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ABSTRACT

This study is the third of three investigating attentional preference in infants. In the second study (PS 003 071), infants gave initial attentional preference to familiar patterns of visual stimuli, and later switched their preference to the unfamiliar, novel stimuli. The purpose of the present study was to duplicate these results with improved experimental techniques, including additional controls. Each of a group of 24 infants and a control group of 10 infants received a bassinet and a stimulus pattern (mobiles of yarn tassels, streamers, paper balls) at about one month of age. Attentional preference was determined by a Rustrak event-recorder instead of the stopwatch used in the previous study. Reliability was also assured in this study by having two experienced examiners record looking times independently during a portion of the test. At 2 months of age, the infants were tested with the now-familiar pattern presented simultaneously with an unfamiliar one. Similar tests were made when the infants were 2 1/2 and 3 months old. At 3 1/4 months a new stimulus pattern was introduced for familiarization. Finally, at 3 1/2 months the newly-familiar pattern was tested against an unfamiliar one. The results did duplicate those of the previous study: infants gave most of their attention to a familiar stimulus pattern, then switched their preference to the unfamiliar pattern. (MH)

ATTENTIONAL PREFERENCE AND EXPERIENCE: III.

VISUAL FAMILIARITY AND LOOKING TIME[1]

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Whether a young infant will prefer a familiar or an unfamiliar stimulus pattern is a question which has interested a number of investigators recently. The majority of findings show infants preferring the unfamiliar of a pair of such patterns presented simultaneously (3, 9, 10, 11, 12, 13, 15, 16). The evidence of this preference has consisted most commonly of looking longer at the unfamiliar pattern while it was paired with the familiar one, but in some instances cardiac deceleration has been found associated with this looking and has been used as evidence (9, 10, 11, 12, 13, 15). Such attentional preference for the source of unfamiliar inputs has appeared in infants as young as two months of age (3, 16), and the strength of the preference appears to increase with age (2, 9, 17). From such evidence, it is becoming widely believed that visual experience with a pattern leads directly to attentional preference for others which are unfamiliar.

On the other hand, Hunt (5, 6, 7) has described several informal lines of evidence suggesting that repeated auditory and visual encounters separated in time appear to lead first to attentional preference for the pattern becoming recognitively familiar, and only later to attentional preference for what is unfamiliar. Uzgiris and Hunt (8, 18) have reported exploratory studies designed to test this hypothesis simultaneously with a second hypothesis that infants will show attentional preference for familiar patterns which have been in some fashion responsive to their own efforts over those which are also familiar but unresponsive. Although the results of their exploratory studies have lent support to the first of these hypotheses, the support has not been strong enough to establish beyond doubt that experience-based attentional preference for what is familiar occurs before the well-known preference for what is unfamiliar or novel. In the first of their studies (8), the infants looked longer at their familiar patterns than at the unfamiliar one, but the three patterns used were not counterbalanced and the intrinsic unattractiveness of one pattern appears to have combined with its unfamiliarity to produce what may have been spuriously strong preference for the familiar. In their second study (18), infants, as expected, averaged significantly longer times of looking at the familiar patterns in the first test and then, after a second four weeks of exposure to the familiar patterns, they averaged more time looking at the unfamiliar pattern. The variety of different cribs provided by the families, however, allowed too much lack of control, and having a second stimulus pattern which could move in response to the infant's efforts present during the familiarization process may have been a confounding variable in the test of the effects of perceptual familiarity per se on attentional preference.

This paper reports another attempt to test the hypothesis that young infants will prefer stimulus patterns which have become familiar through perceptual exposure before they will prefer an unfamiliar pattern paired with the familiar one.

METHOD

The strategy is similar to that used by Uzgiris and Hunt (18) with certain attempts to improve the method. Each of a group of 24 infants received a bassinet as well as a stimulus pattern at one month of age. Providing a bassinet helped substantially to control the condition during the familiarization and the testing of its effects. The second, responsive pattern was eliminated. The testing procedure of Uzgiris and Hunt was improved not only by providing the bassinet, but also by utilizing a Rustrak event-recorder in place of a stopwatch. Finally, the reliability of the tests of attentional preference was assessed by having two experienced examiners record looking times independently during a portion of the test.

