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Dissociation of feature vs. configural properties in the discrimination of faces

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Faces constructed from Identi-Kit transparencies were flashed to either the right or left visual field. For faces shown to the left, discriminations involving the spatial relations among the eyes, nose, and mouth were more accurate. When faces were shown to the right, better performance occurred when the task required discrimination along dimensions.

Attempts to characterize face recognition and discrimination have concentrated, for the most part, on the relative contribution of featural versus configurational properties of faces. The importance of specific facial features or components is suggested by reports that certain aspects of the face, for example, the eyes, are more critical in the discrimination of faces (Ellis, 1975) and by manipulations of feature salience, which affect recognition memory for faces (Friedman, Reed, & Carterette, 1971). Other manipulations are thought to implicate configural properties in face recognition. For example, the frequently observed superiority in recognition of faces flashed to the left visual field (e.g., Ellis & Shepherd, 1975) has been interpreted as implicating recognition processes that are more compatible with the spatial and configural skills of the right hemisphere.

Central to the distinction between the contributions of features versus configurations in face recognition is a clear definition of the terms involved. The present research adopted Garner's (1978) distinctions among the kinds of information available in pattern recognition. Patterns are described by Garner as involving component attributes, defined by the presence of specific features or values on specific dimensions, and holistic properties, which concern the relations among the parts of a pattern. These definitions were used to construct pairs of schematic faces, for which the task involved either the discrimination of component attributes of a particular facial aspect, for example, the shape of the eyes, or the configural relations among aspects, for example, the position of the eyes with respect to the remainder of the face. The former was defined as feature discrimination, and the latter as configural discrimination. One advantage of this approach is that it does not confound the portion of the face containing the critical information for discrimination with the type of discrimination required. In the past, researchers (Sergent & Bindra, 1981) have tended to define right-hemisphere-dependent characteristics of faces in terms of external, general contours and left-hemisphere-dependent characteristics in terms of internal features. The operational definition of configural cues adopted in the present research makes it possible to determine whether hemifield-specific effects can be found independently of the location of the critical information. Both feature and configural discriminations were required across a series of trials in which faces were flashed to either the right or the left hemifield. Of interest was whether dissociation of featural and configural factors would be indicated by differential accuracy contingent upon the hemifield of presentation.

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EXPERIMENT 1

Method

Subjects. Forty-eight undergraduate students participated as part of an introductory psychology course requirement. All subjects wrote with the right hand and had normal vision. Males and females were equally represented.

Stimuli and Procedure. The stimuli were constructed from Identi-Kit transparencies; they portrayed a group of Caucasian adult males. Only the eyes, nose, and mouth were chosen as critical, or discriminating, aspects for the stimulus array, although the other characteristics (ears, head shape, chin shape, and hair style) were also varied across trials in order to represent a range of facial types. Either feature or configurational information was the appropriate basis for making the judgment on each trial. For feature changes, a different set of eyes (nose, mouth) was chosen for the foil, and the other features remained the same. The particular alternative used for the foil was chosen such that it was easily discriminable when the faces were viewed simultaneously and could be described in dimensional terms (e.g., narrow vs. thick, light vs. dark, etc.). For configural changes, the same aspects (eyes, nose, or mouth) were moved either 2 mm up or down with respect to the remainder of the face. The direction of movement was random, with the restriction that a particular movement did not represent an apparent violation of the normal distance range for these characteristics. Again, the foil and the original were easily distinguishable when viewed simultaneously. When photographed and mounted on cards, individual faces subtended approximately 2 x 3 deg and appeared 2 deg to the left or right of fixation, measured to the center of the picture. Stimuli were shown unilaterally to the left and right hemifields at an exposure duration of 150 msec and a

Table 1
Probability of a Correct Response as a Function of Hemifield and Type of Discrimination Required

	Left Hemifield		Right Hemifield	
	Configural	Feature	Configural	Feature
Experiment 1	.66	.60	.58	.65
Experiment 2				
Faces	.72	.59	.65	.73
Houses	.67	.78	.75	.79
Experiment 3	.65	.57	.59	.68

luminance of 85.5 cd/m² for a total of 24 trials. Both the type of discrimination required, featural versus configural, and the side of presentation were randomized across trials. Photographs of the alternatives for each trial were mounted on separate pages of a booklet for the subjects' use.

