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Emotion Pathways in the Brain Mediate Aesthetic Preference

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Abstract

Is preference toward works of art characterized by a "disinterested" or cognitive stance (as presumed by Kant), or is it underwritten by an emotional response toward properties of artworks? While to date most investigations of this critical issue in aesthetics have involved behavioral studies, we suggest that it is also possible to address this question from a biological or neural perspective. To investigate this issue, we sought to determine the contributions of known cognitive and emotional neural pathways to aesthetic experience using *f*MRI. We hypothesized that if aesthetic preference were mediated by emotion, then it should involve brain structures that have been implicated in processing emotion. On the other hand, if aesthetic preference were primarily a cognitive process, then it should involve brain structures that have been implicated in evaluation under emotionally neutral conditions. Participants rated paintings on aesthetic preference while undergoing brain scans. The results demonstrated that activation in several cortical structures that have been implicated in processing emotion or reward covaried as a function of preference ratings. Our findings suggest that in participants with no training in the visual arts, rating paintings based on subjective aesthetic preference activates structures that mediate emotion or reward. Future work in this area should aim to dissociate the neural correlates of aesthetic preference vs. aesthetic judgment as a function of expertise in the visual arts.

Introduction

A longstanding issue in aesthetic theory and research has revolved around the role of emotion in aesthetic experience. In essence, this question can be framed as follows: Is aesthetic preference toward works of art characterized by a "disinterested" or cognitive stance (as presumed by Kant), or is it underwritten by an emotional response toward certain properties (e.g., reward value) of artworks (Kneller, 1998)? This question is of interest not only because people tend to attribute emotions to works of art (Csikszentmihalyi & Robinson, 1990; Erdos, Harvey, & Tan, 2001), but also because some have considered such emotional responses to be the cornerstone of aesthetic experience (see Neill, 2003). As Nelson Goodman said so memorably, can aesthetic experience be due to "a special secretion of the aesthetic glands?" (1976, p. 247). In fact, whereas

Goodman argued quite strongly in favor of a cognitive account of aesthetic experience, others, in particular adherents of the expression theory of art, have emphasized an account of aesthetic experience based on emotion (Spackman, 1998). It is important to note that to label aesthetic experience as "disinterested" does not preclude it from having an emotional component (Goodman, 1976; Neill, 2003). Rather, this view implies that emotion is not sufficient for aesthetic experience (see Kneller, 1998). The reverse argument—that the aesthetic experience is mediated by emotion—necessitates that aesthetic experience be accompanied by an emotional corollary.

The role of emotion in aesthetic experience has been investigated from several perspectives, including subjective/phenomenological (see Kneller, 1998), philosophical (Goodman, 1976; Neill, 2003), and behavioral/experimental (Baltissen & Ostermann, 1998; Herz, 1998). Each of these approaches contributes to elucidating this issue. Recent advances in neuroscience have made it possible to tackle this question from a biological or neural perspective. The basic logic of using brain activity to address this question is as follows: Whatever aesthetic experience is, it is underwritten by neural activity. While much about the details of brain activity remains a mystery, we do have a broad understanding of some overall organizational issues. One of these organizational principles seems to be a partial separation of cognitive and emotional processing systems in the brain (Gazzaniga, Ivry, & Mangun, 2002). Given this mode of organization, we can make the following hypothesis: If aesthetic preference were mediated by emotion, then one would expect the active rating of paintings on aesthetic preference to activate those brain structures that have been implicated in processing emotion. Of particular interest here are limbic, paralimbic, and orbitofrontal regions, but also other structures that have been implicated in processing visual stimuli that vary in emotional valence (Lane et al., 1997; Paradiso et al., 1999; Teasdale at al., 1999). On the other hand, if aesthetic preference were strictly a cognitive process unaffected by emotion, then one would expect active rating of paintings on aesthetic preference to activate brain structures other than those that have been implicated in emotion, and in particular those that have been implicated in decision making under emotionally neutral conditions. Of particular interest here is the left dorsal lateral prefrontal cortex among others, a structure that has been activated consistently in tasks that require decision-making under emotionally "cold" conditions (Goel, Buchel, Frith, & Dolan, 2000; Goel & Dolan, 2003; Goel, Gold, Kapur, & Houle, 1998).

