Pupil responses of addicts in treatment to drug culture argot: I. Auditory presentation of double entendre words

FRED ALTMAN

NIMH Clinical Research Center and University of Kentucky
Lexington, Ky. 40506

and

NILES BERNICK and DANIEL L. MINTZ

NIMH Clinical Research Center, Lexington, Ky. 40507

Eleven addicts in treatment and eight nonaddicts familiar with addict argot were asked to listen to and think about a series of words, half of which were double entendre, having one of their meanings in the addict argot. Pupil size, the dependent variable, was recorded continuously via infrared cinematography. Both groups of Ss responded differentially to the two kinds of words. These results were interpreted in terms of the cognitive processing of the stimuli rather than their emotional impact.

Lyle, Miller, & Monroe (1970) have demonstrated that addict argot elicits distinctive associations in individuals under treatment for narcotic addiction (hereafter referred to as postaddicts) that are reliable indicators of identification with the addict subculture. This technique requires cooperative respondents and can be subject to voluntary distortion. While these researchers point out that addicts are often unaware of the extent of their involvement in the subculture of addiction, it would be desirable to develop a completely involuntary measure of an individual's involvement, especially for applications employing repeated measures and uncooperative or test-wise respondents. Postaddicts have been shown to have lower recognition thresholds for tachistoscopically presented addict argot than for control words (Jones, 1965). In Jones's study, there remained some question however, as to whether the Ss' familiarity with the words used could account for the observed differences—when an attempt was made to control for word familiarity, a significant difference in threshold was demonstrable in only one of the two alternate word lists that were used. In that list, there was still a significant difference in the pleasantness-unpleasantness ratings of the argot and nonargot words, thereby making interpretation of the threshold difference difficult. One explanation of these data assumes that drug argot is arousing for postaddicts because it represents a previously desirable state, a present sense of deprivation, drug related anxieties about the future, or other emotionally laden experiences. If this assumption is valid, it should be possible to discriminate responses to argot and nonargot words using measures that reflect emotional

responses. Recently, there has been a considerable volume of research and some associated controversy relating to the pupil response (see Bernick et al, 1971); however, there is also essential agreement that the pupil does respond to the emotional content of stimulation and that stimuli associated with more positive affects typically produce larger pupil diameters.¹ The recurrent question of the directionality of the pupil response seems to depend upon the essentially arbitrary choice of a baseline and is not relevant for this discussion. Since pupil size has been shown to be related to the emotional properties of stimuli and since there appears to be a negative correlation between pupil size and tachistoscopic recognition threshold (Hutt & Anderson, 1967), we would expect postaddicts to show a larger pupil response to addict argot than to nonargot control words. Our first objective was to test this hypothesis.

Further, a difference in pupil response to argot words between postaddicts and control Ss familiar with the argot would be expected because the argot would presumably have less emotional significance for the controls than it would have for the postaddicts. Such a difference was obtained in Jones's tachistoscopic recognition threshold study.

SUBJECTS

The Ss were 11 postaddicts in treatment at the NIMH Clinical Research Center in Lexington, Kentucky. Eight members of the Center's staff, individuals familiar with drug argot, served as controls. The postaddicts varied in age from 18 to 46 years, with a mean of 23.3 years; 5 were black and 6 were white. For the controls, the mean age was 40.7 years with a range of from 27 to 64 years; 2 were black and 6 were white.

INSTRUMENTATION

Pupil size was recorded, using infrared cinematography at the rate of 2 frames/sec. The apparatus consisted of a box with a face cushion at one end and a 30-cm-square rear projection screen at the other. The distance from the S's eyes to the screen was 62 cm. The camera was mounted on the right side of the box in such a way that it could be focused on the S's left eye via a mirror (Bernick & Oberlander, 1968).

Two levels of illumination were used: in the light condition, the screen was illuminated to 15 fc, and in the dark condition, it was approximately 0 fc. A tape player with earphones was used to present the instructions and to administer the words. For measurement, the photographic image of the eye was enlarged 20 times actual size and the horizontal diameter of the pupil was measured with a caliper. The caliper drove a linear potentiometer whose output was digitized and printed. The measurement accuracy of this system is estimated at ± 0.02 mm of the actual pupil size.