This investigation also utilized additional experimental conditions to help elucidate the attentional preference for familiar patterns. To assess the possible effects of the first test on the behavior of infants in successive tests, a control group of 10 infants, similar in every way to those in the experimental group, were presented with a bassinet and a stable pattern at one month of age, and then tested at 2.5 and 3 months of age. The first test at age 2 months was skipped. Second, to get evidence concerning whether preference for a familiar pattern is a stage of development or a phase in an infant's informational interaction with any kind of stimulus pattern, infants from both the experimental group and the control group got exposed for much briefer periods to new patterns when they were older. The newly-familiar patterns were then presented simultaneously with unfamiliar ones in tests of attentional preference.

Testing the effects of perceptual experience on attentional preference calls for at least two stimulus patterns, one to be made familiar through perceptual contact, and the other to be kept unfamiliar. Ideally these two patterns should be of approximately equal attractiveness. Here equal attractiveness was defined in two ways. First, a number of patterns were so constructed that they appeared to adult observers to be approximately equal in coloring and brightness and to have approximately similar numbers of contours (complexity). Second, the construction was guided also by information gained from past studies making use of similar patterns (4, 14) and from tests of preference in a group of infants without familiarity with any of the patterns.

Five different patterns served. Each of the five consisted of three dangles hung from a base consisting of either a circle of masonite five inches in diameter or an equilateral triangle of masonite with sides of five inches. These bases were painted yellow and were attached to the bar extending from the chemistry stand by means of three strings to keep them level. Three dangles were attached to each base at positions

equidistant on the outer edge. The variation among these patterns resided in the difference in the shape of the bases (circle, triangle) and the difference in the dangles. The five different kinds of dangles can be described as follows: (1) Yarn tassels. These were composed of a center of bright-colored yarn (yellow, red, green) while the outside portion was relatively neutral (gray, tan, or grayish-blue). (2) Boxes. These consisted of safety-match boxes covered with colorful wrapping paper. (3) Streamers. These consisted of streamers of crepe paper four inches long, which more or less filled the base and were not formed into the usual three tassels. (4) Balls. Each individual dangle consisted of three paper balls about an inch in diameter varying in color. (5) Flowers. These were plastic flowers, each of two colors: white inside blue, red inside green, yellow inside brown. Each of these kinds of patterns, viewed as an infant looked at them, subtended approximately equal portions of his view.

Finally, a Rustrak event-recorder facilitated the testing for attentional preference.

Procedure

The longitudinal schedule of events in this experiment with the ages of the 24 infants in the experimental group follows:

Infant's Age in Months	Events
1.00	Bassinet and the stimulus pattern placed in each home and mother instructed
2.00	First test of attentional preference with the familiar pattern presented simultaneously with the unfamiliar one
2.50	Second test of attentional preference
3.00	Third test of attentional preference
3.25	New stimulus pattern attached to each infant's stand for familiarization
3.50	Test of attentional preference for the newly-familiarized pattern versus a new unfamiliar one after 7 days of exposure to the newly-familiarized pattern

The schedule of events for and the ages of the 10 infants in the control group were essentially the same as that for the experimental group except for the omission of the first test of attentional preference when the infants were two months of age, placement of the new stimulus pattern in each home for familiarization when the infants were 3 months of age

rather than 3.25 months, and the test of attentional preference for the newly-familiarized pattern after it had been exposed for only 3 days instead of 7 days.

