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Children's Perceptual Organisation of Hierarchical Visual Patterns

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Children's perceptual organisation of hierarchical patterns was investigated in two experiments through similarity judgements. Previous studies with adults demonstrated that the perceptual relations between the global configuration and the local elements of such patterns depend critically on the number of elements embedded in the pattern: Patterns composed of a few, relatively large elements are perceived in terms of global form and figural parts, whereas patterns composed of many relatively small elements are perceived in terms of global form and texture. In Experiment 1 children at three levels of age (preschoolers, first and third graders) were presented with a standard figure and two comparison figures—a proportional and an unproportional enlargement of the standard. The number of elements in the standard figure was varied. When the number of elements was small, children at all age levels concerned judged the proportional enlargement which preserves the global and local forms as well as the relationship between them as more similar. When the number of elements in the standard figure increased, children switched their preference to the unproportional enlargement which preserves both the global form and the textural properties of the standard figure. When the global configuration and the local elements were pitted against each other (Experiment 2), and the number of elements was rather large, preschoolers and third graders judged the comparison figure having the same global configuration as the standard but composed of different elements as more similar to the standard than the comparison figure having the same elements arranged in a different configuration. Overall,

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these results are similar to the ones obtained with adults: As far as the perceptual organisation of hierarchical patterns changes as a function of the number of elements for the adult perceiver, it changes also for the young child. These results do not support the hypothesis that young children perceive complex visual stimuli as undifferentiated wholes, as some developmental researchers have proposed. Furthermore, the finding that for children, as for adults, the elements do not function perceptually as parts when the number of elements is large, implies that few-element patterns are better candidates for testing hypotheses about the relative priority of wholes and parts across development.

INTRODUCTION

A central issue in perceptual development concerns the perception of wholes and parts. Historically, this question can be traced back to the controversy between the "syncretic" view which held that young children only perceive undifferentiated wholes, and the "pointillistic" view claiming that young children only perceive isolated parts or details (see Vurpillot, 1976, for a review). A developmental trend has been hypothesized from a state of more global, undifferentiated perception to a state of increased differentiation and hierarchical organisation (e.g. Gibson, 1969; Werner, 1957). Empirical findings, however, do not render complete support to this hypothesis, at least in its strong version. Whereas there is evidence that the perception of the young child is dominated by global wholes (e.g. Lowe, 1973), and that the young child tends to classify objects holistically rather than dimensionally (e.g. Shepp, 1978; Shepp & Swartz, 1976; Smith & Kemler, 1977), other studies show that children focus sometimes on parts (e.g. Corah & Gospodinoff, 1966; Elkind, Koegler, & Go, 1964; Prather & Bacon, 1986), depending on the nature of the stimuli and on the tasks involved. Experimental treatments of children's perception of parts and wholes often lack proper control over stimulus material. Wholes and their parts can differ in complexity, familiarity, and recognisability (e.g. Prather & Bacon, 1986). Furthermore, the fact that sometimes it is unclear to what extent the experimental outcomes reflect the nature of the child's perception rather than performance limitation complicates the interpretation of the findings (e.g. Kemler, 1982; Smith, 1983). A critical issue in assessing children's perception is the delineation of developmental changes in perceptual organisation from developmental changes in selective processing and cognitive skills involved in identification, classification, and discrimination (see Shepp, 1978).

The relation between the perception of wholes and parts is an important issue for theories of visual perception in general. Several theorists interested in the microgenesis of perception have recently proposed that perceptual processing proceeds from global structuring towards analysis of more local details (Broadbent, 1977; Navon, 1977; 1981). This global-to-local hypothesis has been tested experimentally by studying adults' perception of hierarchically constructed patterns in which larger figures (i.e. global configurations) are constructed by the suitable arrangement of smaller figures (i.e. local elements). Using a set of converging operations, Navon (1977) demonstrated the perceptual priority of global forms. Other researchers have demonstrated important boundary conditions of the phenomenon, and pointed out some variables that can affect global *vs* local dominance. Such variables include stimulus size (e.g. Kinchla & Wolfe, 1979), sparsity of the local elements (e.g. Martin, 1979), and "clarity" or "goodness" of form (e.g. Hoffman, 1980).

In much of this research with hierarchical stimuli it has been presupposed that there are two perceptual levels corresponding directly to the global configuration and the local elements, and that the critical question is which level gets processed first. However, recent work by Kimchi (1982; Kimchi & Palmer, 1982) has demonstrated that the perceptual relation between the global and the local levels of hierarchical stimuli depends critically on the number and the relative size of the local elements. Patterns composed of many small elements are perceived in terms of global form and texture; the local elements in such patterns function as textual molecules. On the other hand, the local elements of patterns composed of a few, relatively large elements are perceived as figural parts of the overall form. It has been further shown that when many-element patterns are processed in terms of form and texture, the global and local levels are perceptually separable; the global and local dimensions of few-element patterns are perceptually integral (Kimchi & Palmer, 1985).

