The effects of repeated exposure and stimulus complexity on visual fixation in infants¹

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Two groups of 3-1/2 month-olds each received two sessions of successive exposure to variable and repeated stimuli. Complexity of the repeated stimulus differed between groups and across sessions. Repetition produced significant fixation decrement which was reliably greater for the simple than for the complex stimulus. In all instances significant response recovery occurred with stimulus change.

It is generally expected that heterogeneous visual stimulation, whether temporal (novel) or spatial (complex), will promote observing behavior in infants, whereas homogeneous stimulation (repetitious or simple) will produce response decrement. However, research on visual fixation of a repeatedly exposed stimulus has not been uniform with respect either to the magnitude of decrement obtained or to its anticipated variation with stimulus complexity (Fantz, 1964; Saayman, Ames, & Moffett, 1964; Cohen, 1966; Ames, 1966; Lewis, Goldberg, & Rausch, 1967). Whatever the source of the discrepancies (e.g., age of Ss, duration of exposure, intertrial interval, definition of complexity), any attempt to attribute decrement to stimulus conditions per se (e.g., redundancy) rather than to nonspecific response factors (e.g., organism fatigue) is also constrained by the general inability to recover responding when the stimulus is altered or to find pre- to posthabituation shifts in fixation.

An effective demonstration of stimulus control does appear in Fantz (1964). Here, infants presented with pairs of highly complex photographs showed decreasing fixation of a repeatedly exposed pattern accompanied by increasing fixation of a changing pattern and no overall decrement. This finding, moreover, contrasts with the reported resistance of complex stimuli to habituation (Cohen, 1966; Ames, 1966) and suggests that juxtaposition of repetition with stimulus change may provide a more sensitive index of redundancy effects. The present study adopts a similar strategy in order to assess the interactive influence of repeated exposure and stimulus complexity on visual fixation.

Method

The Ss were placed in an infant reclining seat modified to reduce head movements. The seat was centered in a trapezoidally shaped test chamber whose ceiling sloped so that a 7 x 7 in. lenscreen insert provided a viewing area perpendicular to, and 13 in. from, S's line of regard. The interior, painted flat white, was illuminated by a 40 W lamp mounted beneath a low table which supported the chamber.

The E observed S's eyes through one of two peepholes located on each side of the target. Stimulus onset and offset as well as the number and duration of fixations were recorded by button press on a Rustrak event recorder. The criterion of fixation was the reflection of the stimulus over S's pupil. Reliability was obtained from two observers who independently recorded fixations while looking through separate peepholes. The correlation for total fixation time, based on 15 trials for each of 14 Ss, was .94.

Stimuli were rear projected by a Kodak Carousel 800 equipped with a shutter. There were 15 successive 20 sec exposures with no intertrial interval other than that provided by slide advance. The sequence was programmed such that Trials 1-5 constituted a continuously varying series (Trial 1 was warmup), Trials 6-9, a series of repetitions of Stimulus 5, Trials 10-13, a second varying array (of which Trial 13 was the repeated stimulus), and Trials 14-15, new stimuli.

The warmup and terminal stimuli were photographs of multicolored abstract art. The varying stimuli were photographs of designs (4 multicolored, 2 red and white) including random dots, lines, and irregular shapes. The pre- and postrepetition series were matched closely in size of detail, regularity, color, and predominant shape of contours. The repeatedly exposed stimulus was either a 2 x 2 or a 12 x 12 red and white checkerboard.

The Ss were brought to the laboratory by their parents during hours when they reportedly would be well rested and alert. Fussy or drowsy infants were discarded. The final sample included 50 Ss, 14-16 weeks old (median age, 104 days). There were 13 boys and 12 girls in each of two groups which differed in terms of the particular stimulus (2 x 2 or 12 x 12 checkerboard) presented on Trials 5-9 and 13. A second session was administered, typically within three days, in which the alternate stimulus was used. Thus, Group 2-12 received the 2 x 2 checkerboard in Session 1 and the 12 x 12 in Session 2, whereas Group 12-2 received the opposite sequence.

