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ABSTRACT

This study examines serial habituation in a sample of 54 infants aged 2, 3, and 4 months to determine whether age changes are partially a function of different "strategies" rather than simply different rates of habituation. The serial habituation hypothesis proposes that attention and habituation of attention proceed in order of the relative saliencies of cues. This hypothesis was examined cross sectionally, longitudinally within subjects, and longitudinally between subjects (by cohorts) using a traditional habituation paradigm. Individual components of the standard stimulus were displayed before and after successive exposures of the standard for familiarization. Relative saliencies of the individual components for each child were indexed by measuring the degree of response produced by the initial presentation. When pre- and post-exposure fixation times were compared, it appeared that for all ages habituation was underway to the parts of the stimulus in order of the relative saliencies in agreement with the serial habituation hypothesis. The data were also found to be fairly consistent across methodologies, suggesting that results were not a product of a particular experimental design. In addition, it was found that while the order of interaction with components is in agreement with the serial habituation hypothesis, apparent differences between groups of "fast habituators" and "slow habituators" lend some validity to the idea that rate of habituation may be an index of information processing or efficiency. (Author/GO)

Developmental Study of Serial Habituation[1]

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ABSTRACT

Serial habituation of visual fixations in 2-, 3-, and 4-month-old infants was investigated through a design permitting cross-sectional, within-subject longitudinal, cohort longitudinal, and time-lag analyses. The components of the standard stimulus were displayed individually before and after successive exposures of the standard for familiarization. Relative saliencies of the components for each child were indexed by magnitude of responding to these parts in the initial presentation. Comparisons of the pre- and postexposure fixation times suggest that for all ages habituation was underway to the parts of the stimulus in order of the relative saliencies. The nature of the data in general did not appear to be influenced significantly by any one methodology.

Developmental Study of Serial Habituation

The purpose of the present study was to investigate serial habituation in 2-, 3-, and 4-month-old infants and to examine age-related data through a design intended to cope with confoundings of the traditional cross-sectional and within-subject longitudinal methods (see Baltes, 1968; Schaie, 1965).

The serial habituation hypothesis (Jeffrey, 1968) proposes that attention and habituation of attention proceed in order of the relative saliencies of cues. Thus, the notion essentially offers a possible account of the infant's early interaction with perceptual stimuli, a more basic analysis of the infant's decrement in response to repeated stimulation which is assessed generally as habituation. To the extent that data from a number of studies could suggest the infant may be extracting information from the stimulus as habituation is underway, such decrements in response indeed may be an indication of perceptual learning as described in Gibson (1969). While some evidence of serial habituation for 4-month olds can be inferred from results of a few studies (Miller, 1972; Miller, Deslauriers, & Farrow, Note 1), the visual attention of younger infants has not been examined vis-à-vis the hypothesis. Absence of serial habituation in the younger infants might imply that the age changes for habituation, discussed in the literature, may be partially a function of different "strategies" rather than simply different rates of habituation.

To investigate this proposition thoroughly, during a 3-month period infants were studied cross-sectionally, longitudinally within subjects, and longitudinally between subjects (by cohorts) for visual serial habituation at 2, 3, and 4 months of age using a traditional habituation paradigm. A separate cell of 4-month-olds was included in the second month of the study, so that time of measurements confoundings could be explored across three months for the one age group.

Pertinent to the serial habituation hypothesis, if habituation occurs to the components of a stimulus in order of their saliencies, some differential responding to its components would be expected after repeated presentations of the standard. Since successive shifts of attention would be limited in part by the amount of time allowed in the familiarization phase, the exact nature of postexposure responding cannot be specified for all components. The pattern of responding at the test, however, was predicted in directions implied by Jeffrey's hypothesis and in terms of results from a previous study (Miller, 1972). Given that serial habituation is characteristic of all age groups examined, it was predicted that the most salient component would be processed and that at the test, visual fixation time would be less than prior to familiarization. The least salient component, if not assimilated, would generate higher responding at the test than prior to exposure to the intact stimulus. No prediction was made for responding at the test to the component of middle saliency. It could be expected only that some but not all of the infants would habituate to the most salient element and then direct their attention to the next most salient one within the time period. If serial habituation in not characteristic of all the age groups studied, different patterns of pre- and postexposure responding would emerge, but their nature was not specified in advance.

