galvanic skin response (Birk, Crider, Shapiro, and Tursky, 1966; Crider, Shapiro, and Tursky, 1966; Gavalas, 1957; Johnson and Schwartz, 1967; Senter and Hummel, 1965) and heart rate (Engel and Chism, 1967; Engel and Hansen, 1966; Hnatiow and Lang, 1965). Since most visceral responses can be affected by voluntary skeletal behaviors, *e.g.*, changing muscle tension and respiratory pattern (Miller and Carmona, 1967), there is a possibility that the voluntary modification of GSR and heart rate resulted from mediational skeletal responses and not direct instrumental learning. However, when the possibility of emission of voluntary skeletal behaviors was eliminated by utilizing curarized animals as subjects, heart rate (DiCara and Miller, 1968*a*; Miller and DiCara, 1967; Trowill, 1967), intestinal contractions (Banuazizi, 1967; Miller and Banuazizi, 1968), blood-vessel diameter (DiCara and Miller, 1968*b*), and rate of urine formation (DiCara and Miller, 1967) were nevertheless modified by operant conditioning techniques, indicating that autonomic visceral responses can be subject to direct voluntary control.

Laws and Rubin (1969) reported that penile erection, an autonomic visceral response (Kelly, 1961) that is generally considered involuntary (Houssay, 1955), could be voluntarily controlled by normal human male subjects. Their subjects were able both to produce erections in the absence of erotic stimuli and inhibit erections in the presence of effective erotic stimulation. Each subject reported that tumescence was achieved by "fantasizing" about erotic events, and that inhibition was accomplished by producing competing stimuli, *i.e.*, concentrating on asexual stimuli (Laws and Rubin, 1969).

Since the attending indicator of the Laws and Rubin study (1969) ensured attendance only to the display area of the erotic stimulation, the contention can be made that their subjects were not attending to the content of the stimuli when voluntary inhibition occurred. However, if penile inhibition is possible when attendance to the content of erotic stimulation is guaranteed, then it must be as-

[1]This investigation is based in part on a thesis submitted by the senior author to Southern Illiniois University in partial fulfillment of the requirements for the M.S. degree. The research was supported by grants from the Mental Health Fund of the Illinois Department of Mental Health and the National Institute of Mental Health Grant 04926. We wish to thank Drs. R. Campbell and R. Sanders and the late Dr. E. Sulzer for their helpful suggestions, and Dr. P. Gebhard and the Institute of Sex Research, Indiana University for providing access to their collection of films. Reprints may be obtained from H. B. Rubin, Behavior Research Laboratory, Anna State Hospital, Anna, Illinois 62906.

sumed that the autonomic visceral response of penile erection can be at least partially modified by voluntary controls.

METHOD

Subjects

Eight adult males (age 21 to 30 yr) volunteered to serve as subjects. Two (S-1 and S-2) were employees of Anna State Hospital, had participated in an earlier study (Laws and Rubin, 1969), and received no remuneration. Three subjects (S-3, S-4, and S-5) were experimentally naive, were students at Southern Illinois University, and were remunerated for their transportation and time at the rate of $2.50 per hour.

The remaining three subjects did not complete the study, two because during their baseline test session, sample stimulus films were ineffective in eliciting full penile erection, and the third because he attempted to control his penile erection by manipulating his penis. All subjects were fully informed of the nature of the experiment.

Apparatus

The apparatus was similar to that of Bancroft, Jones, and Pullan (1966) as modified by Laws and Rubin (1969). Basically, this apparatus was a mecury strain gauge transducer constructed of a 12-in. (30.5-cm) length of silicone rubber tubing filled with mercury and plugged at both ends with platinum wire. The tubing was attached to a small plastic holder to form a loop of 3-in. (7.6-cm) circumference that when in position, encircled the penis. This loop functioned as one leg of a bridge circuit that was powered by four 1.35-v mercury batteries. The resistance in the circuit was balanced by a variable resistor on another leg. Any changes in the circumference of the penis changed the length of the loop, resulting in a change in the diameter of the enclosed mercury, and this changed the electrical resistance of the mercury. These resistance changes resulted in changes in current flow through the mercury that were amplified and recorded by a polygraph (Grass, Model 7). The transducer was calibrated before and after each session by placing the loop around two standard cylinders and recording the resultant current flow.

