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Vision as an Experience of Virtual Reality

Gaby Coetzee
University of Pennsylvania

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Gaby Coetzee, University of Pennsylvania

IN 2014, A SIMPLE PICTURE OF A WOMAN'S DRESS took the internet by storm. After being posted on a popular photo-sharing website, the image (left) began receiving hundreds of comments debating the color of the featured dress; Some users argued it was black and blue, whereas others insisted it was white and gold. The conviction of both parties led the debate to quickly spread to other forms of social media where, within 24 hours, the dress was viewed over 28 million times. After weeks of circulating the internet, the public was unable to reach a consensus. Furthermore, individuals advocating each color combination were outraged by their counterparts' interpretations of the image. This phenomenon, now referred to as "The Dress," provides a salient example of the fact that human perception is a subjective experience.

Uproar over the color of "The Dress" captured the attention of neuroscientists and psychologists, who were eager to discover the underlying scientific reason for this great controversy. After examining the composition of the image, which in reality depicted a blue and black dress, they arrived at the consensus that the picture's lighting was to blame: parts of the background seemed to imply backlighting, creating an illusion that the dress was cast in a blue shadow. If the brain of the viewer interpreted the blue color as a shadow, rather than part of the dress, it subtracted the bluish tint – this in turn gave rise to the perception of the dress as white and gold. In contrast, if the brain of the viewer did not register and remove a blue shadow, the dress was perceived as black and blue. Essentially, one's interpretation of the picture depended upon the manner in which their brain processed luminance. Scientists studying "The Dress" argued that individual differences in luminance perception are the result of personal experience—specifically, exposure to different types of light. People who wake up in the early morning, so-called "early birds," are exposed to more short-wavelength, bluish natural daylight than their "night owl" counterparts. Therefore, these early risers perceive the dress as white and gold because their brains, accustomed to adjusting for blue tints, are trained to remove the blue shadow. Surveys conducted to study the association between sleeping schedules and interpretation of "The Dress" supported this theory (Wallisch, 2016).

"The Dress" serves as an extraordinary example of how brain processes that interpret visual information can create a perceptual experience that vastly differs from reality. A more commonplace phenomenon that leads human perception to differ subtly from an observed stimulus is the neurological mechanism of lateral inhibition. Lateral inhibition refers to the capacity of excited neurons to inhibit neighboring neurons in order to enhance contrast sensitivity. Horizontal retinal cells, which function to integrate and modulate information from multiple photoreceptors, are the key players in this process. When a horizontal retinal cell detects that a specific group of

photoreceptors are receiving a large magnitude of stimulation, it will inhibit adjacent photoreceptive cells that are experiencing relatively less stimulation. This neurological process improves the human ability to detect contrasts or edges, however it results in a perception of an image that differs from the true stimulus. For instance, lateral inhibition will lead one to perceive a gray square as a lighter color when surrounded by a white background and as a darker color when surrounded by a black background. Additionally, lateral inhibition causes the Mach band visual effect—which exaggerates the contrast between surfaces with different degrees of luminance. These effects are highly adaptive, helping humans to efficiently perceive the edges of objects in order to navigate the environment.

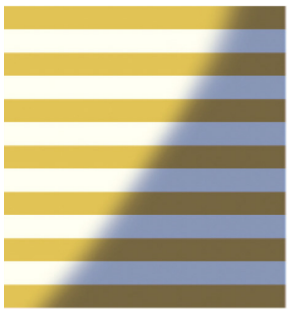
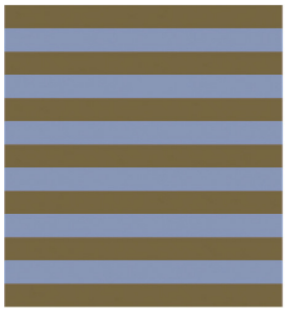


Image depicting the perceptual experience of those who saw white and gold

"The Dress" internet sensation and lateral inhibition demonstrate that perception is an experience of virtual reality. Rather than simply absorbing coherent images in their entirety, as does a camera, the human brain breaks down an image into its constituent parts. These individual features are processed by the brain and later reassembled to produce a coherent image. As evidenced by "The Dress" phenomenon, personal experience can alter the visual interpretation system of the brain, giving rise to individual differences in the perception of a single image. An analysis of lateral inhibition illustrates the existence of a universal, hard-wired neural mechanism that enhances perception of color and contrast. Together, "The Dress" and lateral inhibition exemplify how human perception is not an objective representation of the external world, but instead a highly subjective experience of virtual reality.



Representation of the actual colors of the dress

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