Method and Procedure

Subjects

The sample consisted of 54 infants: 9 tested three times and 45 tested once. (See Fig. 1.) Nine subjects were examined at 2, 3, and 4

Insert Fig. 1 about here.

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months of age for the within-subject longitudinal data. To provide cross-sectional data during the first month of the project, nine 3-month-old and nine 4-month-old infants were tested in conjunction with the 2-month-olds of the within-subject longitudinal cell. The longitudinal sample of cohorts was generated by testing nine 3-month-olds and nine 4-month-olds in the program's second and third month respectively, using the 2-month-olds of the within-subject longitudinal sample for the 2-month cell. An additional group of nine 4-month-old infants was examined in the second month of the study to permit analysis of time of measurement confounding in the data for that age group over the 3-month period.

Infants were excluded from the sample for sleeping, crying, and several procedural anomalies. Also eliminated prior to analysis were the data of additional infants who completed the test but (1) whose birthdates did not represent fairly reasonable yokes with their age-mates in the study or (2) were run as backups for the longitudinal subjects in case one of these did not complete the three testing sessions.

Apparatus and Stimuli

The apparatus was much the same as that described in Miller (1972). Briefly, each subject viewed slides of the stimuli from a standard infant seat facing a back projection screen. During the session the child was observed on a TV monitor in an adjacent room and video-taped. A printout counter was used to record total fixations to a tenth of a second per slide. Constant radio static was on in the infant's room during each session to mask external random noise as much as possible.

Three sequences of stimuli were used, each having a different black and white standard stimulus--a three-part circular, square, or triangular configuration (Figure 2). The projected size of the intact

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Insert Fig. 2 about here.

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standards was about 6½ inches. The components of each figure, when presented individually, were of the same size and location on the screen as when displayed as part of the integrated stimulus. Different colored slides were inserted within each sequence for analyses to rule out interpretations of fatigue, sensory adaptation, etc. A slide presentation was programmed to last 20 seconds from the first fixation and electronic signals marking these stimulus intervals were recorded on the video tape during the session.

Procedure

Each subject was shown a sequence of stimuli characterized as NPPPNSSSSSSSSPPPSN, where N refers to three different colorful slides, P to a component of the standard, and S to the standard (the intact stimulus). Since no significant differences were obtained for order of components in previous work (Miller, 1972), all subjects saw the same sequence for the standard they viewed. Type of stimulus was not shown to significantly affect serial habituation previously (Miller, 1972), but three different stimuli were used so the repeated testings yielding the longitudinal within-subject data would not be confounded by potential recall. So that age groups would be treated similarly, three infants in each age cell in each month of the study were assigned to prerandomized blocks of the three standard stimuli.

After engaging the child's attention with a colored slide (not part of the stimulus sequence) when the infant was positioned in front of the screen, the stimulus sequence was started. A 20-second timer was activated on the first orientation to each slide, and the next slide advanced automatically at the end of that period throughout the 18 slides.

Total fixation time per slide was scored from the videotapes by the third author. Because this experimenter had achieved 98% interobserver reliability during training in another similar project, a second observer was not considered necessary. Intraobserver reliability was provided, however, by scoring first fixations per slide on separate replays of the videotapes and comparing that data with relevant total fixation time scores that derived from a single fixation.

Results

Analyses of total fixation time per slide were conducted to determine whether fatigue could be eliminated as an explanation for the course of responding within the session, to explore the nature of responding to repeated presentations of the standard stimulus, and to find out if the subjects responded differentially to the components of the standard following exposure to the intact stimulus. Effects due to the age factor, specified as groups or ages in the analyses, were assessed for all these questions. Furthermore, portions of the data were reanalyzed in terms of individual differences with subjects classified as fast and slow habituators and short fixators based on the formulation of McCall and Kagan (1970). Because of time limitations, only the data with respect to the serial habituation hypothesis will be elaborated here. Other results are detailed in an extended paper.