The subjects' attention was first directed to a dimly illuminated (8.6 cd/m²) fixation field containing a central fixation point. The subjects were told they would be shown pictures of faces flashed to either the left or the right of fixation, and that they were to turn to the appropriate page of the booklet and indicate which of the two faces matched that which they had just seen. After several practice trials, the test series of 24 trials was administered.

Results and Discussion

The subjects' correct responses were submitted to an analysis of variance with gender, discrimination type, and hemifield as the factors. No main effect in this analysis approached statistical significance. However, the interaction between discrimination type and hemifield was significant [$F(1,46) = 5.0$, $p < .05$]. Table 1 shows the probability of a correct response for each hemifield as a function of the type of discrimination required. Contrasts comparing performance for each type of discrimination in each hemifield indicated a significant difference between the two types of discrimination for the right hemifield ($p < .05$) but only a trend in the opposite direction for the left ($p < .25$).

EXPERIMENT 2

In Experiment 2, the order of presenting choice and test stimuli was reversed, and the subjects were allowed to see both the nature of the discrimination required and the relevant facial area before the test stimulus was shown (although again, the subjects did not know which hemifield would contain the test stimulus).

Of interest was whether foreknowledge of the kind of discrimination required would change hemifield asymmetries in perception. Showing the alternatives before showing the test face would appear to have several consequences, according to Sergent and Bindra (1981). The specific characteristics of importance could be isolated, and the stimulus set would be minimized. These conditions may favor the analytic capacities of the left hemisphere and consequently lead to a right-hemifield advantage in recognition. On the other hand, if the results of Experiment 1 reflect general differences in the efficiency of extracting different kinds of information about faces in each hemisphere, foreknowledge should not essentially change the nature of the hemispheric effect found in Experiment 1.

Experiment 2 was also designed to explore the possibility that differential hemispheric involvement in configural versus feature discriminations occurs for other than face stimuli. Consequently, a second set of stimuli representing schematic frontal representations of two-story houses was constructed. House stimuli were shown under the same conditions under which the set of faces had been shown, and it was expected that, to the extent the isolation of feature versus configural qualities represents general skills associated with the right and the left hemispheres, differential hemifield accuracy would again be found.

Method

Subjects. The participants were 28 undergraduate students who were from the same source and who met the same criteria as those in Experiment 1.

Stimuli. In addition to the face stimuli shown in Experiment 1, a second set of schematic frontal line drawings of two-story houses was constructed according to the same general criteria that had governed the construction of the set of face stimuli. Across the set of houses, 12 pairs were formed, for which the basis of discriminations was a specific feature change, such as in an upper or lower window or door type, a balcony, etc. In the 12 pairs involving configural manipulations, the features remained the same in both members of the pairs, but the distance between features was varied in a manner analogous to that used for the face stimuli.

Procedure. All subjects were shown the face and house stimuli in a blocked design, with half the subjects receiving the faces first. Within each stimulus set, the subjects were shown 12 stimuli to the left and 12 to the right of fixation in a random order, as in Experiment 1. Before each stimulus was shown, however, the subjects were instructed to look at the appropriate page of the prepared booklet and were told that one of the two stimuli shown would be flashed briefly to the left or right. After examining the display pair for the distinguishing difference, they were to look into the tachistoscope, fixate the central dot, and signal the experimenter when ready. The subjects were to report, as soon as the exposure terminated, which member of the test pair had appeared. They could check the booklets again if they wished. As might be expected, providing the alternatives before stimulus onset made the task considerably easier than that in Experiment 1. Hence, the exposure duration was reduced to 40 msec.

Results

Examination of the scores for both sets of stimuli as a function of the order in which the series was administered (either houses or faces first) revealed no consistent differences in the pattern of responses for either stimulus set as a function of presentation order.