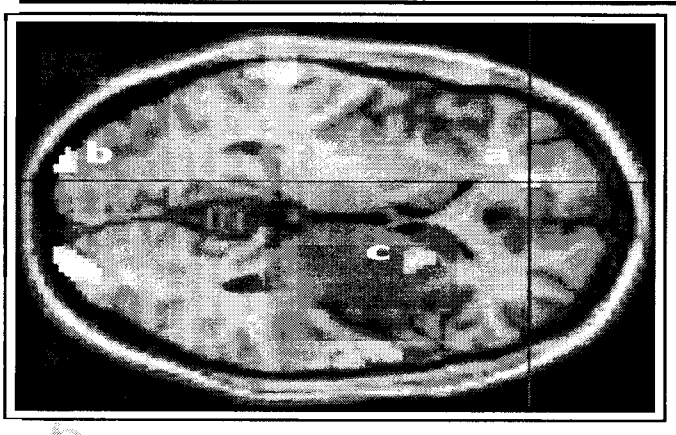
To test this hypothesis, Vartanian and Goel (2004) conducted a study to reveal the neural correlates of aesthetic preference using *f*MRI. Briefly, 12 participants were placed in the scanner and presented with various abstract and representational paintings. Participants viewed each stimulus for 6 sec., and they were instructed to determine their preference ratings for each stimulus using a 0-4 scale, where 0 indicated *very low preference* and 4 indicated *very high preference*. The primary analysis involved an investigation of brain structures where activation covaried as a function of preference ratings (for a detailed description of methods, as well as results concerning other hypotheses of interest, consult Vartanian and Goel, 2004).

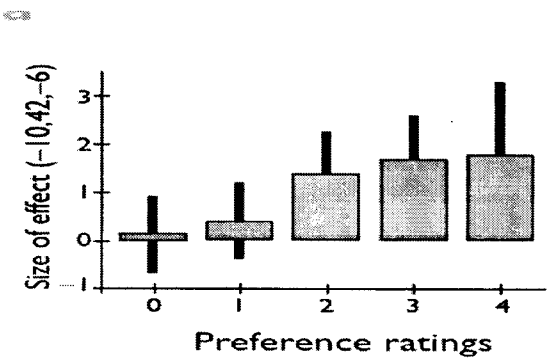
The result of the primary parametric analysis demonstrated that activation in right caudate nucleus, left cingulate sulcus, and regions of the visual cortex (bilateral occipital gyri and bilateral fusiform gyri) covaried with preference ratings (Fig. 1). All the aforementioned structures have been implicated in evaluating reward-based stimuli that vary in emotional valence. For example, results showed that activation in right caudate nucleus decreased in response to decreasing preference ratings, with minimal activation for paintings with very low preference ratings (Fig. 1c). The decrease in activation in right caudate nucleus in response to decreasing preference is in line with evidence from two different lines of research. First, imaging data on mood disorders have demonstrated that activation in caudate nucleus is lower in depressed patients than normal controls (Baxter et al., 1985; Drevets et al., 1992). One feature of depression is a decrease in the ability to experience pleasure and reward (anhedonia). Second, when participants were required to make choices that were rewarded or punished monetarily, activation in bilateral caudate nuclei decreased sharply below

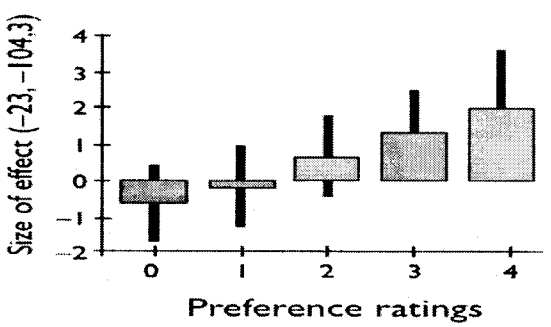
baseline when the outcome was a punishment (Delgado, Locke, Stenger, & Fiez, 2000). It was also demonstrated that the reduction in activation in the caudate nucleus was linked parametrically to magnitude and valence manipulations. Because the involvement of this region in processing emotionally salient and reward-based stimuli is well established (Aharon et al., 2001; Montague & Berns, 2002), the current results suggest that the decrease in activation in right caudate nucleus in response to decreasing preference ratings may be a specific example of its general pattern of reduced activation in response to less rewarding stimuli.