Even though an effort was made to get patterns of approximately equal intrinsic attractiveness, a plan was devised to minimize any effects of residual differences in attractiveness. Each of the 24 infants in the experimental group received one of three patterns (yarn tassels, streamers, or boxes) for familiarization. One of the two remaining patterns served as the unfamiliar one in the tests of attentional preference. Moreover, a counterbalanced design was devised which made it necessary to run subjects in groups of six. Thus, four such groups were required for a total of 24 subjects. This counterbalanced paradigm was as follows:

Subject	Familiar	Test
1	yarn	yarn vs. streamers
2	yarn	yarn vs. boxes
3	boxes	boxes vs. yarn
4	boxes	boxes vs. streamers
5	streamers	streamers vs. yarn
6	streamers	streamers vs. boxes

The first stimulus pattern to be familiarized was left in the home when the infant was one month of age. The mother was asked to put the infant in the bassinet with the pattern in place directly over the infant's line of vision and 12 inches away from his eyes for at least a half an hour each day while the infant was content and satisfied.

In the tests of attentional preference, both the familiar pattern and the unfamiliar one were hung from a 16-inch metal pole. This was attached by means of a movable joint to the upright pole to permit switching the left-right position. Each pattern was approximately 12 inches from the infant's eye level. The experimenter stood at the foot of the bassinet beyond the infant's view. With a Rustrak recorder he recorded graphically the object of the infant's gaze; on one of the two test patterns or on something else. "Looking time" in these tests was defined as that time during which the infant fixated one of the test patterns. Thus, if, while the two patterns were in place, the infant looked at the side of the bassinet or something else other than the patterns, the actual test might take much longer than four minutes. The sides of the two patterns were reversed after every minute of "looking time" to correct for any side preference an infant might have developed. The inter-observer correlation for times of fixating one of the patterns through 24 minutes of looking time with six infants was +.96. To eliminate the effect of short-term satiation, each mother was asked to remove the familiar pattern and to avoid letting her infant see it on the days scheduled for the test sessions.

One week after the third test session, when these infants in the experimental group were 3.25 months of age, the familiarized stabile was

removed, and for 16 of the 24, a new one was put in its place. The arrangements of test patterns for familiarization and testing follows:

Number of Subjects	Familiar	Test
8	flowers	flowers vs. balls
8	balls	balls vs. flowers

As already noted in the schedule of events, the test of attentional preference came after the new pattern had been exposed for but 7 days.

The 10 infants in the control group, run to determine any possible effect of the first test of attentional preference with the experimental group on the results of subsequent tests, received the following stimulus patterns for familiarization at one month:

Number of Subjects	Familiar	Test
5	yarn	yarn vs. flowers
5	flowers	flowers vs. yarn

Following the second test, when the infants in this control group were three months of age, the familiar stimulus pattern was removed and a new one was put in its place. The selection of stimulus patterns for familiarization and tests were:

Number of Subjects	Familiar	Test
5	yarn	yarn vs. balls
5	flowers	flowers vs. balls

In this case, the test of preference came after only three days of exposure to the new pattern.

RESULTS

Table 1 presents the mean percentages of looking time for each of the three kinds of pattern when it was familiar and unfamiliar in each of the three tests. In the first test, the infants looked longer at each pattern when it was the familiar pattern than when it was the unfamiliar one, but in the second and third tests they looked longer at each pattern when it was the unfamiliar one. When these data were treated in a repeated-measures analysis of variance, the process of change from preference for the familiar to preference for the unfamiliar patterns proved to be very highly significant ($f = 14.26$; df 2, 42; $p < .001$). From inspection of Table 1, the patterns appear to differ in attractiveness for the yarn pattern is favored over the other two in each role, but this apparent variation among the patterns in attractiveness falls short of statistical significance ($F = 2.99$; for $p = .05$ with df 2, 21, $F = 3.47$).