An intercom located in the sound-proof, private chamber permitted communication between the subject and the experimenter, but the subject could be heard only if he depressed the "transmit" lever on the unit.

Stimuli

Stimuli were erotic motion pictures of approximately 10 min duration presented on a rear-projection screen in the experimental chamber. The onset and termination of the films were automatically recorded by a multipen event recorder.

Recording Apparatus

A microphone in the experimental chamber permitted non-audible recording of the subjects' verbal descriptions of the stimulus film on a tape recorder located in the adjacent control room. Before the experiment, each subject was fully informed of the presence and function of the tape recording equipment. The tape recorder was manually synchronized with the film projector to allow later comparisons of verbal descriptions and film content.

Detection Signals

To ensure that subjects were attending to the area of the film presentation, each subject was instructed to depress a button located on the arm of his chair whenever a brief (200 msec) flash of light appeared upon the projection screen. The lights could appear at either the top or the bottom of the projected image, and each was controlled by an independent VI 30-sec schedule; thus, a flash appeared on the average of once every 15 sec. Both signals and responses were recorded by a multipen event recorder.

Procedure

The procedure was similar to that employed by Laws and Rubin (1969). Each subject participated in a baseline test session in order to determine penile circumference of the flaccid state and full erection and the ability of the test stimulus film to elicit a full erection. The subject was instructed to place the transducer loop around the center of his penile shaft with the plastic holder on the underside of the penis; he was cautioned not to touch his penis or the transducer for the duration of the experiment, and was informed that such behaviors could be identified from the polygraph recording. The flaccid state was individually defined as the penile circumference recorded

when penile size stabilized (less than 1% of full scale variability for at least 30 sec) after emplacement of the transducer. Full erection was individually defined as the maximum penile circumference recorded from subjects who reported having a full erection while viewing the test stimulus film. These maximums were never exceeded in any subsequent recordings from the subjects. A second test stimulus film was shown to subjects who reported that they did not experience a full erection during the first test film; if the second film did not elicit a full erection from a subject, he was not allowed to complete the study. Partial erections were defined as any penile circumference that resulted in a current flow greater than the flaccid state and less than full erection. Full erections were reported as 100%, flaccidity as 0%, and partial erections as a percentage of full erection. The test session and experimental session for each subject were separated by a minimum of 24 hr, and films presented during the test session were never presented during the experimental sessions.

Every subject viewed the same stimulus film during their experimental sessions; a session consisted of showing a subject the same film five times in succession. The criterion for the onset of the first film presentation of a session was at least 30 sec of penile stability (flaccid state). Subsequent presentations of the film during a session were dependent upon penile circumference returning to within 5% of the flaccid state and remaining stable for at least 30 sec.

For the first presentation of the film the instructions to each subject were:

> "During this presentation of the film, do nothing to inhibit your sexual response to the film. Remember you must depress the button on the arm of your chair whenever a detection signal appears on the projection screen."

For the second film presentation the instructions to each subject were:

> "During this presentation of the film, avoid getting an erection by any means possible except not looking at the film. Remember you must depress the button on the arm of the chair whenever a detection signal appears on the screen."

For the third film presentation the instructions to each subject were:

> "During this presentation of the film, avoid getting an erection by any means except not looking at the film. Also, you are to describe what is going on in the film as it occurs, that is, give a running description of the action. There will be no detection signals during this presentation."

For the fourth film presentation the instructions to each subject were:

> "During this presentation of the film, do nothing to inhibit your sexual response to the film. Also, you are to describe what is going on in the film as it occurs, that is, give a running description of the action. There will be no detection signals during this film presentation."

