Some determinants of looking time under different instructional sets¹

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Four groups of Ss were asked to look at sets of figures whose members differed in degree of complexity and asymmetry. Ss instructed to look as long as the figures were pleasing did so for a significantly shorter time than did Ss who were instructed to look as long as they cared to, as long as the figures were interesting, or until they could recognize the figures in a large group of similar figures. Results indicated that looking time was affected by both the complexity and the asymmetry/symmetry dimensions and led to the conclusion that looking time is primarily a measure of exploratory behavior.

Time spent looking at a visual display must surely be determined by a large number of factors, including affect value and physical characteristics of the material, as well as the set with which S is instructed to respond.

Psychologists concerned with the study of affect as a determinant of approach or avoidance behavior have often accepted the measure of time spent attending to a stimulus as an indicant of degree of preference. Thus Berlyne (1967) suggested that verbal responses of "like" and approach behavior are both presumptive indicators of the reward value of a stimulus, for they express the tendency to restore or to prolong exposure to a rewarding stimulation. Day (1966) found that the distribution of looking time followed that of ratings of liking more closely than ratings of complexity and that both looking time and liking scores described an inverted U-shaped function over increasing complexity. Sobol and Day (1967) also found that Ss looked longer at random polygons displayed in the colors which they preferred. Bakan and Leckart (1966) found a tendency for Ss to look relatively longer at pictures congruent with their personality characteristics. However, results have not always been clear cut and sometimes the relationship has yielded ambiguous results (cf., Berlyne & Lawrence, 1964).

Like many other researchers interested in affective value of stimulation, Helson (1964) assumed that verbal evaluations of "like" or "prefer" denote pleasure. But recently there has developed a tendency to substitute ratings of "pleasing" and "interesting" for those of "like" or "prefer". While it may be argued that evaluations of "pleasing" and "interesting" reflect some measure of affect the relationship between them is still unclear. In 1965 Day found a positive but low rank correlation between the two responses ($T = .277$, $Z = 2.07$; $p < .05$) using 28 figures which differed along a dimension which confounded both complexity and asymmetry. Later, using random polygons, he showed that, while interest increases with complexity, ratings of pleasingness decrease with increasing complexity (Day, 1967). Berlyne (1963) and Eisenman (1966) also found that interest and pleasingness reflected opposite response tendencies. Berlyne suggested that the two measures reflect different internal processes, interestingness reflecting an internal process closely related to arousal-raising properties of the stimulus and pleasingness reflecting an internal process closely related to arousal-reducing or arousal-restricting properties of the stimulus. Research into the relationship between the response evaluations of preference, interestingness and pleasingness have been summarized recently (Day, 1968b).

A number of studies have shown that looking time is directly related to the informational content of the stimulus display. Berlyne, using a set of materials varying in "irregularity" (which he equated with "complexity"), showed that looking time is greater for the more irregular figures (Berlyne, 1963; Berlyne & Lawrence, 1964), while Leckart demonstrated the same effect using photographs (Leckart, 1966; Leckart & Bakan, 1965).

Symmetry has never been shown to be a significant factor in the determination of looking time. However, in a recent study (Day, 1968a) symmetrical polygons were rated as less complex but more interesting and pleasing than asymmetrical polygons with equal number of sides. Thus, if looking time is primarily a measure of information search, then time spent looking at symmetrical figures should be shorter than for asymmetrical figures because their informational content as measured by ratings of complexity is lower. On the other hand, if looking time is primarily a measure of affect then it should be longer for symmetrical figures which are rated higher in affect.

The importance of instructional set in looking time has not been examined extensively. Brown and Farha (1966) reported that while mean looking time for random polygons was the same whether Ss were instructed to look "according to how pleasing" or "interesting" the figures were, looking time scores correlated positively with complexity when the set was for interest but negatively with a "pleasing" set. When Ss were instructed to look "as long as they liked", looking time for all levels of complexity was much greater. Berlyne and Lewis (1963) found that looking time increased when Ss expected to be tested for recognition of the figures.

It was therefore decided to compare the looking time of Ss on the four types of instructional sets with figures varying along both the complexity and the symmetry/asymmetry dimension. In one set of stimulus patterns (Berlyne, 1963) the two dimensions are confounded and in one set (Day, 1968a) they are varied independently. The first group was told to look long enough so that they would recognize the figures and pick them out of a large group of similar figures. The second group was told to look as long as the figures were interesting, the third group as long as the figures were pleasing, and the fourth group as long as they cared to.

