AROUSAL AND EXPLORATORY BEHAVIOR OF BRAIN-DAMAGED AND NON-BRAIN-DAMAGED CHILDREN

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ABSTRACT

Exploratory responses of 25 brain-damaged and 25 non-brain-damaged children who were matched for mental age demonstrated that brain-damaged Ss explored less than non-brain damaged Ss. However, for both groups, exploratory behavior was affected by conditions of high and low arousal, the brain-damaged group seemingly more affected. It was also noted that the type of stimulus pattern chosen was affected by the presence or absence of brain damage.

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Interest and speculation concerning the intrinsic aspects of exploratory behavior have sharply increased during the past decade. The scope of the problem is illustrated by studies which range from stimulus preferences and heightened arousal in rats (Berlyne, Koenig & Hirota, 1966), shock and sensory deprivation (Harrington & Kohler, 1966), shock, sensory deprivation and extinction (Miller, Kiker & Stewart, 1967; Miller, Stewart & Kiker, 1968; Miller, Stewart & Kiker, 1969) to the effects of environmental variations on the development of children (Munsinger & Kessen, 1964).

Exploratory behavior has also been studied relative to curiosity motivation (Smock & Holt, 1962; Harris, 1965), perceptual responses (Clapp & Eichhorn, 1965) and mental retardation (Hoats, Miller & Spitz, 1963; Holt & Ounsted, 1965).

An important finding of the Holt, et. al., study is the diminished exploratory drive of the mentally retarded when compared to normals. Since brain-damaged subjects are

typically characterized as being rigid, perseverative, and concrete, it follows that they should also demonstrate lessened exploratory behavior.

This study seeks to compare exploratory responses for brain-damaged and non-brain-damaged children and the effects of induced arousal on these responses. It also indirectly tests the Berlyne (1960) concept of "arousal jag" which states that in gambling behavior, immediate knowledge of results reduces initially aroused tensions, thus reinforcing gambling whereas delayed feedback perpetuates the level of aroused tension thereby constricting this behavior. The strategy used is basically a modification of the Berlyne and Lewis (1963) study in which they were able to demonstrate, using information theory concepts, that exploratory behavior in normal subjects could be modified by changing the level of arousal.

Exploratory behavior is defined as subject response to stimuli. The intensity of the behavior is measured by the number of times a subject chooses a stimulus possessing more of any of the following characteristics: (1) irregularity of arrangements, (2) irregularity of shape, (3) heterogeneity of elements, (4) amount of material, and (5) incongruity, in preference to a matched pair possessing less of the above characteristics.

Method:

Subjects: A total of 50 hospitalized and non-hospitalized children participated. They were divided into two equal groups of brain-damaged (BD) and non-brain-damaged (NBD) matched for mental age. The adequacy of the match is demonstrated by the non-significant test results ($t = 1.29$, $df = 48$, $p = .05$) between the mean mental ages of 7.0 for the BD group and 7.6 for the NBD group.

Apparatus:

Material used for the stimulus consisted of 40 2" x 2" cards containing various geometric patterns. The cards were presented in pairs. Following Berlyne's (1960) constructs, the pattern on one of each pair was designed to be conceptually more complex than the other.

Procedure:

In order to ascertain the effects of delayed feedback versus immediate feedback, it was deemed desirable to obtain some measure of baseline performance. Accordingly, the following three treatment conditions evolved: (a) baseline, (b) immediate feedback, (c) delayed feedback.

Children selected to provide a measure of baseline performances consisted of 10 brain-damaged and 10 non-brain-damaged. They were presented with each of the 20 pairs of stimulus material in random order and asked to choose between one or the other. The maximum time allowed for each choice was 3 seconds.

Those considered under conditions of immediate feedback consisted of seven brain-damaged and seven non-brain-damaged. Presentation of the stimulus material was the same as previously except that just prior to presentation, the experimenter involved the children in a guessing game. They were given two pennies each time they were able to correctly identify the examiner's hand hiding a coin but were required to return the two pennies each time they were wrong. The game was so rigged that the child invariably won on the first trial but lost all his winnings by the tenth trial.

Under conditions of delayed feedback, eight brain-damaged and eight non-brain-damaged children were similarly engaged in the guessing game just prior to the presentation of the stimulus cards. However, information relative to wins or losses during the ten trials were withheld and reported only upon completion of the entire experiment. As previously, the game was rigged and none of the children received monetary rewards.

Results:

Subject preferences for each of the two groups under the three treatment conditions are presented in Table 1.

Comparison between baseline performances for the brain-damaged and non-brain-damaged groups indicates that non-brain damaged subjects exhibits a higher level of exploratory behavior ($U = 6$, $N_1 = 10$, $N_2 = 10$, $p = .001$) substantiating

our hypothesis.

The data also support Berlyne's concept of "arousal jag". As would be predicted, the level exploratory behavior should increase under conditions of immediate feedback and decrease when feedback is delayed. Such was the case for both groups. Kruskal - Wallis analysis of variance give the following results: For the brain-damaged group (H = 9.51, df = 2, p = .01): for the non-brain-damaged group (H = 8.86, df = 2, p = .02).