For the fifth film presentation the instructions to each subject again were:

> "During this presentation of the film, do nothing to inhibit your sexual response to the film. There will again be detection signals during this presentation of the film."

When verbal descriptions were required, detection signals were not presented; detection signals were presented during film presentations 1, 2, and 5, verbal descriptions were made during film presentations 3 and 4. Table 1 gives a summary of the experimental procedure. The subjects did not remove the transducer or leave the chamber for the duration of the session. Each session was of approximately 90-min duration.

A paired-comparison discrimination procedure was used to determine if naive observers could detect a qualitative difference in the verbal descriptions made under the two instructional conditions by each of the five subjects. The standard stimulus for each subject

Table 1

Film Presentation	*Instructions*	*Attending Indicator*
1	Do Not Inhibit	Detection Signal
2	Inhibit	Detection Signal
3	Inhibit	Verbal Description
4	Do Not Inhibit	Verbal Description
5	Do Not Inhibit	Detection Signal

was always the same 30-sec segment of one of his descriptions and was randomly selected from either his inhibit description or his do not inhibit description. Three 30-sec segments from each of the two film descriptions made by a subject served as comparison stimuli. The standard stimulus and comparison stimuli were never descriptions of the same sections of the film. Each comparison stimulus was paired with the standard stimulus three times; thus, there were 18 pairs of descriptions for each subject. The total of 90 pairs of descriptions (18 pairs from each of five subjects) were tape recorded in random order and subsequently played to the observers. The instructions to each of three observers were:

> You will listen to several pairs of descriptions of film content made under different instructional conditions. Each pair will be numbered and will correspond to a number on your score sheet. Each pair will consist of a standard description and a comparison description made by the same subject at two different times. However, both the standard and the comparison will be from descriptions of the same film. The standard description will always be the first of each pair and may differ in content from the comparison. Some of the comparison descriptions were made under different instructional conditions than the standard, while others were made under the same instructional conditions as the standard. Your task will be to determine if the comparison description was made under the same or under different instructional conditions. The text of the description will *not* give a clue to aid in this discrimination. If you judge the second description of a pair to have been made under the same instructional conditions as the first, circle the "S" under the appropriate pair number on the score sheet. If you judge the second description of a pair to have been made under different instructional conditions than the first, circle the "D" after the pair number on the score sheet. You will have 10 sec to make your decision.

The entire procedure required approximately 2 hr to complete. Transcriptions were made of all six of the 30-sec segments of the verbal descriptions of each subject. A word count from these transcripts provided a measure of rate of speech under the two instructional conditions.

Finally, the entire recording of each verbal description was played through a voice-operated relay (Grason-Stadler Model E7300A-1) and the number and total duration of all pauses of at least 0.5 sec were automatically recorded on a counter and running time meter.

RESULTS

The calibration of the transducer never differed by more than 2% of full scale, within or between sessions.

Eighty-seven per cent of all detection signals were accurately detected; each subject accurately detected between 74% and 100% of the signal lights that appeared during any one film presentation. During the first presentation of the film, when the instructions were to not inhibit sexual responding, the accurate detection of signal lights averaged 84% for all subjects and ranged from 76% to 93% for individual subjects. During the second presentation, when instructions were to inhibit penile erection, signal detections were made with a mean accuracy of 91% for all subjects; with a range of from 86% to 97%. During the fifth film presentation, when the instructions not to inhibit penile erection were repeated, the average percentage of accurately detected signal lights was 87%, with a range from 74% to 100%. In the entire experiment (651 signal presentations), there were 14 false postive responses, *i.e.*, responses made without the appearance of a signal light.