Before illustrating the relevant data, the manner in which these were arranged to examine the influence of saliency as a determinant of attentional distribution will be described. Using Miller's (1972) procedure, fixation times of each subject to the initial showing of each of the parts of the standard were ordered in terms of most to least responding, regardless of the component to which each of these occurred. Thus, magnitude of responding was used to index relative saliencies of the parts. These scores were then compared with scores to the same components presented after famililiarization to the intact standard. For each "set" of data, a 3(groups) x 2(blocks) x 3(levels of saliency) analysis of variance for repeated measures was conducted, followed by tests of a priori predictions on the direction of differences between pre- and postfamiliarization responding. The data are illustrated in Figure 3 where these are collapsed across groups for

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Insert Fig. 3 about here.

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each sample and for the individual difference distribution where subjects had been classified as fast and slow habituators and short fixators. No analysis found significant effects for the 3-way interaction necessary to suggest the patterns of responding were different between the ages or groups within each design or the individual differences distribution. Thus, in essence, across all methodologies, it would appear that infants distributed their attention among components in a similar fashion.

Tests on direction of postexposure responding relative to the serial habituation hypothesis compared pre- and postexposure data: one-tailed levels of significance were used to assess the data with respect to the components initially rated most and least salient, and two-tailed levels were used for the second most salient component. None of the tests for the latter yielded significant differences. For the cross-sectional sample, postexposure responding dropped significantly ($p < .05$) to the most salient component and increased for the least salient, but only approaching significance ($p < .10$). For both the within-subject longitudinal and the cohort longitudinal samples, postexposure differences were in the predicted direction: decreased to the most salient part ($p < .05$) and increased to the least salient ($p < .005$). For the time-lag subjects, scores for the most salient component dropped at postexposure ($p < .005$), but there was no difference for the comparison to the least salient component. The pattern for the individual difference analysis, collapsed as it is across that partitioning, shows the data for all 54 infants, excluding the data for repeated measures at 3 and 4 months for the within-subject longitudinal design. The difference between pre- and postexposure responding is significant and in the predicted direction: for the most salient part, $p < .005$, and for the least, $p < .01$.

Because results of a more recent project in which the relationship between habituation rate and later performance on object concept tasks hinted that short fixators may not merit separate classification, the present data were reanalyzed with all subjects categorized as either fast or slow habituators. This partitioning of the data relevant to the serial habituation hypothesis is shown in Figure 4. As in all the analyses

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Insert Fig. 4 about here.

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reported above, the 3-way interaction which would suggest habituation was underway in other than a serial fashion was not significant. Significant block x group and block x saliency interactions, however, indicated further analyses of the two groups were warranted. As shown in the figure, there are differences between fast and slow habituators in the way they respond after the familiarization phase to the components at the three levels of saliency. Both direction and amount of differences are of interest. Comparing pre- and postexposure data at each level of saliency, the following results should be noted. For the initially most salient component, on the postexposure trial looking dropped significantly ($p < .001$) for the fast habituators but not for the slow habituators. For the middle level of saliency looking decreased for fast habituators but increased for slow habituators. Neither comparison, however, was significant by two-tailed tests. For the component initially indexed as least salient, fixations increased slightly but not significantly for the fast habituators, while it increased significantly ($p < .01$) for slow habituators.

Discussion

The results, reported within this presentation, would appear to bear on several areas of interest for the assessment of visual habituation. According to the way these data were arranged and analyzed, there would appear to be support in the patterns of pre- and postfamiliarization responding for Jeffrey's (1968) serial habituation hypothesis for all age groups studied. Given further verification, a picture of the order in which the infant becomes familiar with elements of his environment begins to emerge. All of us could imagine uses for that kind of information without elaboration here.

The fact that this pattern is fairly consistent across methodologies suggests the results are not just a product of a particular design. The data of the 4-month-olds combined in the time-lag analysis represents the biggest departure in terms of the least salient component and this does not seem attributable to method but rather to variability in responding. Thus, it would appear that designs are not a primary consideration for the particular phenomena involved, at least for the three age groups. This is not to say that a particular design or use of multiple designs is not worthwhile when investigating habituation or other phenomena over distinctly different developmental levels or across different time periods.

While methodology and age do not appear to be factors affecting the nature of the data, rate of habituation (fast and slow) evidently is a consideration. The order of interaction with the components seems to fit the propositions of the serial habituation hypothesis, yet the apparent differences between the two groups lends some validity to the notion that rate of habituation may be an index of speed or efficiency of information processing. In essence, faster habituators appear to have assimilated more of the standard stimulus than slower habituators.

