

# Words and faces: eccentricity distinguishes two context effects

Marialuisa Martelli, Najib Majaj, & Denis Pelli, Psychology & Neural Science, New York University

Words and faces are special objects in the sense that we are expert at identifying them. Words and faces both show a superiority effect: it is easier to identify a letter or a mouth when presented in the word or face context rather than alone. We studied how we recognize these objects as a function of their location in the visual field. In the periphery, people read slowly and can't identify facial expressions. What is the difference in face and word recognition between central and peripheral locations?

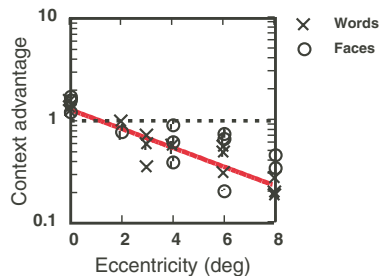
## Context



The word inferiority effect. Fixate on the central square, and try to identify the middle letter on the left...it's hard! Now, while maintaining fixation on the square, try to identify the letter on the right...it's easy! The presence of the other letters in the word made the task hard.



The face inferiority effect. Again, fixate on the central square, and try to tell if the face on the left is smiling or frowning...it's hard! Now keep fixation on the square and try to tell if the mouth on the right is smiling or frowning...it's easy! The presence of the face made your task hard.



Results for six observers. We measured contrast thresholds for identifying the feature (letter or mouth) alone or in context (word or face). We plot the ratio between the threshold for the feature alone and the threshold for the feature in context as a function of eccentricity. The dashed line represents no effect. Xs indicate the results obtained with the words and the letters, Os the results obtained with the mouths and the face.

## Crowding

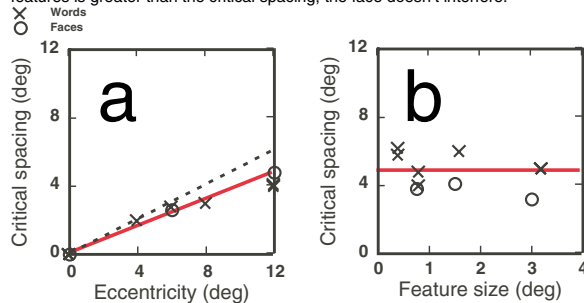
We found that identification of letters and mouth expressions is limited by crowding by the other elements in the object, with a critical spacing proportional to eccentricity.



Critical spacing in a word. Fixate on the square and try to identify the central letter. Just as before it's hard on the left and easy on the right. When the spacing between the letters in the word is greater than half of the viewing eccentricity (critical spacing) the other letters don't interfere.



Critical spacing in a face. Fixate on the square and try to tell if the mouth is fat or thin. Again, it's hard on the left and easy on the right. When the spacing between the face features is greater than the critical spacing, the face doesn't interfere.



Diagnostic tests for crowding, for face caricatures (MM) and words (MS and HS). We measured contrast threshold (not shown) as a function of center to center features spacing at various eccentricities and feature sizes. The results are fitted with a clipped line with breaking points at floor and ceiling. The break point at the floor is "critical spacing". Panel a shows that critical spacing scales with eccentricity (average slope of 0.4). Panel b shows that critical spacing is independent of letters size. These tests show that our ability to identify words and faces in the periphery is limited by crowding.

We also found that the object superiority effect is independent of eccentricity. Thus, words and faces are special at all visual field locations and, the critical spacing that limits the observer's ability to identify the object increases with eccentricity.

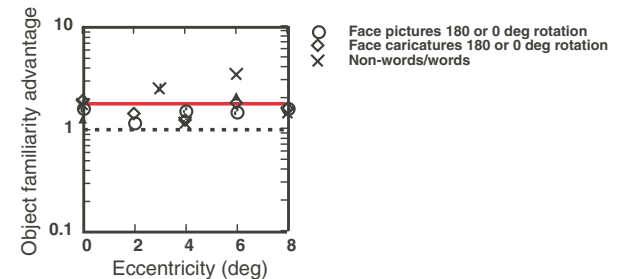
## Familiarity



The word familiarity effect (aka word superiority). This is a small effect. Fixate on the black square and identify the central letter. As before it's hard on the left and easy on the right. The word context helped you in identifying the central letter.



The face familiarity effect (aka face inversion). Fixate on the central square and try to tell if the mouth is fat or thin. Again, it's hard on the left and easy on the right. The face context helped you when it was right-side-up but not when it was up-side-down.



We measured contrast threshold for the objects presented in a familiar (word and right-side-up faces) and in an unfamiliar arrangement (non-words and up-side-down faces). We plot the ratio between the unfamiliar and the familiar arrangement for the three observers as a function of eccentricity. All the data fall above the equality line (dashed line) independently of eccentricity.