Analysis of the subject's descriptions of the film, made while simultaneously listening to the tape recordings and viewing the film, indicated that all subjects accurately depicted the behavior in the film. Although there were numerous individual differences with respect to the vocabularies utilized, the two descriptions made by each subject contained both scientific or medical terminology and the sexual vernacular. The descriptions of four of the five subjects were generally fluent and continuous, and at no time did a pause of more than 10 sec occur in their descriptions. However, both reports made by S-1 were interrupted by several pauses ranging from 10 sec to 25 sec in duration.

Table 2

Observer Accuracy in Paired-Comparison Discriminations of the Two Verbal Descriptions

	Subject									
	1		2		3		4		5	
Observer	% Correct	χ^{2*}	% Correct	χ^{2*}	% Correct	χ^{2*}	% Correct	χ^{2*}	% Correct	χ^{2*}
1	56	0.22	72	3.56	67	2.00	56	0.22	67	2.00
2	50	0.00	67	2.00	39	0.89	39	0.89	50	0.00
3	44	0.22	56	0.22	39	0.89	72	3.56	56	0.22

*$\chi^2 \geq 3.84$ necessary for 0.05 level of significance

A comparison of the two descriptions made by each subject resulted in the experimenters judging that S-3 attempted to alter his "emotional" involvement with the content of the film under the two different instructional conditions. It was judged that when the instructions were to inhibit penile erection and describe the film, S-3 spoke at a faster rate, similar to a radio sportscaster, than during the do not inhibit-verbal description condition when he engaged in a slower, more relaxed report of the film. However, as can be seen in Table 2 the results of the paired-comparison discrimination test did not support the judgment of the experimenters; a chi square analysis of the data indicated that none of the three observers was able to detect a difference, at the 5% level significance, between the two descriptions of any subject. In addition, as can be seen in Table 3, there was no consistent change in either the rate of words spoken or pausing between the instructional conditions.

Three subjects (S-2, S-3, and S-4) spoke faster during the inhibit instructions; the remaining two subjects spoke slower. One subject (S-1) had a longer mean pause duration during the inhibit-instructions, while two subjects (S-3 and S-4) had shorter pause durations, and two (S-2 and S-5) were unchanged.

Figure 1 shows the amount of penile erection produced by each of the five subjects during the five successive film presentations. During the first presentation, when the instructions were for subjects to do nothing to inhibit penile erection, every subject exhibited a full erection during some portion of the film presentation. Each subject's maintenance of full erection ranged from less than 30 sec (S-5) to almost the entire duration of the film (S-2). Average erection for all subjects during this condition was 65% of maximum.

No subject produced a full erection during the second presentation of the film, when each subject was instructed to inhibit sexual

Table 3

Analysis of Verbal Descriptions of the Stimulus Film

Subject	Instructions	Mean Words per Minute[a]	Total Pause Time (Minutes)[b, c]	Number of Pauses[b]	Mean Pause Duration (Seconds)[b, c]
1	Inhibit	41	8.28	68	7.31
	Do Not Inhibit	73	6.49	72	5.41
2	Inhibit	144	2.81	128	1.32
	Do Not Inhibit	123	1.56	70	1.34
3	Inhibit	167	0.58	86	0.47
	Do Not Inhibit	91	3.01	114	1.58
4	Inhibit	167	4.13	138	1.80
	Do Not Inhibit	109	6.35	117	3.26
5	Inhibit	105	5.19	140	2.22
	Do Not Inhibit	134	4.24	118	2.16

[a]Computed from transcripts of three, 30-sec segments of each description. The same segments were used for each subject.

[b]Determined for entire description duration (10.6 min). Only pauses of 0.5 sec or longer included.

[c]Not including first 0.5 sec of each pause.