Finally, one brief comment regarding serial habituation as this might apply to experimental procedures that define visual habituation by a criterion. One example of this is termination of familiarization trials after looking at the standard has decreased X-number of seconds from the first presentation. There is a great deal of merit in this approach in its goal of bringing all subjects to the same level of habituation. If, however, serial habituation is truly the mode of infant interaction with the stimuli, as suggested by our data, investigators will need to bear in mind that the decrement may index only familiarity with the most salient element of the stimulus complex. If a study requires more than this for tests of a hypothesis, the criterion procedure could have inherent problems. Further research on the serial habituation hypothesis is needed of course to verify its basic propositions, but serious attention to the implications of these notions is warranted in the interim.

References

Baltes, P. B. Longitudinal and cross-sectional sequences in the study of age and generation effects. Human Development, 1968, 11, 145-171.

Gibson, E. J. Principles of perceptual learning and development. New York: Appleton-Century-Crofts, 1969.

Jeffrey, W. E. The orienting reflex and attention in cognitive development. Psychological Review, 1968, 75, 323-334.

McCall, R. B., & Kagan, J. Individual differences in the infant's distribution of attention to stimulus discrepancy. Developmental Psychology, 1970, 3, 90-98.

Miller, D. J. Visual habituation in the human infant. Child Development, 1972, 43, 481-493.

Schaie, K. W. A general model for the study of developmental problems. Psychological Bulletin, 1965, 64, 92-107.

Reference Note

1. Miller, D. J. Deslauriers, R. J., & Farrow, B. J. Absence of sex effects in serial habituation. Unpublished report. University of Notre Dame, 1975.

