Tactile stimulation and the short-term perceptual deprivation effect*

R. M. YAREMKO†, BRADLEY GLANVILLE, C. P. ROFER
and BRUCE T. LECKART
San Diego State College, San Diego, Calif. 92115

This study investigated the hypothesis that there is a positive relationship between duration of short-term perceptual deprivation and duration of tactile exploratory behavior. Using a within-Ss design, college students handled octahedrons after 0, 15, 30, and 60 sec of reduced stimulation. The results indicated a positive linear relationship between duration of perceptual deprivation and duration of handling the octahedrons. The results were discussed in terms of a theory of exploratory behavior based on the concept of an optimal level of arousal.

Recently, Leckart, Levine, Goscinski, & Brayman (1970) investigated looking times for random geometric forms when the viewing periods were preceded by short intervals of "perceptual deprivation" (a darkened experimental chamber). That study revealed a direct relationship between looking times and preceding dark periods of 2, 16, 30, and 44 sec. Explanations of this short-term perceptual deprivation effect (PDE) in terms of retinal dark adaptation or avoidance of impending dark periods were ruled out, and it was concluded that the PDE most likely reflects an increase in visual exploration produced by the relative absence of stimulation during the dark periods.

One highly significant aspect of the PDE finding is the fact that it parallels the effects produced by long periods of enforced sensory restriction (e.g., Schultz, 1965). These studies show dramatic increases in exploratory behaviors during or following up to many hours of sensory deprivation, presumably due to an increasing need for stimulation by the organism. One popular theoretical interpretation of this phenomenon invokes the notion of an optimal level of arousal (Hebb, 1955). That is, if prolonged sensory restriction lowers arousal, the resulting exploratory behaviors are an attempt to maintain or increase arousal.

One implication of the short-term PDE reported by Leckart et al (1970) is that such homeostatic processes are not endemic to the long-term sensory restriction paradigm and that transient changes in arousal level motivate all or most exploratory behaviors. This possibility raises important questions regarding the nature and generality of the PDE. Specifically, if the PDE is not an artifact of the conditions under which looking behavior is studied and reflects deprivation-induced exploration, the PDE should not be restricted to the visual modality. Accordingly, the present experiment was designed to investigate the presence of the PDE in the tactile modality under conditions analagous to those employed by Leckart et al (1970). It was expected that time spent handling various polyhedrons would be a function of the duration of the period of "perceptual deprivation" preceding the stimulus.

SUBJECTS AND APPARATUS

Six male and 10 female introductory psychology students at San Diego State College served as Ss in order to satisfy a course requirement. Data were collected from the blindfolded S seated at a table behind a 60 x 90 cm opaque screen. The S's preferred hand extended under the screen and rested on a thick cotton pad. In order to mask E-produced noises and maintain a relatively invariant environment, white noise was delivered to S through earphones. Electrodes from a galvanometer designed for classroom demonstrations were attached to the first and second fingertips of S's nonpreferred hand. The handling stimuli were 20 octahedrons cut from wood blocks approximately 5 x 10 x 10 cm and sanded smooth. The stimuli weighed between 45 and 110 g ($\overline{X}$ = 73.5 g) and displaced between 75 and 200 ml ($\overline{X}$ = 141 ml). A wood sphere, approximating the mean values of the octahedrons and 5.4 cm in diam, was used as a "filler" stimulus between trials.[1]

PROCEDURE

The S was told that this study investigated changes in the galvanic skin response (GSR) from handling various forms. The electrodes were attached, and S observed some of his own GSRs as meter deflections on the galvanometer. The S was told that he would be given a wooden sphere to handle and that at various times the sphere would be replaced by another stimulus (one of the octahedrons), which he was to handle ". . . until you are *finished* handling it." He was also told that this procedure would be repeated several times. Data collection began after the blindfold and earphones were attached. Perceptual deprivation was defined as the interval between octahedrons (0, 15, 30, and 60 sec) when S had to handle the sphere. Each S received a different random sequence of the 20 octahedrons and a different block-randomized sequence of the deprivation intervals. Handling times were recorded to the nearest 0.2 sec.

RESULTS

For each S, mean handling times for stimuli following the four deprivation intervals were computed. These data are presented in Fig. 1. The overall trend toward longer handling times was significant [$F(3,45) = 6.14$, $p < .005$]. Duncan's multiple range test revealed significant differences between deprivation intervals of 0 and 30 sec ($p < .05$), 0 and 60 sec ($p < .001$), and 15 and 60 sec ($p < .01$). Orthogonal analysis indicated a strong linear trend [$F(1,45) = 18.25$, $p < .001$], without a tendency toward curvilinearity [$F(\text{quartic}) < 1.0$].