PROCEDURE

Ss sat down, put on the earphones, and placed their heads against the face cushion. The camera was focused, and a 3½-min light adaptation period started. When this adaptation period was complete, a tape recording was started which ran continuously for the remainder of the experiment, presenting the instructions as well as the auditory stimuli. The instructions that follow lasted approximately 30 sec. "During the next few minutes the light on the screen in front of you will go on and off. Please keep looking at the center of the screen even when the screen is dark. A list of words will be read through the earphones. Think about what each word means to you as you hear it. Do not talk during this part of the experiment. Keep your eyes directed toward the center of the screen and try not to move your head. Begin."

Upon completion of the instructions, the camera was started. The light condition was maintained for another 15 sec followed by 15 sec in the dark condition and another 15 sec in the light. This light-dark alternation was presented so that Ss having abnormal pupillary light reflexes could be identified and removed from the sample. No such selection was required. At the end of this period, the light condition remained for the rest of the experiment. The stimulus words were presented at a rate of 1 word/5 sec. As each word was presented, one frame of the film record was fogged as a reference.

MATERIALS

The drug argot used was selected from published lists (e.g., NIMH CRC, 1971) and from information obtained from interviewing postaddicts. In order to insure that familiarity would be high, and to increase the chances of discriminating addicts from nonaddicts in future applications of the word list, double entendre words were selected as the drug argot. This selection was not difficult to accomplish, since the majority of drug argot words are, for the addict, double entendre in character. While for the control group of the present study these words were also double entendre, for an argot-naïve group, few of these words would be recognized as having other than "straight" meanings. Control words were equated with argot in both length and meaning. The order of presentation was randomized. The list of words used in the order of presentation follows (the asterisk indicates that the word has drug argot meaning): Above, trash, kick*, rest, stuff*, nod*, coke*, Jones*, dress, Smith, high*, repair, slap, pack, spoon*, fix*, outfit*, fork, orange, junk*.

RESULTS AND DISCUSSION

Mean pupil size in millimeters for the 10 frames following the presentation of each word served as the basic data for this study. Contrary to our hypothesis, pupil size following the presentation of nonargot words was larger than pupil size following argot words for both postaddicts and controls. For the postaddict group, mean pupil size following argot words was 3.895 mm while the mean following nonargot words was 3.949 mm ($t = 3.576$, $df = 10$, $p < .01$). For the control group, the means were 3.775 mm and 3.814 mm, respectively ($t = 3.382$, $df = 7$, $p < .01$). There were no significant differences between groups with respect to the difference between pupil responses to addict argot and pupil responses to nonargot words, the mean difference for the postaddict group being .015 mm larger than that of the control group ($t = .777$, $df = 17$, n.s.).² Unexpected as these results were, they cannot readily be attributed to artifact since the light level was constant throughout the presentation, the order of presentation was randomized, the argot and control words were matched in both length and meaning, and all the words were highly familiar.

The results do not support the arousal hypothesis presented earlier. If, however, it is assumed that arousal is not monopolized and that some type of negative arousal has been produced in both groups of Ss, and if one accepts Hess's notion that "negative"

stimuli produce a smaller pupil than do neutral stimuli (Hess, 1965; Polt & Hess, 1968), a case can still be made for these results being due to differential arousal. It is, however, still difficult to reconcile the results of the present study with the correlation between pupil size and tachistoscopic recognition threshold obtained by Hutt & Anderson (1967) and Jones's (1965) finding of shorter tachistoscopic recognition thresholds for argot.

A more satisfactory explanation of our results can be formed in terms of cognitive load. It has been shown that problem solving, imagery, and memory load all produce increased pupil size (Hess & Polt, 1964; Paivio & Simpson, 1966; Simpson & Paivio, 1966; Kahneman & Beatty, 1966; Bernick & Oberlander, 1968). In the present study, Ss were instructed to *think* about the words they heard. The backgrounds of the experimental Ss (postaddicts), and the controls (staff at the Clinical Research Center, a treatment facility for narcotic addicts) and the fact of their being tested at the Center, provide an appropriate set and setting that make references to the drug argot relatively easy. In contrast, thinking about the highly familiar nonargot words may have been more difficult, since these words may not have been associated with such specific references. Accordingly, thinking about nonargot words may have required greater mental effort and hence increased pupil size. Interpreted in this way, these results are analogous to the findings of Paivio & Simpson (1966, 1968). These investigators found that abstract words produced a larger pupil than concrete words, the difference being attributed to greater ease of forming an image for concrete words.