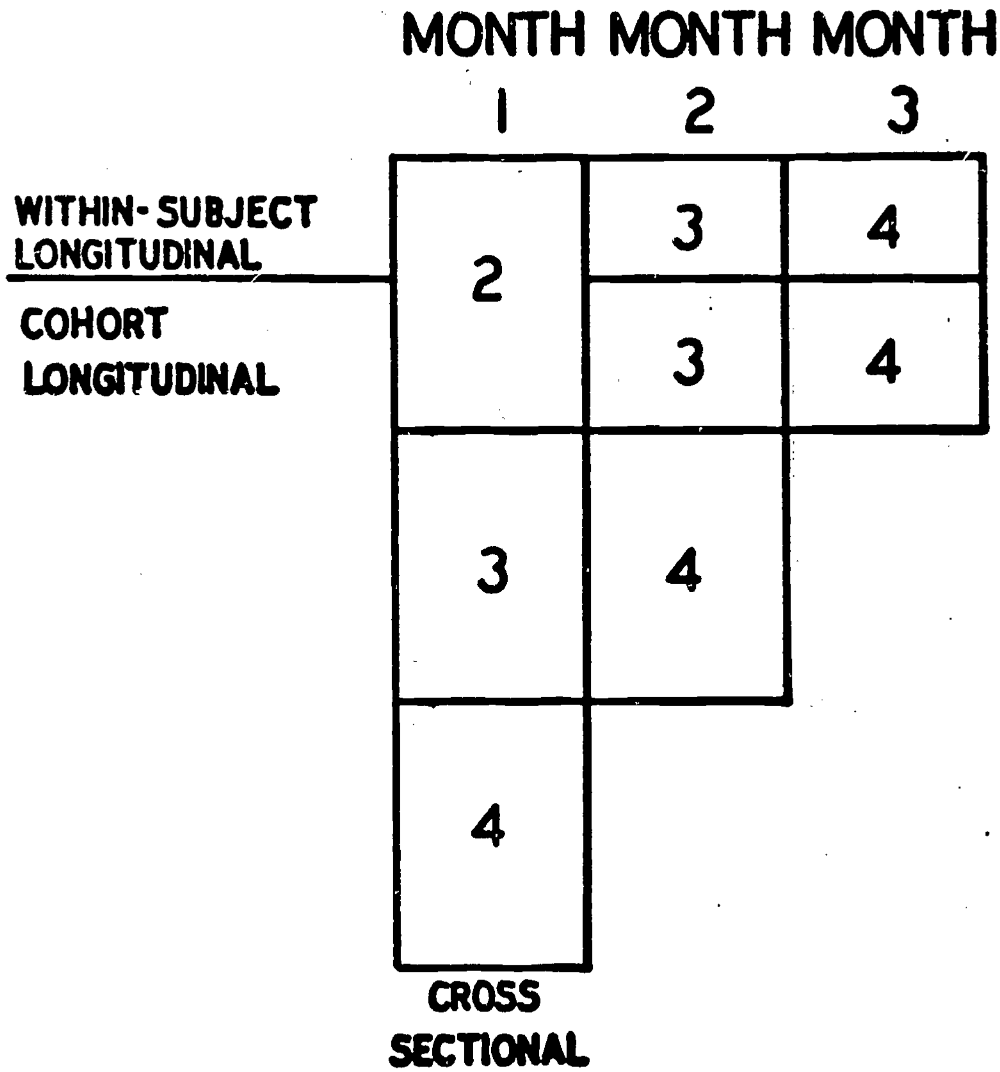

Fig. 1. Distribution of 2-, 3-, and 4-month-old infants across testing months.

