Orientations called "right-side up": Effects of stimulus alignment¹

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Children were shown two orientations of a figure, and asked to choose one as "right-side up." The two orientations were either horizontally aligned (one to the side of the other) or vertically aligned (one above the other). Alignment is not important for figures that elicit a strong preference. Where preferences are not strong, choices are biased towards the upper member of a vertical pair. Results suggest that the effects of stimulus alignment on response to orientation are in part a function of the type of figure.

When children are asked to discriminate forms that differ only in orientation, results with forms aligned vertically are different from those with forms aligned horizontally (Sekuler & Rosenblith, 1964; Huttenlocher, 1967). With forms aligned vertically, for example, Ss confuse up-down mirror images but not left-right mirror images. With forms aligned horizontally, Ss make a few up-down errors and many left-right errors (Sekuler & Rosenblith, 1964).

How general is the effect of alignment on response to orientation? Sekuler & Rosenblith (1964, p. 144) argue that "concern with a theory of form perception . . . must await further investigation of such basic variables as spatial relationships between standard and comparison stimuli," and their results do raise questions about studies using only horizontal arrays. If alignment is always a critical factor in response to orientation, then hypotheses based on these studies may need to be revised. If a change to vertical alignment yields the same results as before, however, then a limit is placed on the significance of alignment as a variable.

A case in point is work by Lila Ghent Braine (e.g., Ghent, 1961; Antonovsky & Ghent, 1964). These studies are based only on figures aligned horizontally, the child choosing one of two orientations as "right-side up." The question now is whether the same results will be found when the two figures compared are aligned vertically. And if results are not the same, what is the direction or form of the difference?

PROCEDURE

On each trial, the child is shown a pair of cards, one of them an upside-down version

of the other. He is asked to point to the one that is "right-side up" or "right," starting off with some realistic forms (e.g., drawings of a cat or car) and moving on to a mixture of realistic and nonrealistic forms. Each child judges two sets of cards, one with the members of each pair aligned vertically, the other with the members of each pair aligned horizontally. (An irrelevant tower-building task separates the two series of judgments.) The member of the pair on S's right in the horizontal condition becomes the upper member of the pair in the vertical condition. In both conditions, all cards are held up by E, up in the sense of being perpendicular to the floor. The distance between cards was roughly $3\frac{1}{2}$ in.

MATERIAL

Set 1 contains 23 pairs, covering 7 realistic and 16 nonrealistic forms. Set 2 contains 34 pairs, 10 realistic and 24 nonrealistic. The nonrealistic forms are shown in Fig. 1, in an order that parallels their development by Ghent, and allows an easy comparison with her results (Ghent, 1961). Set 1 was the first developed. Most of its forms are concerned with the effect of a gap or open part in the figure. Set 2 was developed later, in two parts. Set 2A tested the effect of the point of division between two parts of the figure or two parts of the card (Ghent, 1961, p. 182). Set 2B explored the effect of a variety of differences in size, color, and pattern between the parts of a figure or card (Ghent, 1961, p. 183).

In Set 2A, Designs 5 and 6 are exceptions to the usual pairing of cards. The second member of the pair is a 90-deg rotation rather than the usual 180 deg, i.e., the choice is between a card with a vertical line and a card with a horizontal line.

SUBJECTS

Forty nursery-school children (20 boys, 20 girls) were divided into four groups, the groups varying in whether Set 1 or Set 2 was given first, and in whether the first alignment was vertical or horizontal. The four groups were: 1-H, 2-V (Set 1 horizontally followed by Set 2 vertically); 1-V, 2-H; 2-H, 1-V; and 2-V, 1-H. Children were distributed randomly through the four groups, with the restriction of an equal number of boys and girls in each group.

Children were drawn from Montessori nursery schools. Mean age was 4:9, with most of the children (35 of the 40) either 4 or 5 years of age. Three 3-year-olds and two 6-year-olds were in the same class as the others and were included as being presumably at the same functioning level.

RESULTS

The overall results have been included in Fig. 1. The degree of agreement between vertical and horizontal choices is very high for Set 1 and for Set 2A (correlations of .94 and .90) and middling for Set 2B (.68). Set 2B is the most heterogeneous of the sets, with parts of the figure or card varying in pattern, size, and color.

With vertical alignment, there is a constant bias towards choosing the upper card in a pair. The bias is usually small but is statistically significant.

The two factors—bias towards the top card and preference for one orientation as right-side up—interact. When preference is strong, the bias towards the upper card has little effect. When preference is weak, bias towards the top can exert a sizeable influence. Set 2B, for example, shows the largest difference between vertical and horizontal arrays. It is also the set with the highest proportion of designs where preference for one orientation is fairly weak in the horizontal array. If we define weak preference for an orientation as a choice that falls between .35 and .65, 6 of the 10 figures elicit weak preference in Set 2B, as against 1 out of 14 for Set 2A, and 6 out of 16 in Set 1.