Table 1

Influence of treatment conditions upon the number of preferences for more complex stimuli.

	Baseline	Immediate Feedback	Delayed Feedback
Brain-Damage	5.5	9	2.5
Non-Brain-Damaged	10.5	12	8.5

Further examination of data suggest that brain-damaged and non-brain-damaged subjects differ not only in the overall level of exploratory behavior, but also in the kind of exploratory behavior. This finding is summarized in Table 2.

Table 2

Stimulus characteristics and expressed preferences of brain-damaged and non-brain-damaged children (frequencies for baseline group).

Characteristic	Brain-Damaged	Non-Brain-Damaged
Irreg. of arrangmt.	16%	22%
Amt. of Material	20%	21%
Hetero. of elements	24%	31%
Irreg. of shape	0%	19%
Inconqruity	2%	12%

Discussion:

One effect of brain damage appears to be the inhibiting of exploratory behavior resulting in a loss of flexibility in dealing with high arousal states. This finding, per se, contributes little to the established literature. The significance lies in the quantification of the degree of impairment. In our study, although subjects were equated for mental age, the brain-damaged groups were chronologically much older (11.5 vs. 8.9; $t = 4.62$; $df = 48$; $p = .01$). Since it is commonly assumed that the ability to tolerate ambiguity, incongruity, and irregularities, etc., increases with age, up to a certain point, the degree of impairment must be regarded as being quite pronounced. Furthermore, as the chronological age of the non-brain-damaged group suggests, many of the children included in this group were culturally impoverished and were functioning at an intellectual level of mild to borderline retardation. The hospitalized portion of these children were admitted for treatment of various orthopaedic defects resulting from arthritis, spinal cord injury, spina bifida, etc. Thus, we

tentatively conclude that the presence of brain damage results in the impairment of exploratory behavior beyond the already diminished level of the mentally retarded.

The study suggests that brain-damaged children have their greatest difficulty in dealing with irregularity of shape and incongruity and that once aroused maintain a high arousal state for a considerable longer time than normals and non-brain-damaged retardates. This higher arousal state tends to impair exploratory behavior.

In terms of optimal learning situations, the study implies that when it is desirable that children learn through "discovery", arousal followed by immediate reduction of tension provides an optimal condition for both brain-damaged and non-brain-damaged children since such increases the exploratory level relative to baseline. On the other hand, continued high tension states decrease exploratory level relative to baseline for both groups and since brain-damaged children have lower baseline levels, the avoiding of high arousal states might be critical in the teaching of the brain-damaged child.

REFERENCES

Berlyne, D. E., Conflict, Arousal and Curiosity. New York: McGraw Hill, 1960

Berlyne, D. E., & Lewis, J. L. Effects of Heightened Arousal on Human Exploratory Behavior. Canad. J. Psychol., 1963, 17, 398-411

Berlyne, D. E., Koenig, I. D. V., & Hirota, T. Novelty, Arousal and the Reinforcement of Diversive Exploration in the Rat. J. Comp Physiol. Psychol. 1966, 62, 222-226

Clapp, W. F., & Eichhorn, D. N. Some Determinants of Perceptual Investigatory Responses in Children. J. Exp. Child Psychol., 1965, 4, 371-378

Harrington, G. M., & Kohler, G. R. Sensory Deprivation and Sensory Reinforcement with Shock. Psychol. Reports, 1966, 45, 802-808

Harris, L., The Effects of Relative Novelty on Children's Choice Behavior. J. Exp. Child Psychol., 1965, 3, 297-305

Hoats, D. L., Miller, M. B., & Spitz, H. H. Experiments on Perceptual Curiosity in Mental Retardates and Normals. Amer. J. Ment. Defic., 1963, 68, 386-395

Hutt, C., Hutt, S. J., & Ounsted, C. The Behavior of Children With and Without Upper CNS Lesions. Behavior, 1965, 24, 246-268

Miller, A. R., Kiker, V. L., & Stewart, R. A. An Operant Technique for Studying the Relationship between Shock and Bar-presses. Paper read at the West. Psychol. Assoc., May, 1967, San Francisco, Calif.

Miller, A. R., Stewart, R. A., & Kiker, V. L. The Faciilitative Effects of Shock and Sensory Deprivation on Bar-pressing During Extinction. Psychonomic Science, 1968, 10, 113-114

Miller, A. R., Stewart, R. A., & Kiker, V. L. Facilitative Effects of Shock on Bar-pressing. Psychonomic Science, 1969, (In-Press)

Munsinger, H., & Kessen, M. L. Age and Uncertainty: Developmental Variations in Preference for Variability. J. Exp. Child. Psychol., 1964, 1, 1-15

References, continued

Smock, C.D., & Holt, B. G. Children's Reactions to Novelty: An Experimental Study of "Curiosity Motivation". Child Development, 1962, 33, 631-642