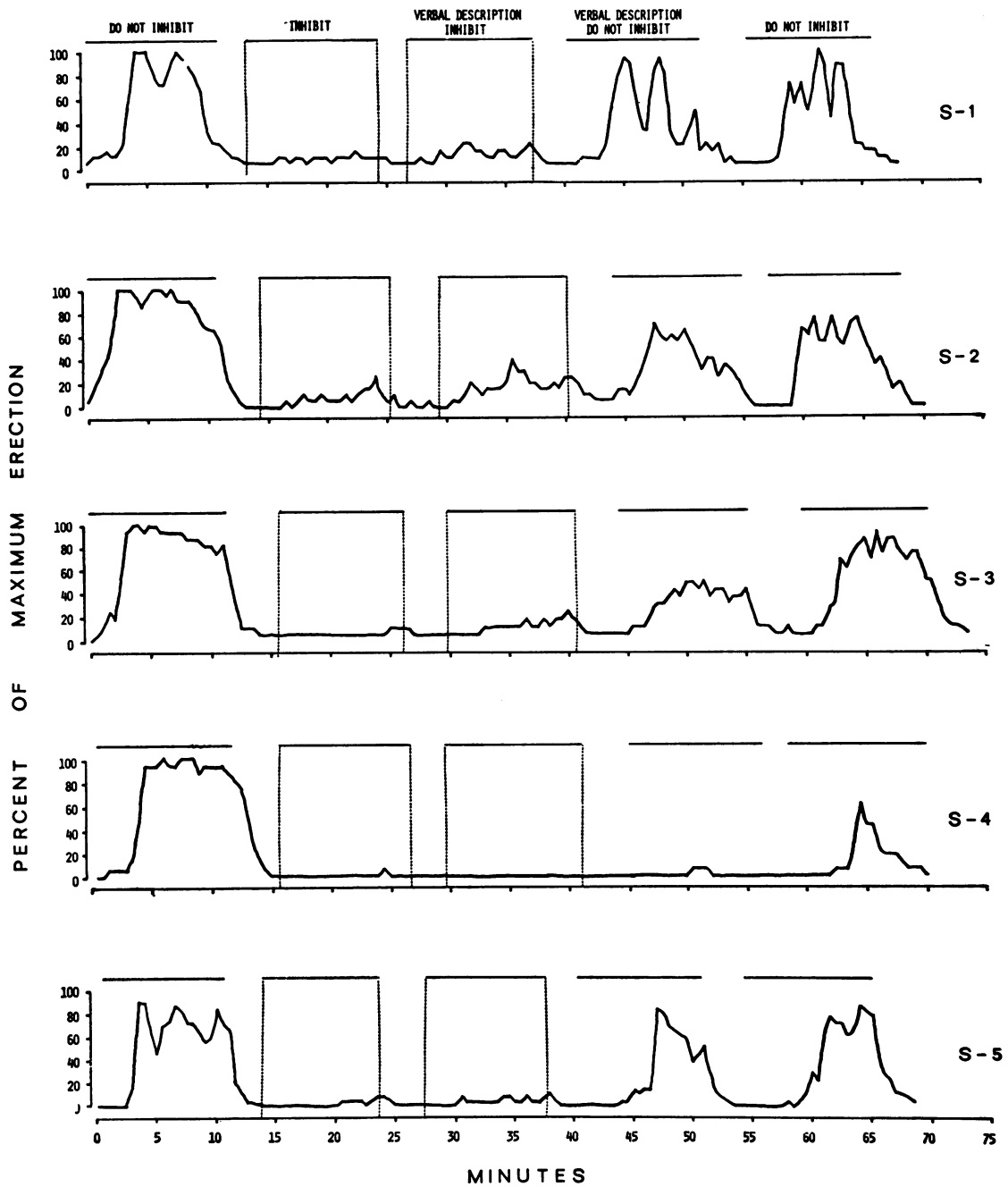

Fig. 1. Per cent of maximum penile erection elicited from five subjects during five successive presentations of an erotic film. The horizontal lines above each graph indicate those periods of time that the film was projected. Subjects were instructed to inhibit during presentations enclosed by dotted lines, and not to inhibit during all other presentations. Subjects were required to give a continuous account of the behavioral content of the film during those presentations labelled verbal description, and were required to make a detection response to the appearance of signal lights on the projection screen during all other presentations.

responding. At no time during this condition did the penile circumference of any subject exceed 25% of maximum, and only S-2 exhibited an erection that was greater than 15% of maximum. The average erection for all subjects during this condition was 5% of maximum.