The overall results are based on pooling results for each set of figures, without regard to whether a set was given first or second. For the finer analysis of data, there was one obstacle to such pooling. Set 2 given first and vertically did not yield the same results as Set 2 given second and vertically. Preference for the upper member of a pair was stronger when Set 2 vertical was given first, and the difference was statistically significant at the .05 level on a Wilcoxon rank-sign test. This is not a large difference but nonetheless the more conservative procedure is to check the overall values with a separation of Set 2 given first from Set 2 given second.

Separating first from second orders does not alter the pattern of correlation between vertical and horizontal choices. For Set 2A, the values of r are .88 when Set 2 is given first, .91 when given second. For Set 2B, the values of r are .56 and .61. The last two values are slightly below the .05 level, but a drop is to be expected with this much sectioning of data.

The separation brings a slight change to the general picture of a small but significant bias towards choosing the upper figure in a vertical pair. For one of the subgroups, the bias fails to be statistically significant on a Wilcoxon rank-sign test. The direction of difference, however, remains the same. The mean differences in choice of an orientation (vertical minus horizontal) are as follows: for Set 2A given first, .07 (n.s.); Set 2A given second, .04 ($p < .02$); for Set 2B given

^a $p < 0.05$ ^b $p < 0.01$

Fig. 1. Proportion of Ss choosing, as right-side up, the orientation shown. Choices are under two conditions:

H—Alternatives are side by side,

e.g., Δ or V ?

V—Alternatives are vertically aligned,

e.g., Δ or V ?

Orientation shown appears on top in vertical alignment, or on S's right in horizontal alignment.

or perceived as unequal in size. Then children very markedly and consistently choose as right-side up the orientation that places the smaller of the two parts above the larger. This is in line with Ghent's (1961) hypothesis about Set 2A. In contrast, the effect of a gap in the figure (Set 1) appears somewhat less stable, with the forms more open to comparison with letters and to variability from one more knowledgeable nursery group to another.

DISCUSSION

The results suggest some limits to the effect of alignment (horizontal vs vertical array) on response to orientation. There is little or no difference between judgments with the two alignments when the response is one of selecting the orientation that is right-side up, if the figure is one that has a clear "right-side up" for children. When the figure does not elicit a clear preference for one orientation, then alignment can become important, and children are more likely to choose as right-side up the upper figure in a vertical pair. They show, in contrast, no marked preference for right or left in a horizontal array.

Two possibilities could account for the lesser effect of alignment in the present study as compared with the effects found by Sekuler & Rosenblith (1964) and by Huttenlocher (1967). One is that the response is different. A child might still give the same results as in the earlier studies if one asked him to make a "same-different" judgment or a reproduction of the original figure rather than a choice of one orientation as right-side up. The other possibility is that the difference comes from the figures. Compared with the Ghent figures used in the present study, the figures in the earlier studies have no clear focal part, and possibly leave a clear field for alignment to emerge as the major determinant of response. Results might be quite different with figures that elicit a definite sense of one orientation as right-side up, figures that have, in Ghent's (1961) analysis a clear focal part.

It is not clear why vertical alignment produces a preference for the upper member of a pair. The child may be responding to the two cards as a single item, so that choice reflects a decision about the array as a

first, .11 ($p < .02$); Set 2B given second, .11 ($p < .02$).

The overall results need detailing on another point, namely the interaction between strength of preference in the horizontal array and degree of bias towards the upper card in a pair. Set 1 shows that a shift to choice of the upper card does not always occur when no strong preference is shown in the horizontal array.

There are in Set 1 a number of pairs where a nonextreme preference for one member of a pair does not shift upwards in a vertical array. It is possible that there are two sources for a relatively even split of choices between two members of a pair in the study. One could be a cancelling of definite preferences, stemming from the way we have collapsed boys and girls, 4- and 5-year-olds, into a single group. This could be the source in Set 1, and would leave the way open for a high correlation still between horizontal and vertical arrays. The other source could be a truly weak preference in all or most parts of the sample, leaving the way open for a strong role to be played by bias towards the upper member of a pair. In Ghent's (1961) results, weak preferences

rather than changing preferences are more frequent in Set 2B than in any other set of cards (cf. Fig. 3 in Ghent, 1961, p. 183), but the point really requires a finer pinning down of age differences than was attempted here. What does appear clear is that a nonextreme preference for one orientation over another in the horizontal array is a fertile, but not a sufficient, condition for a sizeable effect from alignment. And strong preference for one orientation over another makes a sizeable effect from alignment very unlikely.