Although the infants looked longer at each pattern in the first test when it was in the familiar condition than when it was in the unfamiliar one, only in the case of the boxes pattern is the difference statistically significant for a given pattern (see Part B of Table 1). When the results for the 24 infants on the three different familiarized patterns are combined, however, the 24 infants looked at the familiar pattern an average of 137.59 seconds or 57.34% of the total 240 seconds (4 minutes) of looking time comprising the test. When the significance of this preference for the familiar, combined for the three patterns is tested by means of a t-test for the difference between this mean and a hypothetical average of two minutes of focusing on the familiar pattern (to be expected were there no experience effects), this difference is statistically significant ($t = 1.95$, $df = 23$, $p < .05$). In the second test, following an additional 2 weeks of exposure to the familiar pattern, the mean amount of time that the infants looked at their familiar pattern had dropped to 91.99 seconds or 38.33% of the total looking time. This clearly denies a preference for the familiar after 6 weeks of familiarization ($t = 2.43$, $df = 23$, $p < .025$). By the third test, moreover, when the infants were three months old and had been exposed to their patterns for 8 weeks, the mean time of looking at their familiar pattern remained the same as in the second test, 91.99 seconds or 38.33% of the total looking time. A decrease in variability, however, served to increase the level of significance ($t = 2.95$, $df = 23$, $p < .005$). These results clearly support the hypothesis of attentional preference for a pattern made recognitively familiar through repeated perceptual encounters developing before those perceptual encounters lead to attentional preference for an unfamiliar pattern.

Even though, in the first test following 4 weeks of exposure to their familiar pattern when they were two months old, the infants looked longer on the average at it than they did at the unfamiliar one, only 14 of the 24 showed such attentional preference. Six infants looked longer at the unfamiliar pattern, and 4 showed no preference. Although preference for the familiar in this first test is quite short of universal, a test of proportions reveals it to be statistically significant ($z = 2.00$, df 20, $p < .05$). In the second test, after an additional 2 weeks of exposure to their patterns, only 7 showed preference for their familiar pattern, 16 (67%) preferred the unfamiliar pattern, and 1 showed no preference. In this second test, this preference for the unfamiliar pattern is significant at the .05 level. In the third test, after a total of 8 weeks of familiarization and when the infants were three months old, only 3 still preferred their familiar pattern, 20 preferred the unfamiliar one, and 1 showed no preference. It should be noted, however, that all the infants who failed to prefer the unfamiliar pattern in this third test had preferred the familiar one in both the earlier tests. Similarly, all of the infants who failed to prefer the unfamiliar pattern in the second test had preferred the familiar one in the first.

For the 10 control infants, the test at two months of age was omitted. Their first test came when they were 2.5 months old. Only 3 of these 10 infants showed attentional preference for their familiar pattern and 6

preferred the unfamiliar one, and 1 showed no preference. This preference for the unfamiliar pattern, in terms of the difference between means of looking time, is statistically significant ($t = 2.11$, $df = 8$, $p < .05$). The percentage (60%) of these 10 infants showing preference for the unfamiliar pattern in this test (following six weeks of familiarization without previous tests) is very similar to that (58.33%) of the 24 infants in the experimental group showing preference for the unfamiliar in their second test. Thus, being involved in the first test appears not to influence looking behavior in the second at all. Rather, it appears to be duration of the perceptual exposure that determines the shift of preference from the familiar pattern to the unfamiliar one.

When older, the infants failed to show preference for newly-familiarized patterns even though the periods of perceptual exposure were substantially reduced when, after 7 days of familiarization with a new pattern beginning at age 3.25 months, 16 of the 24 infants in the experimental group were tested by presenting this newly-familiarized pattern simultaneously with a totally unfamiliar pattern, only 1 preferred the familiar pattern, 14 preferred the unfamiliar one, and 1 refused to cooperate. The mean times of looking at the unfamiliar pattern averaged significantly longer than half of the total looking time ($t = 4.99$, $df = 14$, $p < .001$). When at 3 months of age, the infants in the control group received for but three days of familiarization the pattern which had been their earlier unfamiliar one, the test of attentional preference showed only 1 preferring his newly-familiarized pattern; 7 preferred the unfamiliar one; and 2 failed to cooperate. Here again the times of looking at the unfamiliar pattern averaged significantly more than half of the total looking time ($t = 2.80$, $df = 7$, $p < .01$).

