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ABSTRACT

A total of 48 8- to 14-week-old infants were presented with a non-contingently moving visual stimulus and the infants' visual attention was measured. Infants who exhibited decrements in attention to the non-contingent stimulus showed recovery in attention when the same stimulus was made to move contingent upon a motor response. Moreover, visual attention was maintained as long as the stimulus moved contingently. The results are discussed in terms of different attentional values for non-contingent and contingent events as well as in terms of young infants' sensitivity to temporal periodicity of stimuli. (Author/SET)

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Abstract

Eight to 14 week old infants were presented with a non-contingently moving visual stimulus and the infants' visual attention was measured. Infants who exhibited decrements in attention to the non-contingent stimulus showed recovery in attention when the same stimulus was made to move contingent upon a motor response. Moreover, visual attention was maintained as long as the stimulus moved contingently. The results are discussed in terms of different attentional values for non-contingent and contingent events as well as in terms of young infants' sensitivity to temporal periodicity of stimuli.

Visual Attention to Non-Contingent[1] and Contingent Stimuli in Early Infancy

Martha Foster, Peter Vietze, and Steven Friedman

The purpose of this investigation was to study the effects on infant visual attention of presenting, contingently, a previously habituated stimulus. The study sought to determine whether infants who showed decrement in attention to a non-contingently moving 3-dimensional stimulus would show recovery in attention when the stimulus was made contingent upon their behavior (in this case, a head-turning response).

Although movement, color, and complexity are believed to be potent elicitors of infant attention, few studies of attention have used either 3-dimensional or moving stimuli and few studies have examined the data for decrement in attention with these stimuli. Both Cohen (1966) and Kagan & Lewis (1965) report decrement in attention to a moving light in 3-6 month old infants but included no test for recovery in their designs. Vietze, Friedman, & Foster (1973) using a 3-dimensional moving stimulus found that 3-month old infants show attentional decrement to periodic but not to aperiodic movement, although they also did not include a test for recovery. Lewis, Goldberg & Campbell (1969) did include a test for recovery but report no recovery of attention following decrement to a moving flashing light in infants at several age levels.

The present data were collected as part of a study of the effects of non-contingent stimulation on infant learning. Infants were presented with a visual stimulus which moved non-contingently and periodically during the initial phase of the study. Subsequently, the same stimulus was set to turn

contingent upon a motor response (head movement) by the infant. Since visual attention was monitored throughout the study it was possible to examine the effects of non-contingent and contingent moving stimuli on infant attention.

Method

Subjects:

Ss were 48 alert full-term infants between 8 and 14 weeks (Mean age 11 weeks). Each of the 4 experimental groups was composed of 6 males and 6 females.

Setting and Apparatus:

Throughout the experimental session the infant lay on his back in a standard infant crib. The visual stimulus was a mobile made of 4 white spheres, 3" in diameter held in a fixed cluster. The mobile was suspended from a 15 RPM motor on a metal stand 15 inches above the infant. A portable automated contingency apparatus (Vietze, 1973) used to record head movements and to rotate the mobile could be set to activate the mobile for 1 second contingent upon infant head movements or non-contingently on a time-based schedule (FI 1:5). Head movements were recorded by means of two air pillows on either side of the infant's head and connected to a control system by air-hoses. Head movements on the pillows changed the air pressure and activated the mobile during conditioning.

Observation of visual fixation:

Two naive observers recorded infant fixation time to the mobile continuously throughout the study. Inter-observer reliability levels ranged between .59 and .99 for individual infants with a mean Pearson r of .89 based on 531 minutes of observation across 33 infants.

Procedure:

The study was divided in 3 uninterrupted phases: baseline, conditioning and extinction. The mobile served as both the target stimulus during baseline and the reinforcing stimulus during conditioning. During baseline the mobile rotated periodically independent of infant head movements. Infants who showed criterion level decrement in looking time were classified as Habituators. The criterion was a 5-second drop in fixation for 2 consecutive 30" trials from the mean of the first 2 30-second trials. The habituation criterion method adapted from Friedman (1972) was used rather than a set-trial procedure in order to maximize sensitivity to individual differences.

One observer determined when decrement in attention occurred. When the decrement criterion was met the contingent condition was instituted. This marked the beginning of the conditioning phase. Since duration of the baseline phase was individually determined depending on each infant's attention to the mobile the minimum duration of this phase was four 30-second intervals or 2 minutes. A maximum of 10 minutes was set to keep the entire length of the session within limits reasonable for young infants.

