Disorientation of forms: An examination of Rock's theory¹

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Abstract

Rock has suggested that recognition is facilitated when a form is oriented in conformity with the S's phenomenal frame of reference. Establishing a phenomenal frame of reference by informing Ss of the exact orientation in which forms would appear did not, however, facilitate recognition in comparison with Ss informed merely that the forms would be disoriented.

Problem

It is clear that perception of a form is strikingly affected when the form is presented in an unusual orientation (e.g., a face presented upside-down). In a series of studies, Rock and his colleagues (Rock, 1956; Rock & Heimer, 1957; Rock & Leaman, 1963) inquired whether the perceptual effects are a consequence of disorientation of the form on the retina or of disorientation in the environment. They concluded by suggesting a reformulation of the problem: they proposed that the major variable is disorientation with respect to the S's phenomenal frame of reference for top, bottom and sides (although they suggested that orientation on the retina plays an independent, but secondary, role). The phenomenal frame of reference may be determined by environmental verticals, by the frame of reference provided by the head, by gravity, or by the S's expectations; which determinants are important depend on the conditions of testing. In any case, perception is impaired by a lack of congruence between the top of the form and the top as defined by the phenomenal frame of reference.

The term "phenomenal" is used by Rock with at least two meanings. First, phenomenal is used to refer to the way something looks—the orientation "...that looks upright, regardless of what cues are operating to achieve this" (Rock & Heimer, 1957, p. 506). Secondly, phenomenal is used to refer to the expected positions of the top, bottom and sides of a form, as defined by verbal instructions to the S—"...by informing O where the top of a form was, he was able to see it accordingly" (Rock & Heimer, 1957, p. 507). However, when phenomenal is used in the first sense, some recent experiments have shown that there are circumstances in which phenomenally upright figures are identified significantly less accurately than phenomenally upside-down figures (Braine, 1965). This work makes it unlikely that a congruence between figure orientation and phenomenal frame of reference is the crucial variable that Rock assumes it to be. The present experiment investigates the importance of this congruence for the other sense in which Rock has used the term "phenomenal"; i.e., the experiment explores the effect on recognition of informing the S of the location of the top, bottom and sides of the forms to be presented.

Such an experiment was, in fact, conducted by Rock & Heimer (1957, p. 500), and they found that the performance of a group informed of the orientation of the figures presented was far superior to the performance of another group that had not been given any information concerning the orientation of the stimulus figures. It was assumed that the factor accounting for the good performance of the informed group was the information of the form's exact orientation. However, it is possible that the Ss in the poorer group were handicapped by the automatic assumption that the forms would be presented in their usual orientations, and that merely informing Ss that the figures could be disoriented might itself be sufficient to facilitate recognition.² In the present experiment, recognition is compared under two conditions of information—when the S knows exactly where the top of the form is going to appear, and when the S knows merely that the forms may be disoriented.

Method

The stimuli used were 10 line drawings of common items that normally have an upright orientation—horse, elephant, automobile, flowers, tree, lamp, face, house, sailboat and grand piano. Each picture was presented in each of four orientations: upright, upside-down, turned 90° left and turned 90° right. The 40 stimuli were arranged in four partially randomized sequences, the sequences being balanced among Ss. Small, photographic prints of the drawings were presented in a Gerbrands tachistoscope; the long axis of each figure subtended a visual angle of 0.87°. Each picture was presented for .03 sec., and the S then wrote down the name of the item he thought he saw. The test items were introduced without any prior practice.

Thirty-two male and 32 female college students served as Ss, and were randomly assigned to either the group receiving general information concerning the orientation of the stimuli, or to the group receiving specific information. Both groups of Ss were told that they would be shown pictures of common objects for a fraction of a second, that they would see the same one more than once, and that the pictures would appear in any of four orientations—upright, upside-down, 90° left or 90° right. The Ss assigned to the general information group were told that they would not know beforehand the orientation in which a picture would appear. The Ss of the specific information group were informed by the experimenter of the orientation of each picture before it appeared; also, the answer sheets for this group were labelled with the orientation appropriate to each item.