In light of the above findings it seems that some clear notion of how hierarchical patterns are organised perceptually by the child is an important prerequisite for asking meaningful questions about the child's processing of wholes and parts. The purpose of the present study is to investigate developmental differences in the perceived organisation of hierarchical patterns through similarity judgements of stimuli triads. It has already been shown that young children adapt readily to similarity judgements of this kind (e.g. Corah & Gospodinoff, 1966). In the stimuli used in the present experiments the global configurations and their local constituents were equated for complexity and familiarity: both were geometrical shapes of either squares or triangles. Also, some of the studies of children's perception of wholes and parts were criticised for relying on verbal skills (see Prather & Bacon, 1986); the present task does not require, at least explicitly, verbal encoding of the perceived stimuli.

EXPERIMENT 1

Children were presented with a standard figure and two comparison figures. All figures were composed of elements. The number of elements in the standard figure was varied. One comparison figure was a proportional enlargement of the standard figure (i.e. the sizes of both the global configuration and the local elements were increased equally by uniform dilation). The other comparison figure was an unproportional enlargement in which the global configuration was enlarged (having the same overall size as the proportional enlargement), but containing elements whose size and spacing were the same as in the standard figure. Previous findings with adults showed that when the standard figure was composed of a few relatively large elements, subjects chose the proportional enlargement as more similar to the standard. When the standard figure was composed of many relatively small elements, the unproportional enlargement was judged as more similar; the probability of choosing the unproportional enlargement increased monotonically as the number of elements increased (Goldmeier, 1972; Kimchi, 1982; Kimchi & Palmer, 1982). As both enlargements preserve the global configuration, the switch from choosing the proportional enlargement to the unproportional one was interpreted as reflecting the appearance of material (Goldmeier, 1972) or texture (Kimchi, 1982; Kimchi & Palmer, 1982). In a pattern composed of few large elements, the elements are perceived as figural parts of the overall form, and the proportional enlargement which preserves the relationships between the global and local structures looks more similar. When the number of elements embedded in a pattern increases, the element loses its function as an individual part of the overall form and serves to define texture. In this case, the enlargement which preserves the textural properties of the standard looks more similar. It is the unproportional enlargement in which the overall figure was enlarged but the measurements of the elements were kept unchanged that perserves both the global form and the texture. The question in the present experiment was how children would make their similarity judgements as a function of the number of elements. The stimuli triads used were identical to the ones used by Kimchi (1982; Kimchi & Palmer, 1982) with adults. This allows a comparison between children's and adults' performance.

Method

Subjects. A total of 40 children participated in the experiment: 14 preschoolers (8 males and 6 females; mean age 4 years 9 months; range 3 years 5 months to 5 years 6 months), 12 first graders (6 males and 6 females; mean age 6 years 8 months; range 6 years 2 months to 7 years), and 14 third graders (7 males and 7 females; mean age 9 years 2 months; range 8 years 6 months to 9 years 5 months). All of the children attended a school serving a predominantly middle-class population.

Stimuli. There were 24 stimuli triads in the experimental trials, the same ones as used by Kimchi (1982; Kimchi & Palmer, 1982) with adults.

Each stimulus triad was presented as three black patterns on a white index card (22 × 13cm). The triad contained a standard figure on the top and two comparison figures side by side below the standard. Each pair of comparison figures consisted of a proportional enlargement and an unproportional enlargement of the standard figure. One set of the stimulus triads is shown in Fig. 1. The enlargement was in the ratio of 1:1.6. Half of the stimulus triads consisted of squares made up of small squares, and the other half consisted of triangles made up of small triangles. In the standard figure there were 1, 4, 9, 16, 25, and 36 elements for the squares, and 1, 3, 6, 10, 15, and 21 elements for the triangles. Children viewed the cards from approximately 60 cm, although this varied from subject to subject in an uncontrolled fashion. At this distance, each individual element subtended 0.29° of visual angle; the global configurations subtended 0.29°, 0.95°, 1.34°, 1.53°, and 2.29° in the increasing number conditions. In half of the stimulus triads for each type of figure the positions of the two comparisons figures were reversed.