While Hutt & Anderson (1967) found pupil size and tachistoscopic recognition threshold to be correlated when the arousal value of their stimuli varied, the results of the present study are most parsimoniously explained in terms of cognitive load and are, accordingly, not quite comparable. Apparently, asking Ss to think about an aurally presented word is more like a problem solving situation and less like one in which the S is simply responding to the arousal qualities of the stimulation *per se*. If we thus abandon the arousal model, we would not necessarily expect our results to resemble those of Jones's study.

The cognitive effects on pupil size that were obtained are interesting in themselves and warrant further investigation. However, such cognitive differences do not appear to be readily applicable to the assessment of an individual's identification with a

group—the type of discrimination involved in our second hypothesis. In an attempt to return to an experimental situation in which we are observing the arousal properties of the stimuli themselves rather than the cognitive responses that they trigger, a second study of pupil responses to drug argot was designed and conducted. It is reported as the second in this series (Bernick, Altman, & Mintz, 1972).

REFERENCES

- BERNICK, N., Relationship between age and pupil size: Some additional variables. *Perceptual & Motor Skills*, 1972, 34, 727-731.
- BERNICK, N., ALTMAN, F., & MINTZ, D. L. Pupil responses of addicts in treatment to drug culture argot: II. Responses during verbalization of visually presented words. *Psychonomic Science*, 1972, 28, 81-82.
- BERNICK, N., KLING, A., & BOROWITZ, G. Physiologic differentiation of sexual arousal and anxiety. *Psychosomatic Medicine*, 1971, 33, 341-352.
- BERNICK, N., & OBERLANDER, M. Effect of verbalization and two different modes of experiencing on pupil size. *Perception & Psychophysics*, 1968, 3, 327-330.
- HESS, H. Attitude and pupil size. *Scientific American*, 1965, 212, 46-54.
- HESS, H., & POLT, M. Pupil size in relation to mental activity during simple problem-solving. *Science*, 1964, 143, 1190-1192.
- HUTT, L. D., & ANDERSON, J. P. The relationship between pupil size and recognition threshold. *Psychonomic Science*, 1967, 9, 447-478.
- JONES, B. E. Visual recognition thresholds for narcotic argot in postaddicts. *Perceptual & Motor Skills*, 1965, 20, 1065-1069.
- KAHNEMAN, D., & BEATTY, J. Pupil diameter and load on memory. *Science*, 1966, 154, 1583-1585.
- LYLE, W. H., JR., MILLER, J. S., & MONROE, J. J. A word association measure of knowledge of addict jargon as an indicator of identification with an addict subculture. *International Journal of Addictions*, 1970, 5, 233-243.
- NIMH CLINICAL RESEARCH CENTER. *Peanuts and tea: A selected glossary of terms used by drug addicts*. National Institute of Mental Health, 1971.
- PAIVIO, A., & SIMPSON, H. M. The effect of word abstractness and pleasantness on pupil size during an imagery task. *Psychonomic Science*, 1966, 5, 55-56.
- PAIVIO, A., & SIMPSON, H. M. Magnitude and latency of the pupillary response during an imagery task as a function of stimulus abstractness and imagery ability. *Psychonomic Science*, 1968, 12, 45-46.
- POLT, M., & HESS, H. Changes in pupil size to visually presented words. *Psychonomic Science*, 1968, 12, 389-390.
- SIMPSON, H. M., & PAIVIO, A. Changes in pupil size during an imagery task without motor response involvement. *Psychonomic Science*, 1966, 5, 405-406.

NOTES

1. For the purposes of the present study, "arousal" and "emotional response" are used interchangeably and "positive-negative" or "pleasant-unpleasant" merely suggest their dimensional qualities.
2. The difference in pupil size between the two groups is accountable for in terms of the difference between their mean ages (Bernick, 1972).