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Source: BioScience, 62(11) : 937-938

Published By: American Institute of Biological Sciences

URL: https://doi.org/10.1525/bio.2012.62.11.2

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Can Neural Signals for Visual Preference Predict Real-World Choices?

SOPHIE LEBRECHT AND MICHAEL J. TARR

Our world is filled with choices— from the mug we choose to pour our coffee into each morning to the kind of toothbrush we use to clean our teeth. The preferences we show for things—for clothing (business or casual), for computers (Mac or Windows), for cars (Escalade or Mini), and so on—all help define us.

For the most part, theories of how we make such choices have been rooted in economics and aesthetics, even when those theories have drawn on neuroscience and human neuroimaging. We suggest that when formulating a theory of how preferences and choices are constructed, researchers should also consider how visual objects are perceptually processed. Evidence suggests that concrete, real-world economic decisions—buying things—are governed as much by vision as by emotion or conscious decisionmaking. Neuroscientific insights into visual processing, we maintain, can inform the understanding of how consumers make their decisions—a matter of obvious interest to marketers and, perhaps, to consumers themselves.

It has been known for decades that 30 percent of the human cortex is wired for vision and, ultimately, object and scene perception. Historically, the study of vision has been focused on how we extract physical properties—for example, color, shape, texture, or size—from images of objects. But of late, visual neuroscientists have come to realize that vision is not a one-way street but, rather, is an integral participant in how we think, feel, and react to the world. Modern visual neuroscience considers how visual processing contributes to and interacts with both nonperceptual and noncognitive domains. Because of this, the study of vision has increasingly asked how the visual cortex extracts nonphysical properties—for example, social or affective characteristics—from object images. Most saliently, extensive work has been done to explore how affective processing interacts with the processing of visual objects believed to carry socially relevant or highly affective content: faces (Vuilleumier and Pourtois 2007) and highly emotional scenes (Sabatinelli et al. 2011). In our own research, however, we take the view that everyday objects carry affective significance that influences our behavior. Moreover, intangible properties such as affective valence are part and parcel of the automatic, obligatory processing applied unconsciously by our visual systems to all objects (Lebrecht et al. 2012).

Under a model in which valence perception, as one component of visual perception, is rapid and automatic, by the time an observer has recognized an object, he or she has also instantiated a neural signal estimating a preference—positive or negative—for that object. During visual processing, object valence is derived from an integration of the inherent valences of visual features (e.g., smooth surfaces tend to be positive, and spiky surfaces tend to be negative) and experience-driven valence associations from visually and categorically similar objects, although some object categories may inherently carry positive or negative valence (Rakison and Derringer 2008). We believe that this process applies to the vast majority objects, including ordinary objects that we constantly encounter; we refer to this as *micro-valence*.

This view of valence processing as both unconscious and obligatory solves two problems. First, consider the amount of visual information that we are faced with every second of every day. Much research points to severe limits on how much information we can consciously inspect. Our awareness would become overwhelming without the complex neural processes needed for extracting valences' being automatic and unconscious, as they are for almost all complex neural processes. Second, many neuroscientists hold that only objects with strong valence or high social significance are analyzed with respect to valence. Yet, it is hard to envisage how the visual system could "know" that an input should be processed further to extract valence without it first knowing that the valence of that input is strong or important. In contrast, if we allow for micro-valences, then, as part of normal visual processing, all objects and scenes are always being processed with respect to valence.

Neuroimaging of how affective valence is evaluated as part of object perception has revealed that the neural representation of valence is interconnected with the neural circuits recruited by choice, decisionmaking, and reward tasks (Lebrecht 2012). Combined with the fact that we consistently observe neural signals associated with the micro-valences of common objects (and that are collocated with the neural signals associated with strongly valenced objects), this suggests that understanding the neural and behavioral bases of valence perception will provide important insights into consumer behavior. Moreover, it indicates that although some aspects of preference may be gleaned from verbal reports, a full account of how consumers make choices regarding package design, advertisements, or brands will include neuroscientific and cognitive theory.

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Although our theory has been built on the perception of objects, we are extending our work to encompass the fact that, today, the vast majority of a consumer's visual experience is digital, meaning that the modern expression of preference and purchase decisions is often the number of mouse clicks. In particular, clicks are highly valued in the economy of the World Wide Web, because they represent an active choice by the user. Consequently, we are exploring how our understanding of valence perception for objects can be extended into the digital realm and, in particular, whether we can use this framework to predict clicks on visual images, icons, or thumbnails. The science of affective valence perception may be even more central to choice in the digital world because Web users are confronted with an ever-increasing number of visual inputs for which their choice of where to click is directly driven by the visual quality of the icon or image. For example, one might read a particular news story because of the lead photograph, watch a video because of the thumbnail representing it, or click on a product icon to obtain further information. All of these choices represent a new form of consumer behavior and one in which neuroscience and cognitive science have a great deal to say about how preference arises from visual inputs.

At the same time, we face significant scientific and practical challenges in the application of neuroscience to real-world behaviors. In the future, for neuroscience to offer solutions to large-scale, real-world problems, such as maintaining online user engagement, experimental insights from the brain must be transformed into products or neurotechnologies with the potential to scale outside of the lab. This means that for our theoretical and experimental understanding of valence perception to actually improve the visual appeal of thumbnails, icons, and objects across the Web, we need to build a software solution with the ability to rapidly and automatically predict the valence of digital visual information. In response to this need, we are developing a Web-based software product that automatically selects the digital image with the most positive valence that, in turn, leads to the most online clicks. Similar neurotechnology methods, with a variety of applications, could change the ways in which brain science solves real-world problems.

References cited

Lebrecht S. 2012. "Micro-valences": Affective Valence in "Neutral" Everyday Objects. PhD dissertation. Brown University, Providence, Rhode Island.

Lebrecht S, Bar M, Barrett LF, Tarr MJ. 2012. Micro-valences: Perceiving affective valence in everyday objects. Frontiers in Psychology 3: 107. doi:10.3389/fpsyg.2012.00107

Rakison DH, Derringer J. 2008. Do infants possess an evolved spider-detection mechanism? Cognition 107: 381–393. doi:10.1016/j.cognition.2007.07.022

Sabatinelli D, Fortune EE, Li Q, Siddiqui A, Krafft C, Oliver WT, Beck S, Jeffries J. 2011. Emotional perception: Meta-analyses of face and natural scene processing. NeuroImage 54: 2524–2533. doi:10.1016/j.neuroimage.2010.10.011

Vuilleumier P, Pourtois G. 2007. Distributed and interactive brain mechanisms during emotion face perception: Evidence from functional neuroimaging. Neuropsychologia 45: 174–194. doi:10.1016/j.neuropsychologia.2006.06.003

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doi:10.1525/bio.2012.62.11.2

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