Procedure. Subjects were tested individually. Eight simple practice stimuli were presented at the beginning to make certain that the child

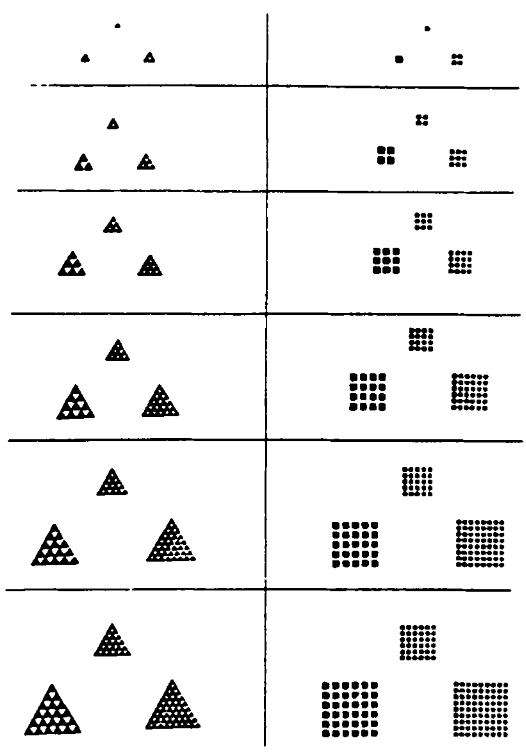

FIG. 1. The set of stimuli triads in Experiment 1. Another 12 stimulus triads were identical to the ones presented here, except that the position of the comparison figures was reversed.

understood the nature of the task before proceeding to the test stimuli. The experimenter pointed to each of the comparison figures at the bottom of the card and said: "Which of these looks most like this one (pointing to the standard figure at the top of the card)?" The child sat in front of a table and saw one card at a time. Each child gave a similarity judgement for each of the 24 cards. The order of the cards was random over subjects.

Design. The three factors of the design were age (three levels), number of elements (six levels), and figure (square, triangle). Within each age group all factors were combined orthogonally except that the value at each level of the factor of number was different for the two types of figures.

Results and Discussion

Mean proportions of choosing the unproportional enlargements as a function of the number of elements for each type of figure for the three age levels are presented in Figs 2a (squares) and 2b (triangles). Each response was scored as 1 if the unproportional enlargement was chosen and as 0 otherwise, and a three-way analysis of variance (ANOVA) was performed. The analysis treated age as a between-subject factor, number and figure as within-subject factors, and the number factor as nested within the figure factor. There was a significant effect of number [F (5, 185) = 55.38, $P <$ 0.0001] and of figure [F (1, 37) = 12.00, $P < 0.002$]. There was no significant effect of age [F (2, 37) = 1.07, $P > 0.35$], and no significant interaction between age and number, and between age and figure ($F < 1$ for both interactions).

A closer inspection of the data by binomial tests was performed in order to detect subjects' preference for the proportional or the unproportional enlargement at each level of number of elements. Because the exact values of number were different for the two figures (squares and triangles) the analyses were performed separately for each figure across age. The analyses showed that when the number of elements embedded in the standard figure was 1 (squares and triangles), 3 (triangles), and 4 (squares), choice of the proportional enlargement was predominant, occurring reliably more often than choice of the unproportional one ($P < 0.00001$, $P < 0.00003$, P < 0.0003, respectively). When the number of elements embedded in the square was 9 or more, the proportion choosing the unproportional enlargement was significantly higher ($P < 0.0003$ for 9 elements; $P < 0.00003$ for 16, 25, and 36 elements). With the triangles the region of transition from proportional to unproportional enlargement was not as clear cut: The proportion choosing the unproportional enlargement was significantly higher for 6 elements ($P < 0.005$), at chance level for 10 elements, just approaching significance for 15 elements ($P < 0.07$), and significantly higher for 21 elements ($P < 0.005$).