The second group was a matched control group of Non-Habituators. To control for fatigue factors and to insure comparability between groups, each infant was matched to one of the habituators by age, sex and number of trials of exposure to the non-contingent moving stimulus. A third group was composed of infants who did not habituate within the entire 10 minutes of baseline. The 4th group (Stabile Group) differed from the other groups in that the mobile remained stationery during baseline. These Ss were included as a contrast group to compare to the infants exposed to prior non-contingent stimulation. For purposes of comparison each of the Stabile infants was matched to the

Habituators and to the Matched Controls on age, sex and length of baseline. Stable infants who showed decrement in attention were excluded.

The Conditioning and Extinction phases each extended for 6 minutes. During Conditioning the mobile was set to rotate contingent on head movements in either direction by the infant. During Extinction, the mobile remained stationary regardless of head movements by the infants. This report will focus on the baseline and conditioning data.

Results

A three-way repeated measures ANOVA (Groups X Sex X Trials) for the first and last minutes of baseline yielded significant main effects for groups (F, 4.044; df, 3,40; $p < .013$) for sex (F, 4.533; df, 1,40; $p < .037$), and for trials (F, 9.670; df, 1,40; $p < .003$). As predicted, the Group X Trials interaction was also significant (F, 15.947; df, 3,40; $p < .0001$). The sex effect indicated that mean looking time across the two intervals was higher for males than for females. One way analyses of variance were performed separately for the first and last trials to interpret the significant Group X Trials interaction. The analysis of the first trial indicated that the four groups did not differ significantly in visual attention to the stimulus initially. A one-way ANOVA on the last minute of the non-contingent phase yielded a significant main effect for groups (F, 13.004; df, 3,40; $p < .0001$). A Newman-Keuls analysis indicated that the group effect stemmed from lower looking time for the Habituators than for the other three groups on the last minute of Phase I.

A three-way repeated measures ANOVA (Groups X Sex X Trials) for the last minute of Phase I and the first minute of the contingent phase yielded a significant main effect for groups (F, 6.575; df, 3,40; $p < .001$) and a Groups

X Trials interaction (F, 4.702; df, 3,40; $p < .006$). A one-way ANOVA of the first minute of conditioning yielded no significant effects. Therefore the significant Group X Trials interaction was a function of the significantly lower looking time for the habituators on the last minute of Phase I. Thus the habituators showed a significant decrement in visual attention to a non-contingent stimulus while looking time for the other three groups remained high. In addition when the same stimulus was presented contingently the habituators showed significant recovery in attention to the level of the other groups.

A repeated measures ANOVA (Group X Sex X Trials) of looking time across the six minute contingent phase (Phase II) yielded a significant main effect for sex (F, 9.230; df, 1,40; $p < .004$). The mean looking time across the one minute conditioning blocks was higher for males (54.45 seconds) than for females (47.54 seconds). However looking times remained high and stable for each of the four groups across the entire period.

Discussion

The results of this study indicate that 8-14 week old infants who exhibit decrement in attention to a non-contingent moving stimulus recover and maintain attention when the stimulus is made contingent.

Some earlier studies report no decrement in attention to a moving stimulus (Haith, 1966; Haith, Kessen & Collins, 1969). Other studies report decrement but include no test for recovery (Kagan & Lewis, 1965; Cohen, 1969). The one study which did include a test trial found no recovery in infants at several age levels (Lewis et al., 1969). All of the above studies used simulated movement and a set trial procedure with various trial lengths and

inter-trial-intervals. The present study employed a more individualized procedure in which a moving stimulus was available continuously to the infant until he exhibited decrement in attention (zero-second ITI). The uninterrupted periodicity of the non-contingent stimulus coupled with the relatively long exposure time may account for the response decrement observed in very young infants in this study. Since visual attention increased when the stimulus was made contingent the decrement observed is not a function of fatigue or adaptation.

The results suggest that presenting an habituated stimulus contingently changes its attentional value. Moreover, visual attention not only increased for the Habituators but remained high for all groups across the six minute conditioning phase. This suggests that even infants who previously habituated to the stimulus will continue to attend when it is made contingent.

It is important to note that the recovery effect cannot be attributed solely to the change in contingency since the onset of the contingent phase marked an interruption in the temporal pattern of stimulus movement. The pattern changed from a periodic schedule during the non-contingent phase to an aperiodic schedule, determined by the rate of head movements, during the contingent phase. The infants who exhibited recovery of attention to the contingent stimulus may have been responding to the change in temporal pattern rather than to the change in contingency. Both explanations are tenable. An earlier study (Vietze, et al., 1973) reported that an aperiodically moving stimulus maintained attention while a periodic stimulus did not. The present data provide further evidence that the temporal patterning of stimuli affect their attentional value. It is possible that the aperiodicity of most response-contingent stimuli initially serves to elicit and to maintain attention

until the contingent relationship is learned. Additional studies are needed to further explore the attentional functions of contingent and non-contingent stimuli.

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