Separate analyses of variance were performed upon the face and house trials, since type of detail changed was confounded with stimulus class. Analysis of recognition accuracy for faces again revealed an interaction between only hemifield and discrimination type [$F(1,26) = 8.4$, $p < .01$]. The probability of a correct response for each of the conditions associated with this interaction appear in Table 1. Contrasts comparing performance for each kind of discrimination in each hemifield indicated a significant difference between conditions for the left hemifield ($p < .05$) and a marginally significant difference for the right ($p < .10$).

Analysis of the subjects' responses to the set of house stimuli yielded no significant sources of variance, although there was a tendency for greater accuracy for feature than for configural discrimination ($p < .10$).

EXPERIMENT 3

The failure to find a hemifield x discrimination type interaction similar to that for the face set for the house series in Experiment 2 may mean the effect found for faces, although replicable, is of limited generalizability, since the set consisted of only 12 different facial prototypes. In Experiment 3, an additional set of 24 different Identi-Kit faces was constructed according to the same procedure and criteria that had governed construction of the previous set.

Method

Subjects. The subjects were 16 undergraduates chosen on the basis of the same criteria as in the previous experiments.

Stimuli. Twenty-four different basic faces were constructed from Identi-Kit materials according to the same procedures that had been used in Experiment 1, but with an independently chosen set of characteristics. Each face was shown to the left and right hemifields, and either a feature or a configural discrimination was required, resulting in a total of 96 test trials. The conditions of presentation were essentially the same as in Experiment 2. Rather than being photographs of Identi-Kit constructions, the stimuli in Experiment 3 were reduced Xerox copies made directly from the transparencies. This resulted in likenesses that were slightly degraded relative to the photographs and necessitated an increase in the exposure duration to 100 msec in Experiment 3 to maintain adequate levels of performance.

Results

Analysis of variance of the subjects' scores included hemifield, discrimination type, and first versus second half of the experiment as (within-subjects) factors. The only source of variance that reached conventional levels of significance in this analysis was the interaction between discrimination type and hemifield [$F(1,15) = 9.5$, $p < .01$]. Contrasts comparing the discrimination types within each hemifield indicated a significant advantage for feature discriminations in the right hemifield ($p < .05$) and an advantage for configural discriminations in the left hemifield ($p < .05$).

DISCUSSION

These results support the notion that people pay attention to several different kinds of information in discriminating and recognizing faces. The set of stimuli used was highly constrained in that only certain aspects of the face were relevant to the task, and an attempt was made to make featural and configural information equally relevant and discriminable. Under these conditions, dissociation of the two types of stimulus manipulation occurred: Configural information was discriminated more accurately when the face was presented to the left hemifield, and information concerning attributes of specific features was discriminated more accurately when the face was projected to the right.[1] Moreover, to the extent hemifield asymmetries may be interpreted as implicating different processing strategies associated with the left and right hemispheres (Springer, 1977), such differences in processing are indicated by the asymmetries observed.

The failure to find an effect with houses may have been due to several factors. Attempts to equate the general difficulty of the different discriminations required in Experiment 2 were not as successful for the house set as they were for the faces. This may have prevented the emergence of hemifield-specific effects. Second, the importance of relational information in the perception of age (Pittenger, Shaw, & Mark, 1979) suggests that configural information may be more important to the recognition of faces, making a left-hemifield advantage easier to elicit. In any case, the present experiments suggest that such configural variations can be empirically dissociated from more feature-specific characteristics in face recognition.

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NOTE

1. There was some limited evidence that all internal areas are not equally salient in this respect. In Experiment 1, performance for either configural or feature discriminations was near chance levels when the mouth region contained the critical information. This is perhaps to be expected, given the apparent salience for the upper part of the face (Ellis, 1975). Since only two trials per feature/discrimination/hemifield were given, further statistical analysis seemed unwarranted. In Experiments 2 and 3, the effects described were present for all facial areas.

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