DISCUSSION

The results of this experiment are not unlike those obtained by Uzgiris and Hunt (18). The infants in the experimental group looked longer on the average than half of the total looking time at their familiar stimulus pattern in the first test which came after four weeks of familiarization when they were two months old. In the later tests, after additional perceptual contact with the familiar patterns, the infants came to look longer than half the total looking time at their unfamiliar stimulus pattern. The design of this study, however, permitted comparisons not possible in the exploratory study of Uzgiris and Hunt. One of these shows that, in the first test, the infants looked longer on the average at each pattern when it was familiar than when it was unfamiliar. In the second and third tests, on the other hand, they looked longer on the average at each pattern when it was unfamiliar than when it was familiar. Moreover, the longitudinal course of change in each individual infant who manifested a change of preference was always from preference for the familiar pattern to preference for the unfamiliar one. These are strong evidences for the existence of a process, deriving from perceptual exposure to a pattern, with a phase of attentional preference for the familiar pattern developing before the appearance of attentional preference for the unfamiliar or novel.

While such comparisons clearly support the hypothesis, an examination of individual preferences again raise a quandary. Of the 24 infants in the experimental group, 6 looked longer at the unfamiliar pattern even in the first test, and 4 showed no preference. Can it be that some other factor is involved here, or may these 6 infants have skipped the phase of preference for the familiar pattern?

Even though the variations in attractiveness of the three patterns used by the experimental group were not statistically significant, one may ask whether such variation could conceivably be such a factor. The streamers, for instance, were looked at less than half of the total looking time in the first test even when it was in the familiar condition. Since somewhat less than 2/3 of the infants preferred their familiar pattern in the first test, one might skeptically consider such a proportion preferring the familiar to be an artifact of this fact that one of the three stimulus patterns was intrinsically less attractive than the other two. Actually, however, 3 of the 8 infants who got streamers in the familiar condition preferred them over the unfamiliar patterns in the tests of attentional preference. Moreover, 2 others of these 8 showed a lack of preference by looking at the familiar but relatively unattractive streamers 50% of the total looking time. Thus, the intrinsic unattractiveness of the streamers cannot account for the proportion of subjects preferring their familiar pattern in the first of the three tests. Conversely, the yarn tassels appear to be intrinsically most attractive, yet 1 of the subjects for whom this was the familiar pattern looked at it substantially less than half of the time in the first test of attentional preference, 2 looked at it but 50% of the time thereby showing no preference, and a fourth looked at it but slightly over 50% of the time. The yarn tassels do, however, resist boredom from familiarization better than the other two, for, in the second test, 4 of the 8 subjects for which this was the familiar one continued to prefer it, and, in the third test, 3 of these still preferred it over the unfamiliar pattern, and the fourth looked at it for half of the time thereby showing no preference.

From a longitudinal point of view, such evidence suggests that the 6 infants with attentional preference for the unfamiliar pattern in the first test at age two months need not have skipped a phase of attentional preference for their familiar pattern. The evidence is clear that once an infant achieves preference for the unfamiliar pattern, this preference persists through later tests. Other infants in the study later made transitions from preference for their familiar pattern to the unfamiliar one. There is no reason for all infants to make such a transition at the same age or even after any given amount of perceptual exposure to a pattern. Thus, this experiment may have caught the phenomenon of preference-for-the-familiar midway in a process of transition. It may well be that the 6 infants who failed to look more at the familiar pattern than at the unfamiliar one in the first test were either developing at a faster rate than their peers or that they required fewer exposures and less time of perceptual contact with a pattern to achieve attentional preference for the familiar and, then, for transition to preference for the unfamiliar. This absence of evidence for a universal preference for the familiar may well be an artifact of failing to test preference after one, two, or three weeks of exposure when these infants were five, six, and seven weeks of age. Had such tests occurred, they too might have preferred their familiar pattern.

