Podcast interview: Benjamin de Haas

PNAS: Welcome to Science Sessions. I'm Paul Gabrielsen. When your eye glances at an image, what part of it do you look at first? A face? A word? An area with high contrast? And do you see first the same thing that I see? Previous studies assumed that individual humans' eye movements and visual perception were similar enough for any differences to be negligible. But in a recent PNAS article, Benjamin de Haas of Justus Liebig University Gießen in Germany and colleagues show that individual differences in image perception are significant and stable – and that these differences manifest in the very first glance. De Haas describes why we move our eyes to fix our attention.

De Haas: If I extend my arm and I look at the tip of my thumb, then the width of my thumb is about 1-2 degrees visual angle. And that tiny spot of the visual field gets a lot of the overall number of photoreceptors we have, and things drop off from there very quickly. We have this high-definition kind of vision at the very center of the visual field, and then in the periphery things get a lot less high quality. But we can simply move our eyes, so we can select objects that we want to put into this focus. And for that reason, every one of us moves their eyes about one or two times per second. So we're moving our eyes around all the time to get different frames, so to speak, of what's in front of us.

PNAS: Researchers trying to predict eye movements have used as a standard the ability of algorithms to predict one person's eye movements based on another person's eye movements.

De Haas: That implies that the difference between people is just the limit, you couldn't get any better than that. There have been some cues, some hints that that may not be the full story. So, there have been two papers that found that the pattern of eye movements for short video clips or images are more similar between identical twins compared to fraternal twins. That means two things: A, the differences between people seem to be somewhat systematic, and B these systematic differences seem to have a genetic component.

PNAS: In the study, participants sat in front of a screen and cycled through a set of 700 images, three seconds at a time. The image set was created by another research team that delineated, pixel by pixel, what objects an image contained. De Haas used eye tracker data and these object maps to determine what participants were looking at, moment by moment. The team then compared how individuals' eye movement tendencies differed. Three aspects of the results, de Haas says, surprised him.

De Haas: One was the size of these differences. The tendency to fixate faces varies by more than a factor two between observers at the extreme ends of the spectrum. And given that previously vision scientists assumed that either there are no such differences or they are more or less negligible, it was quite astonishing that there would be such a big difference. The second thing that was surprising to me was how reliable these differences were. So, if we looked at the differences between person A and person B for one set of images, they almost perfectly replicated, for example, for the tendency to look at faces, for a different second set of images. It was that good, in a way, or that surprising, that strong the effect that I was very worried that it may not be true and it may just be coding error. The third aspect that to me was quite surprising was that these big and reliable differences are apparent from the very first eye movement people make towards an image. Some people are attracted more by faces than others, some are more attracted more by text than others, even from the very first fixation.

PNAS: What can these individual differences teach us about perception? De Haas explains some possible research avenues.

De Haas: One of the things we're interested in is to understand better how the brain directs our eyes to things in the periphery like faces, like text, like objects being touched. We want to compare people that have very strong attraction towards faces, for instance, with those that have little attraction toward faces and compare their visual brains to each other to get at the features that are helping the brain to analyze these types of objects in the periphery.

PNAS: Another avenue may extend de Haas' efforts to capture how real-world stimuli catch our visual attention.

De Haas: We want to know how well these differences in looking behavior generalize from passive viewing just sitting in front of a screen to vision in real life where you're acting or you're driving or you're walking or cycling or doing whatever you do in your everyday life. We want to use mobile eye tracking, eye tracking glasses in future experiments to see whether, for instance, we know that your eyes are strongly attracted by text in the lab, when you passively look at a screen, is this a predictor of you being more easily distracted by billboards when you're driving your car, for instance? That of course would also have potential relevance for how we design our visual worlds around us.

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