During the third film presentation, when the instructions were to inhibit penile erection and to describe orally the behavioral content of the film, again no subject produced a full erection. Only S-2 displayed an erection that exceeded 25% of maximum. Three subjects exhibited slightly more tumescence and one subject slightly less tumescence during this condition than during the inhibit without verbal description condition. The remaining subject (S-5) developed identical peak erections during both inhibit conditions, but his average erection during the inhibit-description condition exceeded by a small amount that exhibited during the condition when instructions were to inhibit and no description was required. The average erection for all subjects during this condition was 9% of maximum.

During the fourth presentation, when the subject was instructed not to inhibit sexual responding and to describe the film, four of the five subjects exhibited a greater degree of tumescence than during any inhibit condition; although the peak erection (6% of maximum) attained by S-4 during this condition was identical to that reached during the inhibit-without description condition, the average erection was greater than that during any inhibit condition. Every subject exhibited substantially less tumescence during this condition (do not inhibit-description) than during the first presentation when the only instructions were not to inhibit penile erection. The average for all subjects during this condition was 28% of maximum.

During this final film presentation, when the instructions to do nothing to inhibit penile erection were repeated, every subject displayed more tumescence than during any condition but the first, when the instructions were also not to inhibit penile erection. The film was effective in eliciting a full erection from only S-1 during this final presentation, as compared to every subject during the first do not inhibit condition. The average erection for all subjects during this condition was 38% of maximum.

DISCUSSION

Laws and Rubin (1969) reported that motivated males were able to inhibit penile erection while attending to the display area of erotic stimuli. All of their subjects reported that they accomplished inhibition of penile erection by thinking about asexual stimuli that required some concentration, *e.g.*, lyrics to popular songs, multiplication tables, verses to poetry, or the immediate detection of stimulus lights (Laws and Rubin, 1969). All subjects in the present study reported using the same methods of intellectual asexual stimulation to inhibit tumescence when their attention to the erotic stimuli was monitored by the detection signal response. The substitution of the verbal description for the detection signal response, as an attending indicator, served two functions. The description guaranteed that the subjects were attending to the content of the erotic stimuli and afforded the subjects little or no opportunity to concentrate on a competing asexual stimuli; yet all subjects were able to inhibit their penile erections to about the same degree as when they were able to produce competing stimuli. Thus, the present study not only confirms the results of Laws and Rubin (1969), but also suggests that the self-generation of such competing asexual stimuli is not essential for successful inhibition of penile erection.

All subjects reported that they were motivated for their penile responding to conform to the instructions to inhibit penile erection; however, none could identify the mechanism by which inhibition was achieved when they were required to describe the stimulus film. The only behavior that subjects reported engaging in was the description of the film itself. A comparison of the penile responding during the final two conditions, in which instructions not to inhibit were in effect, indicated a reduction in tumescence when a description was required as compared to when none was required. Therefore, the verbal description might have functioned as a competing behavior that resulted in reduction of penile erection. The inhibitory effect of the description was most dramatic for S-4, penile erection was almost totally eliminated when he was required to describe the film. For the other four subjects, the decrease in penile tumescence generated by the description was small com-

pared to the marked reduction in penile circumference when the instructions were to inhibit, regardless of whether a description was required.

Since the act of describing the film was the only behavior that subjects reported engaging in when they effectively inhibited penile erection, perhaps the control over penile tumescence resulted from subjects differentially describing the film under the two instructional conditions. However, analysis of the two descriptions made by each subject did not confirm this hypothesis. Although the experimenters judged that S-3 gave qualitatively different descriptions under the different instructional conditions, three observers were not able to detect a difference between the two descriptions made by each subject and, an analysis of the speech patterns of all subjects indicated no consistent change in either the rate of words spoken or in the pattern of pausing. Each subject was able to exert voluntary control over penile erection while attending to the content of erotic stimuli, but at this time the method of such control is not known by either the subjects or the experimenters.