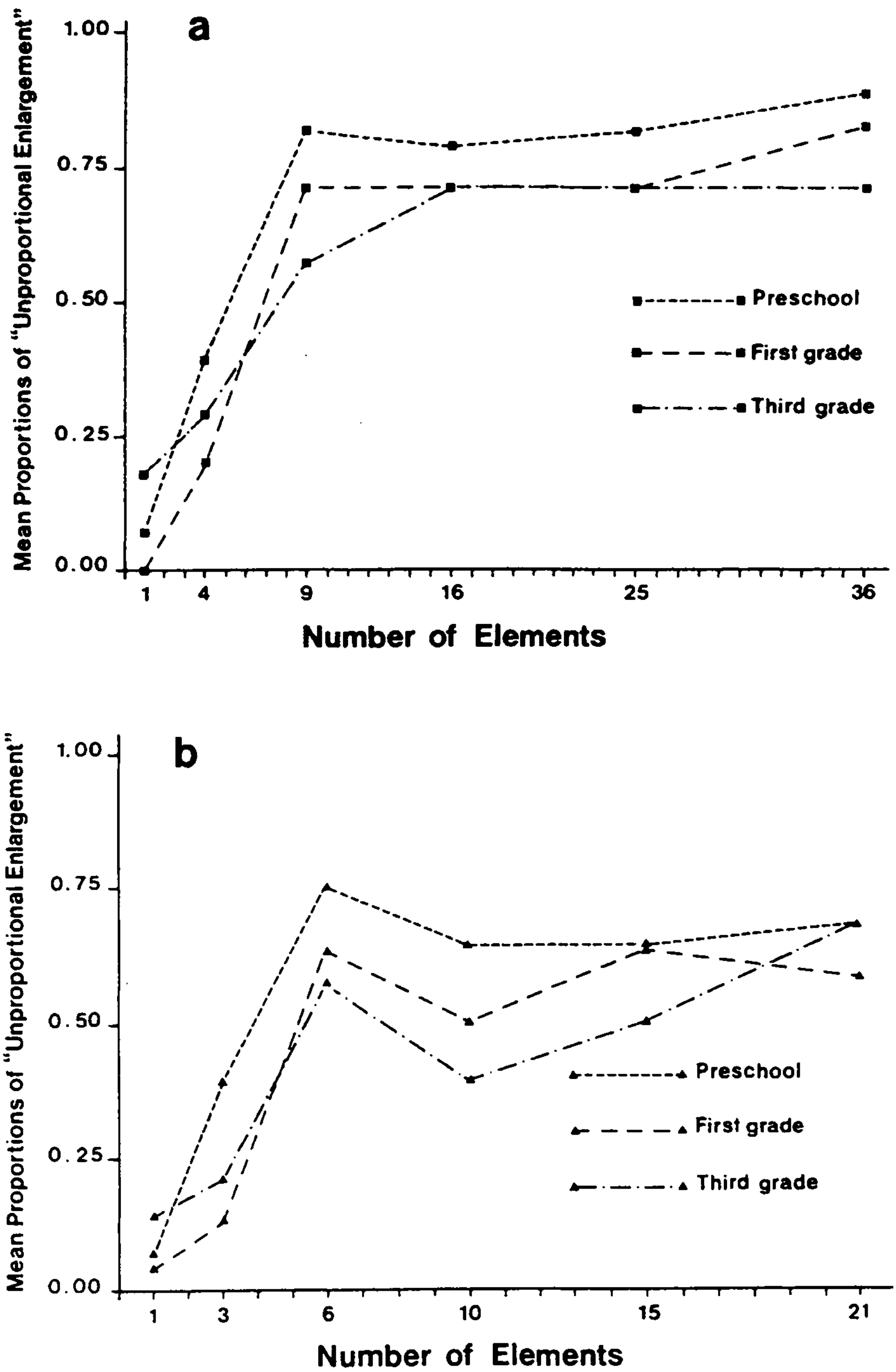

FIG. 2. Mean proportions of choosing the unproportional enlargement of the standard figure as a function of the number of elements in the standard figure, for the three age groups, for squares (a) and triangles (b).

The difference between squares and triangles regarding the switch from proportional to unproportional enlargement was observed also with adults, and was explained by the fact that the white spaces between the small triangles are themselves triangles (see Fig. 1) and their number is smaller. If they are perceived as figure (rather than ground), the parametric difference between the square and the triangle conditions diminishes.

The results indicate that children at all age levels concerned performed in a similar way: When there were few elements embedded in the standard figure, children tended to choose the proportional enlargement as more similar. When the number of elements increased, they switched their choice to the unproportional enlargement. This switch in choice seemed to occur around 9 elements. If the children were focusing on isolated elements only, we would expect them to choose the unproportional enlargement regardless of the number of elements, because the measurements of the elements were kept unchanged in this enlargement. If children were focusing on the overall form only, they could either make their judgements arbitrarily, because both comparison figures preserve the global configuration, or they could choose consistently one of the comparison figures regardless of the number of the elements. If children were focusing only on the relations between the elements, we would expect them to choose the proportional enlargement all along. Under each of these possibilities no effect of the number of elements on the similarity judgements would be expected. The results, however, are identical to the ones obtained with adults (Kimchi & Palmer, 1982, experiment 1) and they clearly indicate that children's similarity judgements were affected by the number of elements in the standard figure. A set of converging operations with adults have demonstrated that the perceived organisation of hierarchical patterns depends critically on the number of local elements and their size relative to the global configuration. Patterns composed of a few, relatively large elements are perceived in terms of global form and figural parts, whereas patterns composed of many relatively small elements are perceived in terms of global form and texture (Goldmeier, 1972; Kimchi & Palmer, 1982; 1985; Klein & Barresi, 1985). The switch from the proportional to the unproportional enlargement when the number of elements increased, suggests that the children in the present experiment perceived a change from figural parts to texture. When the number of elements increased, children perceived the dimensions of form and texture and chose the comparison figure that maximises similarity on both dimensions.

