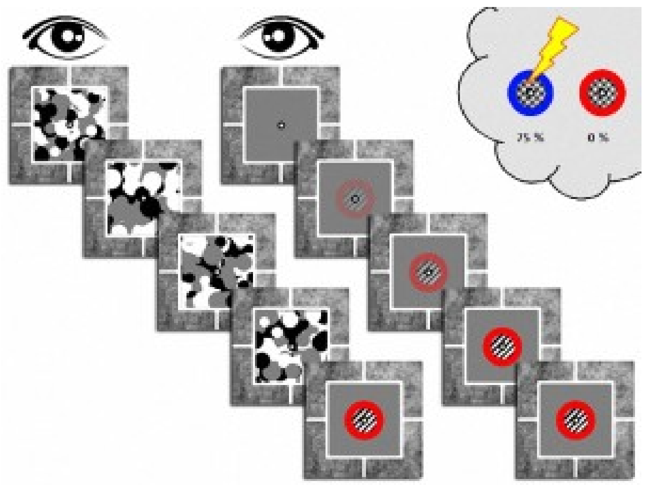
Visual information signaling threat gains privileged access to consciousness

At any moment in time we are submerged in an overwhelming amount of visual information. If our brain had to consciously process all the information reaching our eyes, it would take us a lifetime just to read this sentence. Fortunately, part of the information that reaches our eyes enjoys a privileged position: it is summarized into a single coherent subjective experience, which we refer to as (visual) consciousness. Considering that our consciousness eventually only has access to a small part of the visual information reaching our eyes, this raises the question what part of our visual world reaches consciousness. In this study, we hypothesized that visual information that signals threat, and is therefore inherently relevant to us, should gain privileged access to consciousness.



In the first phase of the experiment, participants learned that one of two colors (red or blue) signaled an immiment aversive event (an electric shock) whereas the other color did not. In the second phase of the experiment, a dynamic pattern was presented to one eye, which rendered a static image presented to the other eye invisible. The time it took for participants to detect the static image (a colored ring) reflected the propensity of said image to enter consciousness. The results revealed that images that signaled an aversive event became visible (i.e., accessible to consciousness) about 20% faster than comparable images that did not signal threat.

In order to test this hypothesis in an experiment with naïve participants, we were required to combine two experimental paradigms. First, we needed to manipulate whether visual information signals threat or not. Threat was manipulated by means of a phenomenon called classical fear conditioning. This procedure start with participants repeatedly observing two basic visual images with no intrinsic emotional significance (in this case a red and a blue ring). While observers were observing these images, they could receive aversive electric shocks, through an electrode placed on their ankles. Specifically, after viewing one ring color (e.g., blue) participants had a 75% chance of receiving an electrical shock, whereas no electric shocks were delivered after seeing the other annulus color. Hence, participants learned that one color signaled threat whereas the other color did not.

Second, we needed to compare the propensity of threatening and non-threatening visual information to reach access to consciousness. For this purpose, we used an experimental method that renders an image invisible (i.e., inaccessible to consciousness), despite it being presented on a computer screen right in front of the participant. This was achieved by presenting a static image to one eye, while presenting a moving pattern to the other eye of the participant, as a result of which the participant only sees the moving pattern (this is called interocular suppression). Subsequently we measured the time it took for participants to detect this initially invisible image. The time at which participants are able to detect visual information reflects the time at which the initially invisible image becomes visible again (i.e., accessible to consciousness).

It turns out that when an image signals threat (i.e., its color is associated with a high likelihood of receiving an electric shock), this image becomes visible about 20% faster than a similar image that does not signal threat. This shows that visual information signaling threat gains privileged access to consciousness. Considering that the threat associated with initially invisible visual information determined the time it took for this information to reach access to consciousness, it can be deduced that threatening information could be segregated from non-threatening information when it was not yet accessible to consciousness.

The present findings contribute to our fundamental (psychological, biological, and philosophical) understanding of conscious and non-conscious human perception. Such knowledge is eventually relevant to applied fields, in which the limited capacity of human visual consciousness constitutes a bottleneck to performance. These applications range from the human monitoring of information and warning signals in airport control rooms and cockpits, to doctors searching for tumorous cell clusters in MRI or CT scans.

Surya Gayet
Helmholtz Institute, Utrecht University, Department of Experimental Psychology
Utrecht, The Netherlands

Publication

Visual input signaling threat gains preferential access to awareness in a breaking continuous flash suppression paradigm.
Gayet S, Paffen CL, Belopolsky AV, Theeuwes J, Van der Stigchel S.
Cognition. 2016 Apr