Results and Discussion

If knowledge of where to locate the top of a figure aids identification, this facilitation should manifest itself in two ways. First, the total number correct should be higher for the specific information group than for the general information group, and secondly, the disoriented figures should be identified almost as frequently as the upright items by the specific information group, whereas a large discrepancy should exist for the general information group. The results in Table I indicate that neither of these expectations is confirmed; moreover, the negative findings are the same for both sexes. The differences between the scores of the specific and general information groups for each sex are not statistically significant, and are, in fact, negligible. Also, better recognition for figures in the upright orientation appears in all subgroupings and to approximately the same

TABLE I
Mean Number of Correct Responses for the
Up, Down, Left and Right Orientations

	U	D	L	R	Total
Males					
General Info.	7.6	5.4	5.3	5.3	23.6
Specific Info.	7.2	5.6	5.6	5.7	24.1
Females					
General Info.	5.9	3.6	4.1	3.5	17.1
Specific Info.	6.8	3.9	3.9	4.4	19.1

Note. An analysis of variance yielded significant *F* values only for sex ($p < .01$) and for orientation ($p < .01$).

degree. Interestingly, both groups of males show better scores than either group of females, and this difference appears for each of the four orientations.

The negative results are surprising, both from the theoretical view proposed by Rock and from a commonsense point of view. Nevertheless, it seems clear that a coincidence in location of the actual top of a figure and of the top of the Ss' frame of reference does not necessarily facilitate recognition. It might be argued that the phenomenal top cannot be shifted by verbal instructions from moment to moment, and that the phenomenal top in this experiment was determined by the environmental and retinal cues to the upright, equally available to both groups. This position may be reasonable, but would add to the difficulty of defining the phenomenal top. It has already been pointed out that the phenomenal upright as defined by judged appearance does not necessarily facilitate recognition, and it now appears that the phenomenal upright as defined by verbal instruction does not necessarily influence recognition.

Fig. 1. Improvement occurring for each orientation from the first to the fourth set of trials. (U, D, L and R refer, respectively, to upright, upside-down, turned left and turned right.)

An additional argument against the idea that knowledge of the exact orientation of a form influences recognition comes from an unexpected finding. The total scores in Table I are misleading in the sense that they do not show the striking improvement that occurs in the recognition of the disoriented figures during the testing period. Fig. 1 shows a marked difference between upright and disoriented figures during the first group of 10 trials and a very small difference after 10 min. of testing. This rapid learning occurs in the complete absence of knowledge of results. It is clear that the effects of repeated exposure are essentially the same in the groups with different kinds of information concerning the orientation of the figures. It might be thought that the markedly improved recognition of disoriented figures

during the last 10 trials was due to the Ss having already identified these items in the upright positions on a previous trial, but this explanation is not supported by a detailed analysis of the correct responses during the last set of trials.³ A significant part of the perceptual learning during testing must have been an increasing ability to use the cues identifying the specific items that were repeated. However, if learning to recognize specific items were the only learning occurring, then a significant increase in the number of upright items recognized would be expected to occur, but did not. This lack of improvement for the upright items cannot be attributed to a ceiling effect since the upright items were recognized only 72% of the time during the last set of trials.⁴ A similar lack of improvement for upright items has been found repeatedly in unpublished work by the writer with A. Milne, using realistic figures with adult Ss.

The data reported here contribute, not only to an evaluation of Rock's theory, but also to a new approach for investigating the relation between recognition of form and its orientation. The work of Rock and his colleagues undoubtedly indicates that when forms appear in an orientation different from that in which the S assumes they will appear, then recognition is impaired. However, the present results indicate that when the handicap of the wrong assumption is removed, then an alignment of the top of the form with the S's expectation of the top does not enhance recognition further. The high level of recognition of disoriented figures observed during the last set of trials (which occasionally surpassed recognition of the upright figures, as indicated in note 4), suggests that disorientation, even with respect to retinal and environmental frameworks simultaneously, may not be a sufficient cause of impairment in recognition. Further, the perceptual learning observed raises the question of what cues are used to identify the disoriented forms and how this cue utilization improves with exposure. Perhaps the problem of the relation between form-perception and orientation may be best approached by investigation of the cues used in the perception of different kinds of forms; then the ways in which cue utilization could (or could not) be affected by varying orientation would presumably become clearer.

References

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Notes

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- This possibility has been suggested by other work (Ghent, 1960; Braine & Milne, unpublished). Although Rock (1956) did refer to this problem, the experimental techniques devised to deal with the question were indirect and never posed the simple alternatives described here.
- During the last 10 trials, 39% of the Ss recognized one or more disoriented items that they had not previously recognized when the items had been presented in the upright position on an earlier trial. Also, when all trials were considered, 91% of the Ss recognized one or more items in a disoriented position before they recognized the same item(s) in the upright position.
- The apparently consistent superiority of the upright items even for the fourth group of trials is due to the performance of the female groups. During the last group of trials, the mean number of correct responses for all males was 1.78 for the upright items, 1.75 for the upside-down items, 1.62 for the left items and 1.87 for the right items, whereas the comparable scores for the females were, respectively, 1.77, 1.42, 1.32 and 1.45.