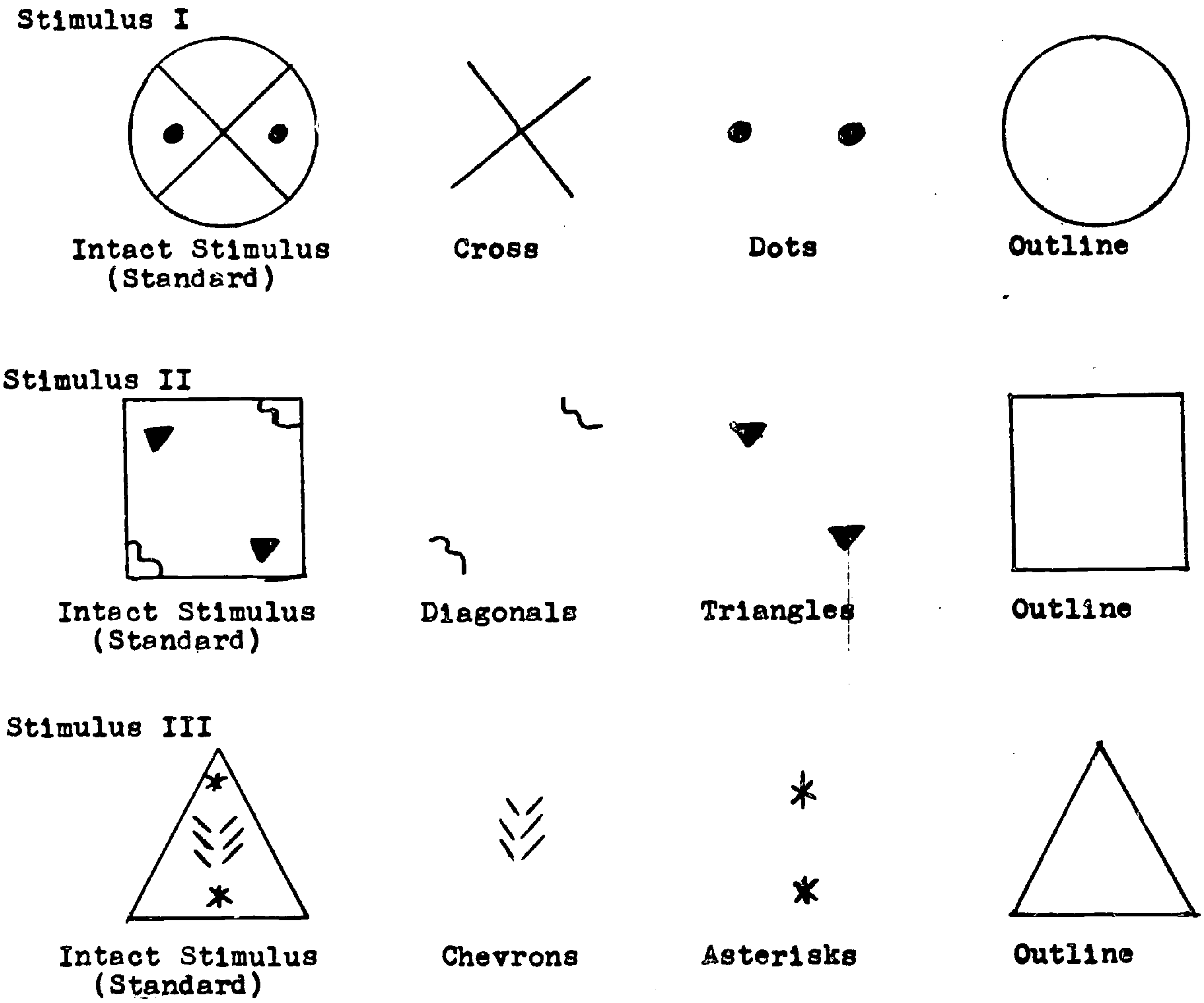

Fig. 2. Intact stimuli (used as the standards) and their respective parts.

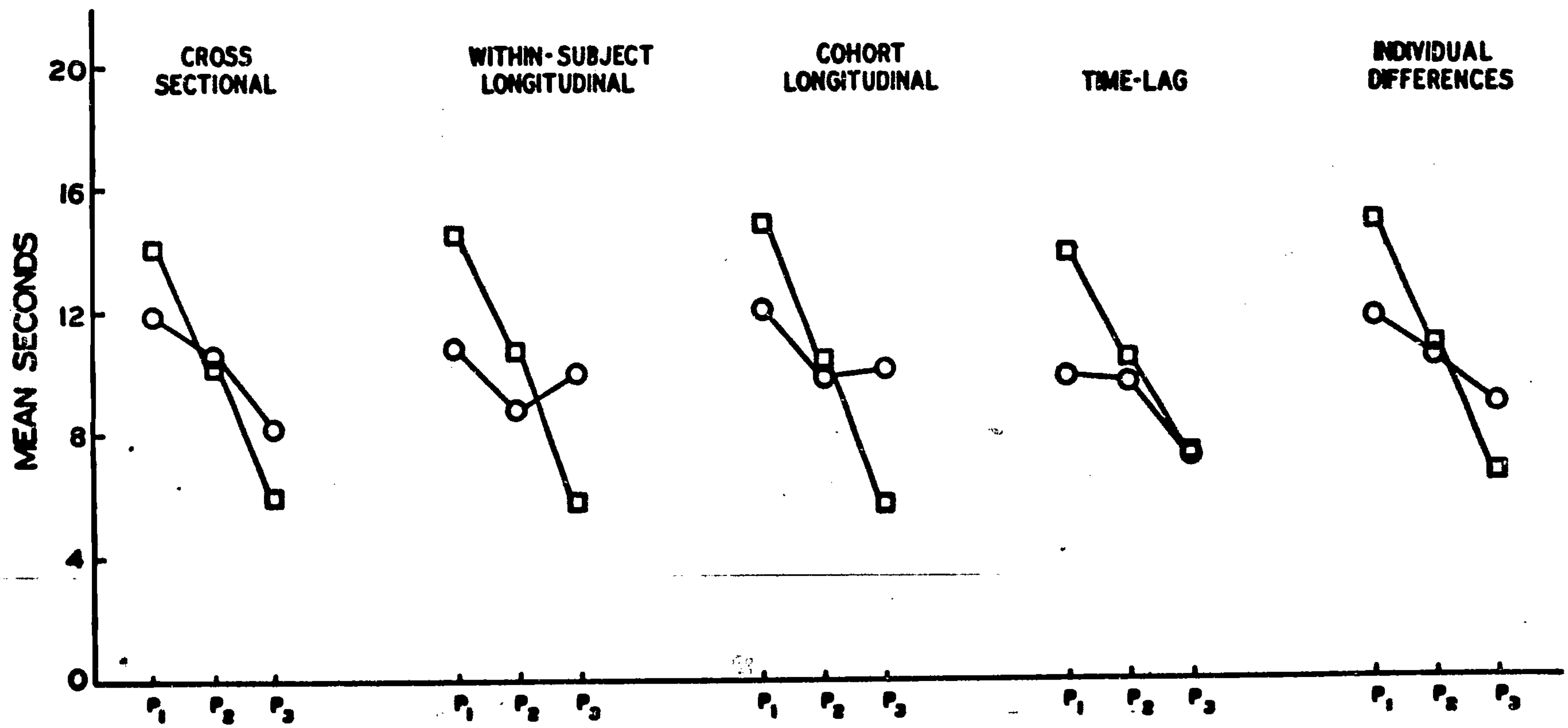

Fig. 3. Mean total fixation time for pre-exposure (□) and postexposure (○) responding to the parts of the standard stimulus, indexed according to relative saliencies.