Results

Figure 1 summarizes the total fixation time (TF) data for each treatment group within each session. Since there were no significant effects involving sex, the male-female subgroups have been collapsed. The Mann-Whitney U test was used to assess between-group comparisons; the Wilcoxon matched-pairs signed-ranks test to assess within-group comparisons (two-tailed tests).

Session 1. There was no significant difference in TF between Groups 2-12 and 12-2 on Trials 1, 2, 3, 4,

Fig. 1. Fixation during varied (1-5, 10-12, 14-15) and repeated (6-9, 13) trials. For Group 12-2 a 12x12 checker was repeated in Session 1, a 2x2 in Session 2; for Group 2-12 the order was reversed.

or 5. Furthermore, within each group, TF on Trial 5 was not significantly different from the average TF on Trials 2-4. Prerepetition observing behavior, then, was comparable for both groups, and also for the checkerboards and other geometric stimuli.

Within each group repeated exposure produced a progressive decline in TF, the difference between Trials 5 and 9 being significant in each case ($p < .01$). In accord with the complexity hypothesis, the percentage decrement from Trial 5 to 9 (5-9/5) was significantly steeper in Group 2-12 than in Group 12-2 ($p < .001$). Although recovery was somewhat attenuated in Group 2-12, both groups, nevertheless, showed a significant rise in TF from Trial 9 to 10 ($p < .01$ for each), indicating that the preceding decrement was due neither to general nor to sensory fatigue. Furthermore, in each group the reappearance of the previously repeated stimulus (Trial 13) produced a significant decline in TF, relative both to the average value of Trials 10-12 and to Trial 5 ($p < .01$ for both groups in each case). Stimulus complexity also affected the magnitude of this decline, since the percentage decrement from Trial 5 to 13 (5-13/5) was significantly stronger in Group 2-12 than in 12-2 ($p < .025$). Finally, both groups again showed a significant recovery from Trial 13 to 14 ($p < .01$ for both).

Session 2. Session 2 results mirrored those of Session 1. Significant decrements occurred in both groups from Trial 5 to 9 ($p < .01$ in each case), Trial 5 to 13 ($p < .05$ for Group 2-12; $p < .01$ for Group 12-2), and the Trial 10-12 average to Trial 13 ($p < .01$ for both groups).² Again, both groups recovered from Trials 9 to 10 and 13 to 14 ($p < .01$ for all comparisons). Complexity effects were also replicated since the two groups predictably reversed ranks. Thus, the percentage decrements from Trial 5 to 9 (5-9/5) and from Trial 5 to 13 (5-13/5) were significantly steeper in Group 12-2 than in Group 2-12 ($p < .01$ and $p < .025$, respectively). For Group 12-2, moreover, both decrements were significantly steeper in Session 2 than 1, whereas for Group 2-12, the reverse was the case ($p < .01$ for all comparisons).

Discussion

The results demonstrate clearly that repeated exposure of a stimulus produces decrement in the observing behavior of young infants, that the magnitude of the decrement is governed by the complexity of the repeated stimulus, and that stimulus change can effect response recovery. The data are congruent, also, with an age-related concept of complexity and with the finding that 11-week-olds habituate an 8 x 8 but not a 24 x 24 checkerboard (Ames, 1966). Since our 12 x 12 stimulus was of intermediate complexity for 3-1/2 month-olds, it should have produced some decrement (and did), but predictably less than the very simple 2 x 2.

The manifest selectivity of responding obtained in the present study confirms the view that young infants can discriminate and "recognize" specific visual patterns.³ It indicates, in addition, that the procedure used—alternation of repetitious and variable stimuli—was effective both in maintaining the infant's general disposition to respond and in establishing discriminative stimulus control.

References

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Notes

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2. Although Group 12-2's initial fixation on trial 5 had been somewhat lower ($p < .05$) than the trial 2-4 average, the corresponding postrepetition differential (Trial 13 vs Trials 10-12) was significantly greater.
3. It is noteworthy that decrement was often accompanied by vocal "protest" and increased restlessness, behaviors which diminished upon recovery to stimulus change.