Thus, the results of the present experiment suggest that the perceived structure of hierarchical patterns is available to children as young as 3 years 5 months. As far as the perceptual organisation of such patterns changes as a function of the number of elements for the adult perceiver, it changes also for the young child.

The change in the perceptual status of the element from a figural part of the overall form to a textural molecule with an increase in the number of elements, can affect the relative perceptual salience of the local element and the global configuration. When the element is perceived as an individual unit it is perceptually salient; when the element functions as a textural molecule it loses its individuality and becomes less salient relative to the global configuration. Indeed, when the global configuration was pitted against the local elements, adults found the comparison figure having a different global configuration but containing the same elements as the standard to be more similar to the standard than a comparison figure which had the same configuration but different elements only when the standard figure was composed of a few relatively large elements; when the number of elements increased, the comparison figure having the same global configuration as the standard but containing different elements looked more similar (Kimchi & Palmer, 1982, experiment 2). The next experiment studied children's performance in such a task.

EXPERIMENT 2

Children were presented with a standard figure and two comparison figures, each consisting of a global square or triangle made up of local squares or triangles. In the same-configuration comparison figure, different elements were arranged in the same configuration as the standard figure. In the same-element comparison figure, the same elements as in the standard figure were used but were arranged in a different configuration. The number of elements used to construct the standard figure was varied. If the elements are less salient for the child when they are more numerous and relatively smaller, then the probability of perceiving the same-configuration comparison figure as more similar to the standard should increase as a function of the number of elements. Again, the stimuli triads used were identical to the ones used by Kimchi (1982; Kimchi & Palmer 1982, experiment 2), allowing comparison between children and adults' performance.

Method

Subjects. A total of 43 children participated in the experiment: 15 preschoolers (8 males and 7 females; mean age 4 years 9 months; range 3 years 5 months to 5 years 6 months), 12 first graders (6 males and 6 females; mean age 6 years 9 months; range 6 years 6 months to 7 years 1 month), and 16 third graders (7 males and 9 females; mean age 9 years; range 8 years 5 months to 9 years 5 months).

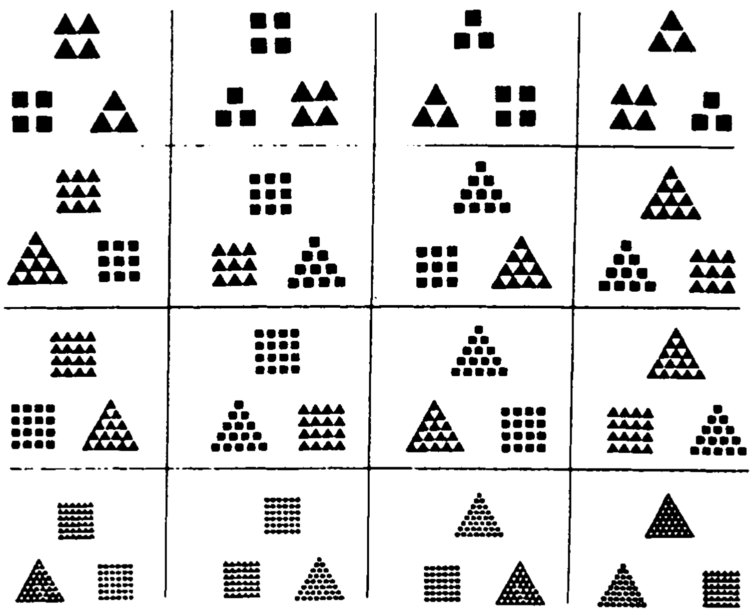

FIG. 3. The set of stimulus triads in Experiment 2.

Stimuli. There were 16 stimulus triads. Each stimulus triad was presented as three black patterns on a white card (15 × 13 cm) and contained a standard figure and two comparison figures as described. The set of the stimulus triads is shown in Fig. 3. In half of the stimulus triads the standard figure was a "square" made up of either squares or triangles. In the other half the standard figure was a "triangle" made up of either triangles or squares. In the standard figure there were 4, 9, 16, and 36 elements for the "squares", and 3, 10, 15, and 36 elements for the "triangles". Children viewed the card from a distance of approximately 60 cm. At this distance the global configuration subtended about 1.9° of visual angle in the different stimulus conditions. Each individual element subtended 0.76°, 0.48°, 0.38°, and 0.19° in the increasing number conditions. Each type of comparison figure appeared equally often in the right and left position.

Procedure. The procedure was the same as in Experiment 1.