METHOD

Subjects

Subjects were female student nurses at Lakeshore Psychiatric Hospital in Toronto. They served as volunteers for individual sessions. Because of technical difficulties data from some Ss had to be discarded and analysis was made with unequal sized groups ($N_s = 10; 11; 12; 13$).

Apparatus

A Kodak Carousel projector was fitted with a foot pedal to actuate the slide changes and a pen in an event recording device.

The stimulus material consisted of two different types of figures: one type comprised a set of 28 slides originally developed by Berlyne (1963) and later ordered into a continuum of rated complexity by Day (1965). The other type comprised three sets of polygons, one set of 10 asymmetrical polygons varying in approximately even logarithmic steps from 4 to 90 slides and used by Day (1967) and two sets of symmetrical polygons, one horizontally and one vertically symmetrical each ranging in 10 steps from 4 to 90 slides and used in previous research by Day (1968a). Four slides at the beginning and 4 at the end of the series served as practice slides and were not scored. The slides were displayed as black-on-white figures on a white screen.

The slides were arranged so that the four sets of materials (two symmetrical, one asymmetrical and the Berlyne slides) were well intermixed and so that they followed the same sequence when displayed in reverse order. Within each set, the figures were randomly selected. Approximately half the Ss in each group viewed the slides in one order while the others viewed the slides in the reverse order.

Procedure

Each S was allowed to adapt to the dim, quiet room for 5 min prior to viewing the slides. Then the instructions were read to S and she was instructed in the use of the foot pedal switch. In three groups the instructions were "In this projector there is a series of slides of irregular shapes that you may look at. Please look at each slide as long as *you care to* (the slide is *interesting (pleasing)* to you). When you wish to look at the next slide just press this foot pedal once."

The fourth group was told that "at the end of the session you will be asked to recognize the slides you will now see from a large group of similar slides and therefore you should look at each slide long enough to *recognize* it later."

The Ss were then left alone in the room until the session was completed.

RESULTS

Looking time scores were transformed into log scores and an analysis of variance of instructional set group by complexity level by shapes (1 asymmetrical and 2 symmetrical) with groups of unequal size was performed. The results with the sets of polygons show that the instructional set factor was in itself not significant but was significant when in interactions with complexity level ($F = 1.90$, $df = 27/1218$, $p < .005$) and with the symmetry factor ($F = 2.22$, $df = 6/1218$, $p < .05$). The complexity factor was significant ($F = 7.62$, $df = 2/1218$, $p < .001$) but the interaction of the two was not significant. Figure 1 shows the Instructional set by Complexity interaction.

The distributions of the four curves indicate that the "pleasing" group looked at the 30 figures (3 at each level of complexity) for a shorter length of time than the average of the other three groups. Orthogonal linear contrasts performed on the Instructional set means show that this difference is significant ($F = 6.11$, $p < .05$) whereas no differences were found between the largest and smallest means of the other three groups. Figure 1 also shows that the slopes of the curves are significantly different although all appear to increase with complexity. The positive slope of the "pleasing" group is of interest (F for linear component = 5.47, $p < .05$) because earlier research has shown that verbal ratings of pleasingness decrease with complexity (Day, 1967).

Orthogonal linear contrasts performed on the means of the three levels of the symmetry/asymmetry factor show that looking time for asymmetrical shapes was longer than for the average of the two symmetrical shapes ($F = 10.77$, $p < .01$) and symmetrical shapes with a horizontal axis were looked at longer than symmetrical shapes with a vertical axis ($F = 4.47$, $p < .05$). The distribution of looking time for the three types of shapes is presented in Fig. 2. Figure 2 shows that while both complexity and symmetry are significant factors, the interaction of the two is not.

Fig. 1. Distribution of the means of log looking time scores for a series of symmetrical and asymmetrical polygons varying in number of sides.

Fig. 2. Distribution of the means of log looking time scores for symmetrical and asymmetrical polygons varying in number of sides.

