University of Pennsylvania
ScholarlyCommons

Undergraduate Humanities Forum 2009-2010: Connections

Undergraduate Humanities Forum Research Fellows

4-1-2010

Rebuilding Neuroaesthetics from the Ground Up

Benjamin Van Buren
University of Pennsylvania, vanb@sas.upenn.edu

Suggested Citation:
Van Buren, Benjamin. (2010). "Rebuilding Neuroaesthetics from the Ground Up." *2009-2010 Penn Humanities Forum on Connections.*

This paper is posted at ScholarlyCommons. http://repository.upenn.edu/uhf_2010/16
For more information, please contact repository@pobox.upenn.edu.

Rebuilding Neuroaesthetics from the Ground Up

Disciplines
Arts and Humanities

Comments
Suggested Citation:
Van Buren, Benjamin. (2010). "Rebuilding Neuroaesthetics from the Ground Up." *2009-2010 Penn Humanities Forum on Connections.*

This other is available at ScholarlyCommons: http://repository.upenn.edu/uhf_2010/16

Rebuilding Neuroaesthetics from the Ground Up

Benjamin van Buren

2009–2010 Penn Humanities Forum
Undergraduate Mellon Research Fellowship

Introduction

One of the most remarkable features of the human mind is its capacity for aesthetic appreciation. In the visual modality, aesthetics can be defined as the ability to derive pleasure from arrangements of colors, forms and patterns. This piece of our psychology acts in subtle ways, but it nonetheless plays an extremely consequential role in many people's lives. The sense of aesthetics is a product of activity in our brains, and it follows that it can be studied using empirical methods. The goal of neuroaesthetics is to apply techniques from experimental psychology to the study of aesthetic appreciation.

Philosophical aestheticians have long puzzled over the exact connection between the sense of aesthetics and works of art. Historically, these two subjects have almost always been discussed together, but this has not lead to a consensus regarding their relationship, or even their individual definitions (Tolstoy, 1896). The experience of looking at an artwork results from the contributions of many component processes, and our sense of aesthetics operates on many percepts that are not works of art. In this paper, I will argue that neuroscientists are well equipped to study simple visual aesthetics, but that they should carry out this research program without using artworks as stimuli. In order to argue this point convincingly, I will attempt to integrate perspectives from evolutionary psychology, art history, philosophical aesthetics and cognitive neuroscience.

The Evolution of Artistic Behaviors

Recently, a number of authors have argued for the existence of an "art instinct" (Dutton, 2009; Dissanayake, 1998). These scholars suggest that tendency to make art, be it music, or paintings, or theatrical productions, is biologically ingrained in the human psyche as the result of the survival advantage that these behaviors brought our Pleistocene ancestors. According to them, each of the many behaviors that we now call "the Arts" was originally used in socially important situations. Individuals who

derived pleasure from these activities were more likely to participate in communal rituals, and this ultimately led to the spread of their genetic material within the group (Dissanayake, 1998).

In *What is Art For*, Ellen Dissanayake writes that early humans thus created an environment that favored the evolution of an elaborate sense of aesthetics, and that this was the origin of our universal preference for decorative colors, forms and patterns. Her argument accounts for the fact most societies make use of art objects in the context of group rituals. However, it seems unlikely that early humans would have begun decorating objects without the preexisting ability to derive pleasure from visual percepts. This suggests that the earliest human aesthetics developed sometime before we began to generate artwork.

The Origin of Visual Aesthetics

In addressing this question, we are immediately confronted with the problem of whether "aesthetics" refers to one faculty or many. We use the term "beauty" to describe the experience of viewing decoration, attractive faces and elements of nature such as trees or waterfalls. Furthermore, an aesthetic experience often draws on our ability to take pleasure in many aspects of a single percept. For example, the beauty of a waterfall consists in our enjoyment of the colors, forms and patterns of motion therein.

Steven Pinker has speculated that an aesthetically pleasing stimulus is one that is clear, and hence easily processed by the visual system (Pinker, 1997). He does not go so far as to say that the capacity for aesthetic pleasure is adaptive, but others, such as Francis Steen, have suggested that the sense of aesthetics helps us to calibrate our perceptual systems during post-natal development (Steen, 2006). Steen characterizes aesthetic stimuli as those exhibiting "ordered complexity…or evidence of what we might term a generative order." In other words, infants' proclivity towards clearly defined patterns and forms might help them to learn the rules (such as perspective and object-occlusion) needed to navigate the visual world.

