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Permalink
https://escholarship.org/uc/item/39c9h28d

Journal
Proceedings of the Annual Meeting of the Cognitive Science Society, 26(26)

ISSN
1069-7977

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Publication Date
2004

Peer reviewed

Reexamining the "Distinctiveness Effect": Poorer Recognition of Distinctive Face Silhouettes

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The distinctiveness effect in face processing

A recognition advantage for distinctive faces has been widely reported (e.g., Valentine, 1991). In such studies, distinctive faces produce more hits and fewer false alarms than typical faces. Although the finding is robust, the mechanism for this advantage has not been carefully explored. The choice of distractors in these studies does not guarantee equivalent target-distractor distances for typical and distinctive faces. In fact, because typical faces lie in a denser, more central region of face space (Valentine, 1991), they will be on the whole more similar to the distractor set than distinctive faces. The location of distractors may thus be sufficient to explain the distinctiveness advantage. In fact, theories of perceptual learning would predict a processing *disadvantage* for distinctive faces that we have less experience with. To control for the effect of unevenly spaced distractors, we constructed a parameterized face space and created equally spaced targets and distractors.

Parameterized face silhouettes

Forty-eight face profiles from the FERET database were reduced to two-toned silhouettes (Figure 1 A and B). The position of 18 key points was recorded for each silhouette from which a 32-dimensional set of principal components (PCs) was computed to fully describe the shape of each silhouette, up to rotation and dilation (Figure 1 C).
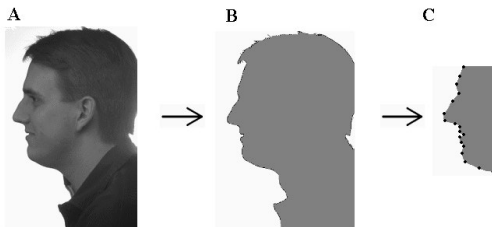

Figure 1. Silhouette parameterization

Experiment 1

From this parameterization, 100 typical and distinctive silhouettes were constructed by setting two of the first 10 PC values to +/- 1 (for typical faces) or +/- 3 (for distinctive faces) standard deviations from the mean. This resulted in distinctive faces being farther from the origin of face space (see Figure 2A), a measure that correlated highly with rated distinctiveness. Distractors were constructed for each face by varying two orthogonal PC values to +/- 1 and +/- 2. In a 3AFC recognition task, 16 Stanford undergraduates observed the randomly presented faces, each followed by a 2-second mask and a choice of three faces (the target and two distractors). Performance was coded as percent identification of the target face. Mean performance was 61% for typical and 56% for distinctive faces, a significant disadvantage for distinctive faces (p<.05). To control for the possibility of biased online learning of the typical region of face space, we conducted a second experiment where the size and density of the two regions were matched.

Experiment 2

The design was the same as above except that the set of distinctive faces was defined as a translation in face space from the set of typical faces. Each distinctive face corresponded to a typical face translated by a fixed number of units on a set of eight orthogonal PCs. To control for item effects, the direction of translation was reversed in two between-participant conditions (see Figure 2 B and C).
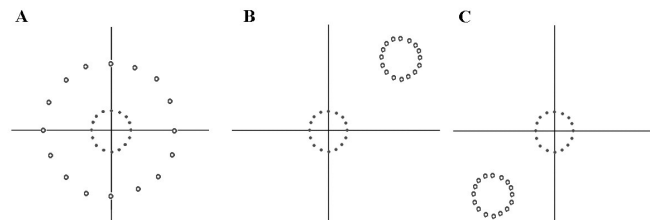

Figure 2. Relative sizes of typical (dots) and distinctive (rings) face regions in Experiments 1 (A) and 2 (B and C)

In conditions 1 (N=16) and 2 (N=14), typical faces were correctly identified more often than distinctive faces (62% vs. 57% and 64% vs. 59% respectively; p<.05 in each case).

Discussion

By using parameterized silhouettes, we were able to construct distractors that were equally spaced from their respective targets, across typical and distinctive faces. In two experiments, we found that when controlling for distractor distance, the advantage associated with distinctive faces *reverses*. This "reverse distinctiveness effect" is consistent with the notion that people have less experience with distinctive regions of face space.

References

Valentine, T. (1991). A unified account of the effects of distinctiveness, inversion, and race in face recognition. *Quarterly Journal of Experimental Psychology: Human Experimental Psychology, 43A*, 161-204.