With such a possibility in view, an effort was made in pilot studies to test several babies at earlier ages than two months. As other investigators (1) have noted, however, tests of paired comparisons seemed inappropriate at such an early age for the infants tended to fixate one pattern and to ignore the other. Several infants were tested by presenting each pattern singly. The unfamiliar pattern was displayed first for a minute and the time that the infant spent looking at the pattern was recorded. Then for a second minute, the familiar pattern was displayed, and the time the infant spent looking at it was recorded. Because the patterns utilized in this experiment attracted the gaze of the infants almost constantly, however, this method was also unsatisfactory. With less attractive patterns, perhaps tests involving the presentation of single patterns might prove more successful. Some change of method is needed to test this process interpretation further.

The issue of whether the shift in preference from the familiar pattern to the unfamiliar one is a matter of maturation or of perceptual interaction with the patterns remains unsettled. If the basis is one of maturation, it would appear that preference for the familiar is characteristic of infants of about two months of age and progressively less characteristic of older infants. On the other hand, it may be that such a shift exists in a person's interaction with every pattern. Even adults may possibly prefer what is becoming recognitively familiar, although the exposure required for recognition may be quite brief, and the shift to preference for what is unfamiliar and novel may come very rapidly. In this study, when the 16 infants of the experimental group received a new pattern for familiarization at 3.25 months of age, only 7 days of exposure resulted in 14 of the 16 infants preferring the unfamiliar pattern. Moreover, when the 10 infants in the control group got new stimulus patterns at 3 months of age, only 3 days of familiarization resulted in attentional preference for the unfamiliar in 7 of the 8 infants cooperating during the test. These two sets of results are consonant with the view that the shift is a matter of maturation, but they leave ample room for an alternative view which might well be tested by limiting the periods of exposure to the regularly encountered pattern to brief daily tests.

To the best of our knowledge, McCall and Kagan (13) have done the only other study of long-term home experience with a stimulus pattern When they tested infants at four months of age, after one month's exposure to the pattern, they found clear preference for an unfamiliar one using heart deceleration as the dependent variable. On the basis of the results of the present study, however, it would seem that this month of experience beginning when the infants were three months old was far too much to yield any signs of attentional preference for their familiar pattern over an unfamiliar one.

The results of the first test for the 24 infants in the experimental group may also appear to conflict with those of Fantz (3) and of Saayman, et al. (16). Both have reported attentional preference, measured by means of looking time, for an unfamiliar pattern at about two months of age. In their experiments, however, the tests of attentional preference were made

immediately after their infants had had a period of essentially continuous visual contact with the familiar pattern. Hunt (7) has contended that such continuous visual contact could well lead to perceptual satiation in young infants without establishing the central processes required for recognition. In this study, familiarization consisted of daily exposures to the familiar pattern, and no exposure for the last 24 hours before the tests of attentional preference. Both Hunt (7) and Uzgiris and Hunt (18) have distinguished perceptual saitation with continuous exposure from habituation with intermittent exposure. In a review of the literature on memory, McGough (14) summarizes the abundant evidence for a clear distinction between short-term memory and long-term memory. Satiation could well involve the former, and habituation the latter. The evidence for a clear distinction between short-term and long-term memory processes lends additional credence to this distinction between satiation and habituation and thereby removes the apparent conflict between the findings of Fantz (3) and Saayman, et al. (16) and those reported here and in the earlier study of Uzgiris and Hunt (18).

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FOOTNOTES

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2. Now at the University of Nebraska.

3. Now at Clark University.

Table 1

A. Means of the Percentages of the Four Minutes of Looking Time That Each Pattern was Fixated During Each Test of Preference When Familiar and When Unfamiliar

Stimulus Pattern	Test 1 Age 2 months		Test 2 Age 2.5 months		Test 3 Age 3 months	
	Fam	Unfam	Fam	Unfam	Fam	Unfam
Yarn	63.44	54.88	53.14	77.00	50.63	69.13
Streamers	48.63	40.88	37.00	60.00	30.75	57.78
Boxes	59.94	32.25	26.31	43.63	35.12	58.25

B. Values of t for t-tests Applied to Data of Part A

Pattern	Test 1	Test 2	Test 3
Yarn	.94	27.40**	1.82*
Streamers	1.03	2.51*	3.30**
Boxes	3.21**	1.60	2.97**