

Spacing, not size, matters in visual recognition, researchers find

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You might think that the farthest distance at which you can hold a book and still read it quickly is determined by the size of the letters. However, New York University neuroscientists have concluded that it's the spacing between letters, not their size, that matters. In general, objects, such as letters, can be recognized only if they are separated by enough space, the "critical spacing." Objects closer than that spacing are "crowded" and cannot be identified. A broad review of this crowding phenomenon, appearing in the latest issue of the journal *Nature Neuroscience*, shows that this critical spacing is the same for all objects, including letters, animals, and furniture.

According to the authors, NYU Professor of Psychology and Neural Science Denis Pelli and Katharine Tillman, an undergraduate researcher in NYU's College of Arts and Science, the critical spacing is a key parameter in the brain's cortical architecture underlying object recognition.

"The idea that spacing limits object recognition could not be simpler, but it has been very hard to accept because it displaces a firmly held belief that visibility is limited by size, not spacing," Pelli and Tillman wrote.

The human visual system recognizes a simple object by detecting and then combining its features (lines or edges). However, this process is impaired when, in seeking to identify an object in clutter, your brain combines features over too large an area surrounding the object, failing to isolate the object's features from those of the clutter. This usually

happens when the cluttered object is in peripheral vision (the corner of your eye), as shown in this demonstration:

R + ARE

Fix your eyes on the plus. It is easy to recognize the letter "R" if it is alone, as on the left. However, if the letter "R" is among other letters, it is much more difficult to recognize. This is "crowding."

"We can easily see a single bird flying in the sky because there is no crowding, but most of our visual world is cluttered, and each object that we identify must be isolated from the clutter," the researchers added. "When an object is not isolated, and therefore crowded, we cannot recognize it."

The critical spacing is greater for objects that are more peripheral (farther from fixation). Objects are crowded when their spacing is less than critical and uncrowded when their spacing is more than critical. This dichotomy defines an "uncrowded window" through which we are able to read and search. The size of the uncrowded window increases through childhood and accounts for the increase in reading speed.

Source: New York University

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