This view accounts for the enthusiasm shown by babies the world over for patterns and sharply contrasting images (Fantz & Nevis, 1967). However, given the great similarity between the visual systems of humans and other primates, we are left wondering why monkeys turn a blind eye on Mondrian. Steen and others have argued passionately that chimps do in fact derive pleasure from painting, but because these creatures do not make art without external prompting it seems unlikely that they possess an "aesthetic drive" akin to ours.

Alternatively, our ability to derive pleasure from formal aspects of visual stimuli might exist as a by-product of other aspects of our psychology. In the past, biologists and biological anthropologists have often been unduly tempted to try to explain all of an organism's features in terms of adaptivity. Scientists Richard Lewontin and Stephen Jay Gould criticize this mentality in a now-classic essay entitled *The Spandrels of San Marco and the Panglossian Paradigm: A Critique of the Adaptationist Programme.* They explain that the dome of Venice's Saint Mark's cathedral is held up by four arches, and that these arches are separated by triangular spandrels bearing images of the apostles. Although the positioning of these mosaics makes for a lovely composition, one would not say that the spandrels exist for the sake of these designs. Rather, the spandrels are necessary to the structural integrity of the building, leaving the mosaics as somewhat of an afterthought. In evolutionary terms, a structure that appears to be the result of natural selection might also be the by-product of another structure that in fact is.

Is the capacity for aesthetic appreciation a spandrel? Perhaps it is an offshoot of the mental architecture that allows us to appreciate a beautiful face, or a beautiful day. For present purposes, the true origin of visual aesthetics is not terribly important. I only wish to make the point that there are many avenues by which we might have arrived at visual aesthetics without ever making artwork.

The Relationship between Art and Aesthetics

Occasionally, somebody challenges the program of empirical aesthetics on the grounds that it is an ill-guided attempt to study a "subjective" phenomenon using the

tools of science. When asked to rate paintings or websites for preference, subjects certainly show a great deal of variation, presumably based on differences in personal experience (Pandir & Knight, 2006). However, one cannot help but wonder whether statements of preference are in fact a good reflection of a person's *aesthetic* response. An individual's preference for a particular website might be based other factors, such as its content.

Experimenters differ in whether they consider aesthetic experience to be integrated with semantic factors such as context and content. I tend towards a more conservative definition of aesthetics as the ability to derive pleasure from the forms, patterns and colors of a percept. These components are sufficient for an aesthetic experience, and so other factors are best thought of as qualifiers to the phenomenon we are interested in. Researchers who study the neural correlates of the "art experience" face the enormous challenge of distinguishing between data corresponding to semantic versus aesthetic processing.

In *Art as Experience,* John Dewey provides an eloquent expression of the fundamental difference between aesthetic perception and recognition:

> Recognition is perception arrested before it has the chance to develop freely…Bare recognition is satisfied when a proper tag or label is attached, "proper" signifying one that serves a purpose outside the act of recognition…The esthetic or undergoing phase of experience is receptive. It involves surrender. But adequate yielding of the self is possible only through a controlled activity that may be intense. In much of our intercourse with our surroundings we withdraw; sometimes in fear, if only of expending unduly our store of energy; sometimes from preoccupation with other matters, as in recognition. (53-54)

The idea that semantic and aesthetic processing are distinct has existed for a long time and, indeed, this was motivating ideology behind many works of abstract art in the 20th century[1].

[1] Alfred Barnes went so far as to hang silverware on the walls of his house, recontextualizing these pieces of cutlery as purely aesthetic objects.

So what, then, is the exact relationship between visual aesthetics and works of art? In some cases, such as Marcel Duchamp's *Fountain*, there is almost no connection. However, it is undeniable that most of history's art objects are noted for their ability to evoke aesthetic pleasure in the viewer. Artworks, from ceremonial masks to surrealist landscape paintings, have always existed in order to convey messages to their viewers. These messages can pertain to the status of the work's owner, or to the sacredness of the space where the work is kept. Most recently, these messages are related to the emotions or ideas of the artist. In manufacturing a work of art, the artist is faced with the challenge of conveying his message as effectively as possible. He will often employ designs, colors and patterns that stimulate the viewer's sense of aesthetics in order to get his point across.