Design. The three factors of the design were age (three levels), number (four levels), and configuration (square, triangle). At each age group all factors were combined orthogonally. (Technically, the number of elements were not identical for squares and triangles at levels 1, 2, and 3 of that factor, but they differed by only one element in each case.)

Results and Discussion

The proportions choosing the comparison figure having the same configuration are shown in Figs 4a (squares) and 4b (triangles) as a function of the number of elements embedded in the standard figure. Each response was scored as 1 if the same-configuration stimulus was chosen and 0 otherwise. These data were submitted to a three-way ANOVA (age × number × configuration) mixed design. The analysis indicated a significant effect of number [$F(3, 120) = 23.32$, $P < 0.0001$]. There was no significant effect of age [$F(2, 40) = 1.07$, $P > 0.35$], and no significant difference between square and triangle configurations [$F(1, 40) = 2.76$, $P > 0.10$]. Age did not interact significantly with number [$F(6, 120) = 1.06$, $P > 0.39$] or with configuration ($F < 1$). There was no significant interaction between number and configuration ($F < 1$).

The difference between the proportion of choices of same-element and same-configuration comparison figure was tested by binomial tests across age for each level of number of elements. The results indicate that when the number of elements was 3 (triangle configuration) and 4 (square configuration), subjects tended to choose the same-element comparison figure ($P < 0.006$ for 4 elements, but not statistically reliable for 3 elements—$P < 0.16$). When the number of elements was 9 and 10, performance was at chance level. When the number of elements increased, the tendency to choose the same-configuration comparison figure increased—just approaching significance with 15 elements ($P < 0.08$) and becoming statistically reliable with 36 elements (square and triangle configurations, $P < 0.0009$ and $P < 0.00003$, respectively). Two preschoolers, two first graders, and five third graders made all their choices on the basis of the global configuration. One preschooler, two first graders, and one third grader made all their choices on the basis of the elements.

Thus, children's performance at all age levels concerned showed an increase in the likelihood of choosing the same-configuration comparison figure with an increase in the number of elements. When the number of elements was the smallest, children—like adults (Kimchi & Palmer, 1982, experiment 2)—tended to prefer the same-element comparison figure. When the number of elements was rather large, children—again like adults—preferred the same-configuration comparison figure, suggesting that the global configuration in this case is perceptually more salient than the individual elements. These results converge with the results of Experiment 1 and support the hypothesis that the perceptual status of the local element changes from figural unit to textural molecule with an increase in the number of elements.

Indeed, the likelihood of choosing the same-configuration comparison figure increased with an increase in the number of elements for all three age groups, yielding no significant effect of age or a significant interaction between age and number, and thus justifying testing subjects' preferences