Because Ghent's (1961) original results are more finely keyed to age and sex than the results of the present study, we have attempted no formal analysis of agreement between the present results with the horizontal array and Ghent's (1961) results. A comparison of Fig. 1 with the figures in the 1961 study shows the overall picture to be one of good agreement for forms where the 1961 preferences did not vary with age and sex. The latter forms are most frequent in Sets 2A and B. By and large, preference for one orientation seems to be most stable when a break separates a figure or the entire card into two parts that are unequal in size

whole. Or he may simply be choosing the first card he sees, particularly when he has no strong feelings about one card being right-side up or is confused by the mirror-images that occur in the vertical array. The latter possibility would imply a more consistent scanning process vertically than horizontally. With either possibility, the occurrence of a bias in the vertical array but not in the horizontal array suggests again that the direction of scanning or comparison makes a difference to the young child's judgments, a point that unites Ghent Braine (Ghent, 1960; Braine, 1966), Sekuler & Rosenblith (1964), and Huttenlocher (1967).

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NOTE

1. Based on a Master's thesis by Carolyn Moeller, directed by Jacqueline Goodnow, with Goodnow's participation made possible by support from the National Institute for Child Health and Human Development (1K03-HD36791; 1R01-HD03105; and 2T01-HD00203).

Visual and pronouncing responses in free recall learning

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In two experiments the relative importance of pronouncing and visual responses during free-recall learning were compared. When overt pronouncing responses were required of both groups, the different amount of time available for visual responding had no effect. When Ss were not required to make overt pronouncing responses, the group which had less opportunity to make visual responses did significantly better. These results obtained with a different methodology supported previous work by Mechanic and his co-workers, who have stressed the importance of the pronouncing response and the relative unimportance of the visual response.

Mechanic & D'Andrea (1966) raise an interesting and important question when they ask "whether S can learn passively by the imprinting upon him of a sensory image or trace, or whether he has to make some response in order for learning to occur." In comparing a group of undergraduates told to rate the visual attractiveness of a number of trigrams and a similar group told to pronounce the same trigrams silently, they found significantly greater recall in the pronouncing group. It was concluded that little learning occurred as a result of "visual responses" when pronouncing responses were not made by S.

The difficulty with such an interpretation is, of course, that no direct measure of visual or pronouncing responses was obtained. It was assumed that the different instructions given Ss caused them to respond differently during learning. However, in an earlier study, Mechanic (1964) made the pronouncing response observable by having Ss repeat aloud the nonsense syllables. When pronouncing responses were equated across groups, there was no difference between Ss given intentional learning instructions and those given incidental learning instructions. Thus the effectiveness of the pronouncing response was shown to be independent of the type of task instructions given.

The role of visual responses is less clear, however. Obviously, at least an initial visual response must be made in order for a pronouncing response to be formed which verbalizes the visual stimulus. Whether further visual responding is necessary to support further pronouncing responses, is an open question. A methodology which controls the level of both visual and pronouncing responses is needed.

In an attempt to provide such control, Mechanic's procedure for having Ss say the stimuli aloud was coupled with a procedure for controlling the availability of visual responses. For one group, the stimulus was presented visually during the entire learning trial. For a second group, the stimulus was only briefly presented, followed by a blank screen during the remaining learning trial. Thus the availability of the stimulus for making visual responses was eliminated

during the time when the screen was blank. Pronouncing responses (aloud) were required during the entire learning trial for the two groups. For two additional groups, there was no pronouncing requirement.

EXPERIMENT 1

Subjects

The Ss were 40 undergraduate students enrolled in an introductory psychology course, who received credit for participating in experiments. Previous participation in a nonsense-syllable experiment disqualified Ss from the experiment.

Apparatus and Materials

The stimulus materials were 24 trigrams, with four each being rated at a 0%, 20%, 40%, 60%, 80%, and 100% level of meaningfulness (Hilgard, 1950). A Kodak Carousel projected the syllables onto a screen about 10 ft away from S. The same random order of stimulus presentation was used for all Ss, and each S was run individually.

Procedure

Two groups which differed in only one respect, and each containing 20 Ss, were run. Group 1 was shown each stimulus for 15 sec with a 1-sec ITI, while Group 2 was shown each stimulus for 6 sec, followed by a blank slide for 8 sec which took 1 sec to appear. The ITI was also 1 sec for Group 2. Thus the only difference between the groups was that Group 1 received the stimulus visually 2.5 times as long as did Group 2. The groups had an equal amount of time to learn the stimuli.

The groups were told that they would see a number of nonsense syllables and that their task was to remember them so that they could write them down in any order. Both groups were instructed to say each syllable out loud "at a rate and in a tone" that was comfortable for them, and to keep repeating it from the time that it came on until the next syllable appeared. Additional instructions were given to Group 2 which explained the blank slide procedure and emphasized the importance of continued pronouncing aloud throughout the entire trial, even during the time when the stimulus slide was changed to a blank slide.

The retention test was identical for both groups. A free-recall test of 190 sec was administered by having Ss write down in any order as many of the nonsense syllables as they could remember. They were told that incorrect answers did not count against them. After their answer sheets were collected, Ss were asked what they had done to remember the syllable during the time the stimulus was being presented. In addition, Group 2 Ss were asked what they had done during the time the blank slide was being presented to remember the nonsense syllables.

Results

The mean number of stimuli recalled by Group 1 was 9.05, as compared with 8.25