Art in Experiments

The use of artworks as stimuli in experiments introduces many non-aesthetic variables that can nevertheless influence subjects' judgments of preference. For example, a person who recognizes the hand of a particular artist might subsequently choose to concentrate on different components of a painting. It is for this reason that some experimenters recruit only "artistically-naïve" participants, but given that everybody in the population has been exposed to art of some form, and given the enormous variation in the art to which different people are exposed, picking a representative sample can be challenging.

When it comes to data analysis, works of art present an even greater problem. If a researcher is interested in determining the contribution of a given attribute to the aesthetic experience,[2] then an experiment must be set up that controls for every variable except for the one in question. Any two works of art will inevitably differ across multiple attributes, and so their use as stimuli makes it difficult to draw serious

[2] This would, of course, have to be determined indirectly. The experimenter would manipulate a single variable, such as color warmth, and look for corresponding changes in viewing-time, preference ratings, eye-movements, etc.

conclusions about the relationship between a single attribute and a subject's aesthetic response. These sorts of problems can be solved through the use of abstract, computer-generated patterns as stimuli. [3]

Berlyne himself discussed the pros and cons of using artworks, rather than simple visual patterns in experiments on the psychology of aesthetics:

> In the former case, there is the advantage of studying reactions to real art and the disadvantage that any two works of art differ from each other in several different respects, so that the actual factor responsible for any differences in reactions to them is difficult to pin down. The use of artificially simple material overcomes this drawback but may be open to criticism that it is a long way from anything that could be regarded as art and may thus prevent us from identifying essential components of real-life aesthetic behavior. (Berlyne, 1971)

There are a few reasons why one might react skeptically to Berlyne's claim that exposing subjects to images of artwork constitutes a study of "real-life aesthetic behavior." Some would argue that people constantly make aesthetically informed decisions regarding what to wear, where to sit and which brand of gum to buy. In this sense, artworks form only a small subset of the objects and environments that we subject to aesthetic processing.

Those who hold the Kantian view that aesthetics is grounded in our appreciation of the "sublime" might insist that full-fledged aesthetic experience requires a prolonged period of disinterested contemplation (Kant, 1764). However, proponents of this view will likely acknowledge that this sort of beauty can easily be found in a natural setting, when we spend time looking at trees or waterfalls. It is clear that we can take pleasure in a variety of visual percepts, and that not all of these are works of art.

---

[3] In addition to holding virtually no semantic information, computer-generated patterns can be manipulated with a great deal of precision. Some will argue that these patterns are "unnatural," and this may well be the case. However, were it not for psychologists' use of unnatural stimuli in experiments, we would never have discovered such edifying phenomena as the McGurk effect.

Neuroscience and Art

The field of neuroaesthetics is still very young, and it holds a great deal of promise. An increasing number of researchers have recognized aesthetics as a tangible component of conscious visual experience—one deserving of serious investigation. In the past decade, cognitive neuroscientists have conducted studies, opened labs and founded research institutes devoted to studying the neural correlates of aesthetic appreciation. These researchers have won millions of dollars in grants, and they have employed a variety of methods, including fMRI, MEG and lesion studies.

Many neuroaesthetics researchers have, at one time or another, chosen to use artwork as stimuli. For examples, see work by Zeki (2004), Vartanian (2004) and Livingstone (2004). These researchers generally acknowledge the existence of a purely perceptual aesthetics, and they believe that simple aesthetic judgments play a significant role in the art experience. They view artistic appreciation as an interplay between the viewer's aesthetic, emotional and cognitive responses.

Chatterjee (2003) has proposed a neurocognitive framework with which to describe the art experience. At a low level, our visual system responds to the aesthetic qualities of a percept. Symmetrical, colorful and elaborate compositions engage frontoparietal attentional structures, and these areas reciprocally modulate visual processing, leading to a positive feedback loop. Within this framework, the emotional response to an artwork is separate from aesthetic processing, but it is still an essential component of the art experience. Activity in the brain's reward circuitry is presumed to play a role in emotional response, although the distinction between "liking" and "wanting" has not been worked out at the neural level.