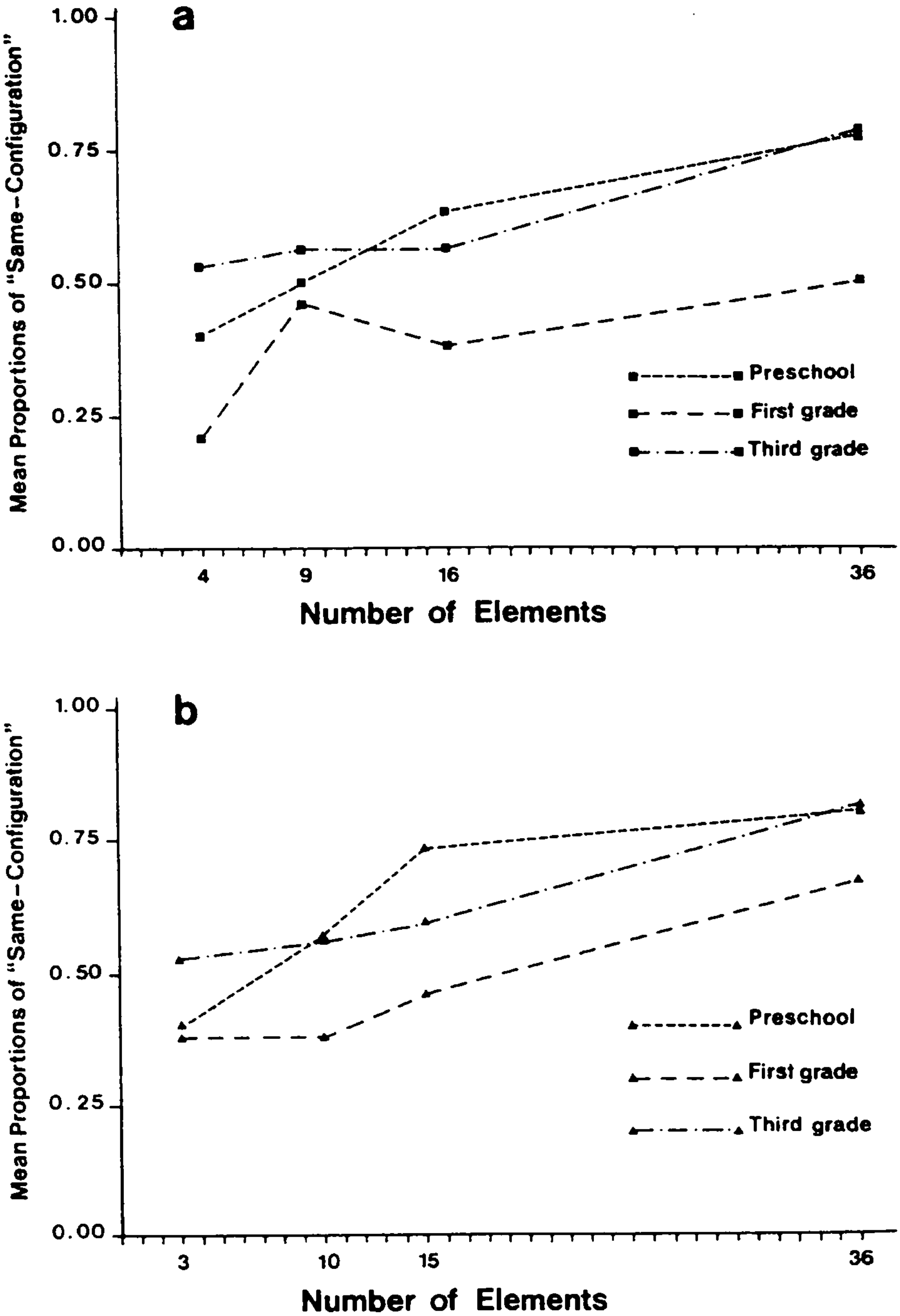

FIG. 4. Mean proportions of choosing the comparison figure having the same configuration as the standard figure as a function of the number of elements, for the three age groups, for squares (a) and triangles (b).

across age, as reported above. However, a closer inspection of the data presented in Fig. 4 reveals a somewhat different pattern of results in the different groups which deserves to be mentioned, albeit very cautiously. Both preschoolers and third graders chose the same-configuration comparison figure significant more often when the number of elements was rather large (preschoolers: 15-element triangle configuration, $P < 0.009$, 36-element square and triangle configurations, $P < 0.004$, $P < 0.001$, respectively; third graders: 36-element square and triangle configurations, $P < 0.002$, $P < 0.0005$, respectively). The first graders tended to focus on the elements: While the proportion of their choices of the same-configuration comparison figure increased when the number of elements increased, they did not show a significant preference for the same-configuration comparison figure even when the number of elements was rather large ($P > 0.50$, $P < 0.08$, 36-element square and triangle configurations, respectively). A plausible interpretation of the first graders' performance is the effect of schooling. In particular, the first graders were just beginning to learn to read, a process requiring scrutiny and attention to component parts and details, especially when it is first acquired. By the time most children reach third grade, cognitive activities such as reading are more likely to involve top-down processing as well, rather than relying completely on bottom-up processing. A similar pattern of results, though with a different task, was reported by Elkind and Weiss (1967) in their study of the development of children's perceptual exploration abilities. They found that 5- and 8-year-olds performed in a similar way, employing a pattern of exploration dominated by Gestalt laws of organisation. However, the visual scanning of the 6- and 7-year-olds (first and second graders) deviated from the best path dictated by Gestalt laws. Rather, it seemed to reflect spontaneous visual movements required in reading.

The present results with preschoolers seem to disagree with the findings of Vurpillot and her colleagues (reported in Vurpillot, 1976). In her studies, children from 3 years 5 months to 5 years 5 months were presented with pairs of figures that were either made up of the same 9 elements but differed in their global configuration, or had the same global configuration made up of different elements, and judgements of "same" or "not the same" had to be made. The results show that judgements depended more on the elements than on the global configuration. Preschoolers' performance (as well as that of the first and third graders) in the present experiment with configurations made up of 9 and 10 elements was at chance level, suggesting a conflict between the global configuration and the elements. However, while the elements in Vurpillot's stimuli were always 9 identifiable, familiar shapes (daisies or leaves), the global configurations were circles or *irregular* configurations. Thus, her findings may show a preference for "good" forms, rather than a preference for component parts *vs* global wholes (Vurpillot, 1976). The global configuration and the local elements of the stimuli in the present experiments were equated in familiarity and recognisability: both were either squares or triangles. It can still be argued, however, that in the case of few elements in the present experiment the variant that supposedly had the same configuration was different. For example, the triangular configuration made up of three relatively large triangles results in a "better" global triangle than the triangular configuration made of three relatively large squares (see Fig. 3). This could affect the relative perceptual salience of the local elements, resulting in a conservative estimate of the children's tendency to favour the global configuration with these patterns.