Orthogonal linear contrasts performed on the Instructional set Groups by Symmetry/Asymmetry interaction shows that asymmetrical shapes were looked at longer within the "interesting" and "recognize" groups when compared with the average for the symmetrical figures (F interesting = 4.74, $p < .05$; F recognize = 19.19, $p < .005$), but the "pleasing" and "care to" groups looked equally long at all three sets of figures.

Looking times for the 28 Berlyne figures were also transformed and an analysis of variance was performed on the transformed data. Since complexity and asymmetry are confounded in the Berlyne figures only an Instructional set Group by Complexity/Asymmetry analysis was possible. The results of this analysis generally concur with the analysis of the polygons. Instructional set was not a significant factor in looking time but complexity/asymmetry was ($F = 12.22$, $df = 22/1134$, $p < .005$) as was the interaction of the two factors ($F = 7.82$, $df = 81/1134$, $p < .005$). The distributions of looking time responses for each of the four instructional sets were similar to those for the other sets of materials but showed more internal variability, probably due to the confounding of the complexity and asymmetry factors.

Finally, mean log looking times for the random polygons and for the Berlyne figures were almost the same (.77 and .72, respectively).

DISCUSSION

Berlyne (1960) argued that when an organism is confronted with stimulation high in collative variability (novelty, complexity, irregularity, etc.) there will be induced in the organism a state of heightened arousal which will lead to a tendency to explore the stimulation in order to reduce the collative variability and restore the arousal level to its optimum. The results of this experiment suggest that looking time is a function of the level of collative variability in the stimulation rather than its affect value when the latter is measured in verbal ratings of pleasingness. Regardless of instructions looking time appears to be positively related to the level of informational content of the stimulus, for it increases with increasing complexity and is greater with asymmetrical than with symmetrical figures. In fact, when the two tendencies, that of looking for the informational content and looking for positive affect, are opposed, the former tendency seems to be a more dominant determinant. For, while evaluations of pleasingness have been found to decrease with both complexity and asymmetry (Day, 1968a) looking time in this study increased along both factors. Looking time was also longer for horizontally symmetrical figures than for vertically symmetrical ones probably because horizontal symmetry is much less common in our environment.

However, looking time is not independent of the observer's affective evaluation of the situation. In the group where Ss were instructed to look as long as the figures were pleasing, they were

far less influenced by changes in informational content and symmetry, as shown by the differences in the slope for this group when compared with those of the other groups. Since it is generally assumed that organisms engage in activities which maximize positive affect, it must be concluded that informational processing is in itself a rewarding activity. For Ss in this experiment engaged longer in those activities which yielded the greatest potential for information processing and when instructed to look as long as they cared to, did so for as long a period as those Ss who were warned of a memory test and for a longer period than did those Ss who were instructed to look as long as the figures were pleasing.

These findings confirmed the theoretical formulations of Hunt (1963) as well as of Berlyne (1963) and others who argue that information processing is intrinsically motivating. For when Ss are asked to interest themselves in the task, or to participate in it as long as they care to, they appear to be willing to invest a great deal more time and energy than they would in that same task if their goal was that of pleasure. When instructed to look as long as the stimuli were pleasing, Ss were relatively indifferent to changes in complexity (but not to the asymmetry factor, for in this group, they looked at the symmetrical figures for the same length of time as the asymmetrical ones with the same number of slides).

The response set look "as long as you care to" which could be considered to be equivalent to "as long as you like", yielded some unexpected results. Whereas in other research the concept "like" was used as indicative of pleasure, present data suggests that elements of both pleasingness and interestingness may be incorporated within the concept. Thus, while a number of studies have found that extremely simple figures were "liked" (Berlyne & Lawrence, 1964; Munsinger & Kessen, 1964; Thomas, 1966) and were rated as "pleasing" and not "interesting" (Berlyne, 1963; Day, 1967), Day found that patterns of a fairly high level of complexity were "liked" (Day, 1966) and rated as interesting (Berlyne, 1963; Day, 1966), but not "pleasing" (Berlyne, 1963; Day, 1967).

The linear increase in looking time with increasing complexity points to the conclusion that looking behavior, at least in an experimental situation is a measure of exploration and may be a response to an increased level of arousal, possibly induced by collative variability. At the same time there is also evidence for the importance of instructional and environmental effects. For looking time increases under threat of memory tests, with instructions that direct attention to arousal raising properties of the stimuli and with vague "care to" instructions which probably induce added uncertainty in the S.

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NOTES

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