REFERENCES

Bancroft, J. H. J., Jones, H. G., and Pullan, B. R. A simple transducer for measuring penile erection, with comments on its use in the treatment of sexual disorders. *Behavior Research and Therapy*, 1966, **4**, 239-242.

Banuazizi, A. Modification of an autonomic response by instrumental learning. *Psychonomic Bulletin*, 1967, **1**, 30.

Birk, L., Crider, A., Shapiro, D., and Tursky, B. Operant electrodermal conditioning under partial curarization. *Journal of Comparative and Physiological Psychology*, 1966, **62**, 165-166.

Crider, A., Shapiro, D., and Tursky, B. Reinforcement of spontaneous electrodermal activity. *Journal of Comparative and Physiological Psychology*, 1966, **61**, 20-27.

DiCara, L. V. and Miller, N. E. Instrumental learning of urine formation by curarized rats. *Psychonomic Bulletin*, 1967, **1**, 23-24.

DiCara, L. V. and Miller, N. E. Changes in heart rate instrumentally learned by curarized rats as avoidance responses. *Journal of Comparative and Physiological Psychology*, 1968, **65**, 8-12. (*a*)

DiCara, L. V. and Miller, N. E. Instrumental learning of vasomotor responses by rats: Learning to respond differentially in the two ears. *Science*, 1968, **159**, 1485-1486. (*b*)

Engel, B. T. and Chism, R. A. Operant conditioning of heart rate speeding. *Psychophysiology*, 1967, **3**, 418-426.

Engel, B. T. and Hansen, S. P. Operant conditioning of heart rate slowing. *Psychophysiology*, 1966, **3**, 176-187.

Gavalas, R. J. Operant reinforcement of an autonomic response: two studies. *Journal of the Experimental Analysis of Behavior*, 1967, **10**, 119-130.

Hnatiow, M. and Lang, P. J. Learned stabilization of heart rate. *Psychophysiology*, 1965, **1**, 330-336.

Houssay, B. S. *Human physiology*. New York: McGraw-Hill, 1955.

Johnson, H. J. and Schwartz, G. E. Suppression of GSR activity through operant reinforcement. *Journal of Experimental Psychology*, 1967, **75**, 307-312.

Kelly, G. L. Impotence. In A. Ellis and A. Arbarbanel (Eds.), *Encyclopedia of sexual behavior*. New York: Hawthorne Books, 1961. Pp. 515-518.

Laws, D. R. and Rubin, H. B. Instructional control of an autonomic sexual response. *Journal of Applied Behavior Analysis*, 1969, **2**, 93-99.

Miller, N. E. and Banuazizi, A. Instrumental learning by curarized rats of a specific visceral response, intestinal or cardiac. *Journal of Comparative and Physiological Psychology*, 1968, **65**, 1-7.

Miller, N. E. and Carmona, A. Modification of a visceral response, salivation in thirsty dogs, by instrumental training with water reward. *Journal of Comparative and Physiological Psychology*, 1967, **63**, 1-6.

Miller, N. E. and Dicara, L. V. Instrumental learning of heart rate changes in curarized rats: shaping and specificity to discriminative stimulus. *Journal of Comparative and Physiological Psychology*, 1967, **63**, 12-19.

Senter, R. J. and Hummel, W. F. Suppression of an autonomic response through operant conditioning. *The Psychological Record*, 1965, **15**, 1-5.

Trowill, J. A. Instrumental conditioning of the heart rate in the curarized rat. *Journal of Comparative and Physiological Psychology*, 1967, **63**, 7-11.

Received 29 June 1970.
(Revised 20 November 1970.)