GENERAL DISCUSSION

Hierarchical patterns are characterised by two geometrical levels: global configuration and local elements. Whenever small figures are positioned near each other in such a way that their positions form the pattern of a larger simulus figure, the two geometrical levels of global configuration and local elements are present regardless of the number or relative size of the elements. However, previous findings with adults (Goldmeier, 1972; Kimchi, 1982; Kimchi & Palmer, 1982; 1985; Klein & Barresi, 1985) suggest that the mapping from these two geometrical levels into meaningful perceptual levels differs for patterns composed of few large elements and those composed of many small elements in the following way. When many small elements comprise a pattern, the local elements are perceived as texture and the global configuration as form, and they are coded separately. When few large elements comprise a pattern, the local elements are perceived as figural parts of the overall form, and the global and local levels are coded relative to each other.

Two of the converging operations leading to this hypothesis were similarity judgements tasks identical to the ones employed in the present experiments. Children's performance in Experiment 1 was identical to that of adults. When presented with a figure composed of few large elements, children from 3 years 5 months chose its proportional enlargement which preserves the global and local structures as well as the relationships between them as more similar to it than its unproportional enlargement. When the number of elements increased they switched their choice to the unproportional enlargement, which preserves both the global form and the textural properties of the standard figures (see Experiment 1). These results clearly indicate that the perceptual structure of hierarchical patterns is available to young children. The perceptual status of the local element in such patterns changes for the young child as a function of the number of elements, and when the dimension of texture emerges the child chooses the comparison figure that maximises similarity on both dimensions (form and texture), the same as adult perceivers do. There is evidence that overall similarity is the primary perceptual relation by which young children compare complex stimuli (e.g. Kemler & Smith, 1978; Smith, 1983). However, it does not necessarily imply that young children treat complex stimuli as undifferentiated wholes. Rather, the present results seem to support the hypothesis proposed by Kemler and Smith (1978) that "young children perceive complex stimuli as wholes in a dimensionally-organised space" (p. 506). Namely, the dimensional organisation available to older children and adults is also available to young children. Whether they can abstract dimensional components and selectively attend to them is quite another matter.

When the number of elements in a pattern increases they are relegated to the role of defining texture and lose their phenomenal individuality. In this case, the global configuration is expected to be perceptually more salient than the individual elements. This hypothesis was tested in Experiment 2 by pitting global configuration and local elements against each other. Children seemed to be more at conflict with this task than were adults, particularly when the number of elements was small. Nevertheless, the effect of number on the similarity judgements of preschoolers and third graders was similar to its effect on adults' similarity judgements. When the number of elements in the patterns was rather large, preschoolers, third graders, and adults chose the comparison figure having the same global configuration but different elements as more similar than the one having the same elements arranged in a different global configuration. A similar tendency was exhibited by the second graders, although their results did not reach statistical significance (see Results and Discussion of Experiment 2). Thus, for children as well as for adults, the global configuration of many-element patterns seem to be perceptually more salient than the individual local elements.

The findings of the present experiments demonstrate the importance of a systematic investigation of children's perceived organisation of hierarchical patterns. Children—like adults—seem to perceive patterns composed of a few, relatively large elements in terms of global form and figural parts, and patterns composed of many relatively small element in terms of global form and texture. Thus the local elements do not function perceptually as parts when the number of elements is large. This implies that patterns composed of a few, relatively large elements are better candidates for testing hypotheses about the relative priority of whole and parts across development. Furthermore, results indicating that children focus on global configurations and ignore differences in local details can be interpreted as implying that children do not perceive local aspects in general, or that they are unable to perceive multiple aspects of a complex stimuli simultaneously, as has been proposed by some investigators (e.g. Elkind, 1978). However, if the stimuli involved are composed of many elements, such a generalisation might not be warranted: Such results can reflect the relative perceptual salience of the global configuration of these patterns (observed also with adults) rather than the child's inability to perceive local details.

The processing mechanisms involved in the perception of hierarchical patterns are not yet fully understood. Some of these processes are likely to take place early in the perceptual or even the sensory system. Other relevant processes are probably attentional in nature, and some might also result from still later processes concerned with decision and response selection (see Kimchi & Palmer, 1985, for a discussion). The finding that the perceptual organisation of hierarchical patterns is the same for children as young as 3 years 5 months as for adults, may suggest that sensory and perceptual factors play an important role in the processing of such patterns. A systematic delineation of developmental changes in children's perceptual organisation from developmental changes in attention and cognitive processing will contribute not only to our understanding of perceptual development, but also to our understanding of perceptual processing in general.

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