DISCUSSION

These results clearly support the hypothesis that time spent handling various stimuli is a function of the duration of the deprivation interval preceding the stimulus. Further, the findings convincingly demonstrate that the short-term PDE is not restricted to the visual modality and is most likely not an artifact of the conditions under which looking times are measured. Rather, these findings indicate that the

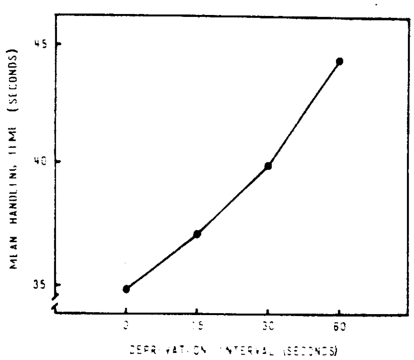

Fig. 1. Duration of handling as a function of preceding deprivation interval.

*Supported in part by grants to the first and last authors from the San Diego State College Foundation.

†Address reprint requests to R. M. Yaremko, Department of Psychology, San Diego State College, San Diego, Calif. 92115.

PDE most probably reflects modality-nonspecific exploratory behaviors motivated by the lack of stimulation experienced during the deprivation intervals.[2] The data, therefore, increase the generality of the PDE.

One rather interesting aspect of the present results is the significant linear relationship between deprivation and handling times. In the earlier PDE study, the relationship between deprivation and looking times was curvilinear, reaching asymptote at 30-44 sec. While the depriving conditions in both studies were comparable (visual and auditory constancy), the fact that exploratory behaviors in the present study were tactile rather than visual tempts queries about the relative contributions of stimulation mediated by different sense modalities relative to the "most deprived" modality.

The parallel between the PDE and the results of long-term sensory restriction studies invites the application of, and extrapolations from, Hebb's (1955) notion of an optimal level of arousal. According to this position, each organism has an optimal level of arousal, departures from which create a state of homeostatic imbalance. Assuming that stimulus change produces arousal, the deprivation periods used here may be viewed as intervals during which arousal level declines from the optimal, the amount of decline being commensurate with the duration of deprivation. Given that tactile exploration provides arousal through stimulus change, S will explore more or less depending on the discrepancy between his level of arousal and the optimal. This explanation involves the prior assumption that the more distant S is from the optimal, the less stimulus change is needed to produce a given increase in arousal. Further, it is assumed that S continues to explore so long as the stimulus raises arousal or maintains an optimal level of arousal. The fact that long handling times follow longer deprivation periods most likely stems from the ability of the stimulus to provide prolonged increases in the level of arousal due to S's distant position from the optimal, i.e., the arousal-producing potential of the stimulus is exhausted slowly. Likewise, the shorter handling times that follow short durations of deprivation stem from S's closer proximity to the optimal, where more stimulus change is needed to produce a given increment in arousal. That is, the arousal capacity of the stimulus is rapidly exhausted.

An alternative interpretation (Berlyne, 1960) suggests that an *increase* in arousal follows periods of stimulus deprivation. Like other need states, stimulus deprivation contributes to general drive, and like other appetitive behaviors, stimulus-seeking (stimulation achieved by increased handling in the present study) decreases general drive. This view might account as well for the present results. However, the concensus of research on physiological measures of arousal as a function of short periods of stimulus deprivation (e.g., Duffy, 1962) is that arousal *decreases* over the short term. Thus, the former theoretical account seems, on balance, more consistent with the results of the present study.

REFERENCES

BERLYNE, D. E. *Conflict, arousal and curiosity*. New York: McGraw-Hill, 1960.

DUFFY, E. *Activation and behavior*. New York: Wiley, 1962.

HEBB, D. E. Drives and the C. N. S. (conceptual nervous system). Psychological Review, 1955, 62, 243-254.

LECKART, B. T., LEVINE, J. R., GOSCINSKI, C., & BRAYMAN, W. Duration of attention: The perceptual deprivation effect. Perception & Psychophysics, 1970, 7, 163-164.

SCHULTZ, D. P. *Sensory restriction effects on behavior*. New York: Academic Press, 1965.

NOTES

1. The use of deprivation intervals during which S was totally quiescent would leave the results open to the alternative interpretation that accumulating motor fatigue from handling the stimuli could not dissipate sufficiently during the shorter deprivation intervals to permit handling times to resume some operant level. To avoid this sort of "reminiscence" interpretation, the present study employed the spherical "filler" stimulus to equalize the motor aspects of deprivation and free handling periods while reducing stimulation relative to that presumably provided by octahedronal forms and thus maintaining the stimulus contrast between deprivation and exploration intervals.

2. An alternative interpretation maintains that the Ss try to match or mimic the preceding deprivation interval. A recent study by Leckart, Butler, & Yaremko (unpublished manuscript) presents data contrary to this hypothesis.