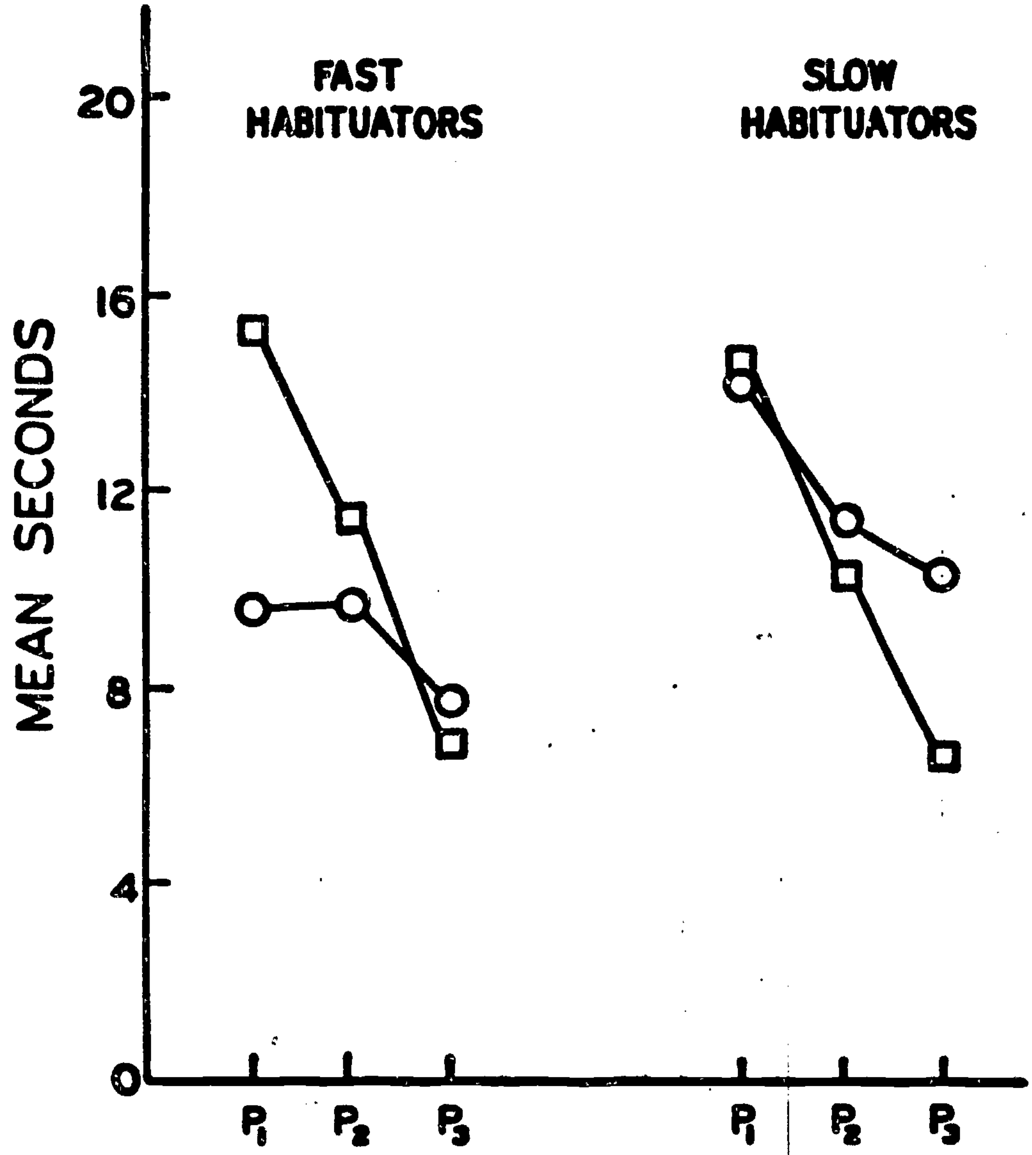

Fig. 4. Mean total fixation time for pre-exposure (□) and postexposure (○) responding to the parts of the standard stimulus, indexed according to relative saliencies.