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Universal eye problem leads to better vision

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'Crowding', the phenomenon when people are less able to differentiate letters if they are surrounded by other letters, actually leads to better vision.

This is the conclusion of Dr Frans Cornelissen (University of Groningen, The Netherlands), who together with Dr Ronald van den Berg and Prof. Jos Roerdink is the first to succeed in explaining crowding with a mathematical model. ‘At this moment in time our model is mainly interesting in a fundamental sense’, says Cornelissen. ‘In the long term, however, it may acquire practical applications, for example when designing learning material for children with dyslexia.’

In order to illustrate the phenomenon of crowding, Cornelissen makes the letter E, a cross and the digit 8 appear on his monitor. People who look at the cross in the middle are able to recognize the E and the 8 without any problems, even if they are standing off to the side. However, once more letters and digits appear on the screen, the E and the 8 are suddenly unrecognizable. Everything runs into each other. ‘And this despite the fact that nothing has changed in the E and the 8’, says Cornelissen. ‘The reason you can no longer recognize the E and the 8 is crowding. That limitation is locked into our brains and appears in everything we look at. You could call it a universal eye problem, because objects are nearly always surrounded by other objects.’

Although crowding has always been regarded as a sight limitation, the research by Cornelissen and his colleagues has revealed that it actually helps us. ‘In fact, people see better as a result of crowding’, states

Cornelissen. ‘Our eyes are continually being bombarded with information, and our brains have to decide what is important. Simulations conducted with our model show that crowding appears to help make the important information much clearer. If you look at pictures without crowding, the illustration always stays a bit fuzzy. However, if you then apply crowding, the edges of letters and objects in an image become much sharper. Crowding is thus an image strengthening trick by the brain to differentiate between important and useless information. We have to do more research to determine exactly how this strengthening works. So far, the model has only been tested on a limited number of pictures.’

Cornelissen emphasizes that the model is currently only interesting in a fundamental sense for a better understanding of our brain functions, but at the same time he sees a number of potential practical applications, for example in the field of dyslexia. ‘Previous research has shown that people with dyslexia have more problems with crowding. Our model can simulate how someone with normal sight identifies a text and how that differs from someone with more problems with crowding. It will probably turn out that someone with extra crowding needs the letters to be further apart before they become clear. Our model can thus calculate the optimum way to present things to someone with dyslexia. This will probably not completely remove the dyslexia, because there’s more to the problem than just crowding. However, it could certainly reduce the consequences.’

More information: A Neurophysiologically Plausible Population Code Model for Feature Integration Explains Visual Crowding, Ronald van den Berg, Jos B. T. M. Roerdink, Frans W. Cornelissen, *PloS Computational Biology*, doi:10.1371/journal.pcbi.1000646