Studying the neural response to art can be extremely challenging. When subjects make judgments about a work's aesthetic value, one sees activity in areas associated with vision, attention, memory, decision-making and emotion. The time course in which these structures become engaged is unclear, and it is difficult to measure the

amount of cross talk between them. Thus, although we have a basic understanding of the neural activity that might be responsible for the art experience, it is difficult to imagine how today's imaging techniques could be used to explain the difference between appreciating a painting by Masaccio and enjoying a work by Memling.

I am not arguing that research into the neurocognitive basis of the art experience is inherently wrong. Rather, I have tried to demonstrate the importance of simple visual aesthetics as a pervasive part of conscious experience in and of itself. The sense of aesthetics is one of the most striking aspects of our psychology, and it can be studied using empirical methods. So far, much of the conversation on the psychology of aesthetics has revolved around the mystery of why we make art. I believe that visual aesthetics can and should be understood separately from art, and that this will be an important step towards the establishment of neuroaesthetics as a full-fledged subfield of empirical psychology.

References

Berlyne, D. E. Aesthetics and psychobiology. New York: Appleton-Century-Crofts, 1971.

Cela-Conde, C. J., Marty, G., Maestu, F., Ortiz, T., Munar, E., Fernandez, A., et al. (2004). Activation of the prefrontal cortex in the human visual aesthetic perception. Proceedings of the National Academy of Sciences, U.S.A., 101, 6321–6325.

Chatterjee, Anjan. "Prospects for a Cognitive Neuroscience of Visual Aesthetics." Bulletin of Psychology and the Arts 4, no. 2 (2003): 55-60.

Dissanayake, Ellen. What is Art for?. 4th. Washington DC: University of Washington Press, 1998. Print.

Dutton, Denis. The Art Instinct: Beauty, Pleasure and Human Evolution. 1st. New York: Bloomsbury Press, 2009. Print.

Jacobsen, T. (2006). Bridging the arts and sciences: A framework for the psychology of aesthetics. Leonardo, 39, 155–162.

Jacobsen, T., Schubotz, R. I., Höfel, L. & von Cramon, D. Y. (2006). Brain correlates of aesthetic judgment of beauty. NeuroImage, 29(1), 276-285.

Kant, Immanuel. *Observations on the Feelng of the Beautiful and Sublime.* Translated by John T. Goldhwait. University of California Press, 1961.

Kawabata, H., & Zeki, S. (2004). Neural correlates of beauty. Journal of Neurophysiology, 91, 1699–1705.

Livingstone, M. (2002). Vision and art: The biology of seeing. New York: Abrams.

Locher, Paul. "The usefulness of eye movement recordings to subject an aesthetic episode with visual art to empirical scrutiny." Psychology Science 48.2 (2006): 106-114. Web. 28 Mar 2010.

Machotka, Pavel. "Daniel Berlyne's contributions to empirical aesthetics." Motivation and Emotion 4.2 (1980): 113-121. Web. 28 Mar 2010.

Nadal, M., Munar, E., Capo, M. A., Rosselo, J., & Cela-Conde, C. J. (2008). Towards a framework for the study of the neural correlates of aesthetic preference. Spatial Vision, 21, 379–396.

Pandir, Muzeyyen and John Knight. "Homepage aesthetics: The search for preference factors and the challenges of subjectivity." Interacting with Computers 18.6 (2006): 1351-1370. Web. 28 Mar 2010.

Pinker, Stephen. How the Mind Works. 1st. New York: Norton , 1997. 524-527. Print.

Ramachandran, V. S., & Hirstein, W. (1999). The science of art: A neurological theory of aesthetic experience. Journal of Consciousness Studies, 6, 15–51.

Tolstoy, Leo. What is Art? 2nd. New York. Penguin Books, 1996/1896.

Turner, Mark and Francis Steen. The Artful Mind: A Cognitive Account of Aesthetics. 1st. New York: Oxford University Press, 2006. 57-72. Print.

Vartanian, O., & Goel, V. (2004). Neuroanatomical correlates of aesthetic preference for paintings. NeuroReport, 15, 893–897.