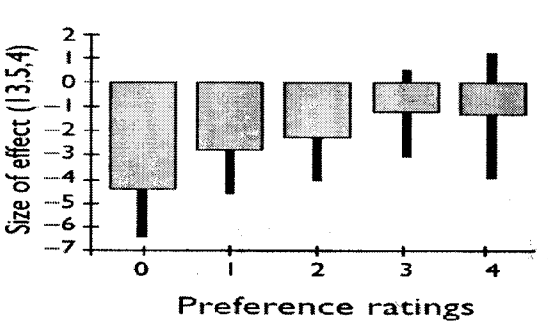
In contrast, activation in bilateral occipital and fusiform gyri (Fig. 1b) and left cingulate sulcus (Fig. 1a) increased in response to increasing preference ratings, with maximal activation for paintings with very high preference ratings. The increase in activation in bilateral occipital poles and fusiform gyri in response to increasing preference is in line with findings from several studies that have highlighted the role of primary and associative visual cortex in processing visual stimuli that vary in emotional valence. For example, it has been shown that viewing pleasant versus neutral pictures results in increased regional cerebral blood flow (rCBF) in right primary visual cortex (Paradiso et al; 1999). It has also been shown that viewing faces that convey positive emotion results in significant activation in bilateral fusiform gyri (Iidaka et al., 2002). These results suggest that primary and associative visual cortex are involved in the assessment of visual stimuli that vary in emotional valence, although the results could also imply increased visual attention in response to higher preference ratings.

Figure 1.
Activation in a. left cingulate sulcus, b. bilateral occipital gyri and bilateral fusiform gyri (not shown), and c. right caudate nucleus is related to preference for paintings. a. Graph shows increasing activation in left cingulate sulcus in response to increasing preference for a single subject. b. Graph shows increasing activation in left occipital gyrus in response to increasing preference for a single subject. c. Graph shows decreasing activation in right caudate nucleus in response to decreasing preference for a single subject.









The increase in activation in left cingulate sulcus in response to increasing preference adheres to findings from the literature on processing emotionally salient content. For example, rating as opposed to passively viewing pictures that vary in emotional valence was associated with increased activation in anterior cingulate sulcus (Taylor, Phan, Decker, & Liberzon, 2003). Attending to subjective emotion in response to picture sets was also associated with increased neuronal activity in anterior cingulate cortex (Lane, Fink, Chau, & Dolan, 1997). The current results add to a body of implying increased visual attention in response to higher preference ratings.

These results demonstrate that rating paintings on aesthetic preference engages several cortical structures that have been implicated in evaluating reward-based stimuli that vary in emotional valence. This suggests that paintings may function as stimuli that embody reward properties, and that rating them on aesthetic preference may instigate an emotional response toward their reward value. However, an important point to consider while evaluating these results is that participants were instructed to indicate their *subjective* level of preference for each stimulus, rather than their objective judgments regarding the artistic merit or quality of each stimulus. Research has shown that emotions play a bigger role in "warm" subjective preferences than in "cool" objective evaluations thereof (Machotka, 1982). Bamossy, Johnston, and Parsons (1985) have argued that whereas aesthetic *judgment* involves an evaluation of objects as works of art, aesthetic *preference* is not about the work of art per se, but rather about whether one likes or dislikes any given work of art. As such, one would expect preference ratings to be more closely linked with emotions than aesthetic judgments. Had we asked our subjects to evaluate each stimulus on aesthetic quality or merit, it is possible that different parts of the brain may have been activated. In fact, it seems to us that a study designed specifically to dissociate the neural pathways that underlie aesthetic preference vs. aesthetic judgment would be the next logical step to pursue.

Previous research has also demonstrated that level of expertise in art affects the evaluation of paintings (Hekkert & van Wieringen, 1996). Therefore, to minimize the extent to which preference ratings would be affected by variation in art education, we specifically recruited a rather homogeneous sample with no training in the visual or fine arts. However, it is quite possible that when participants with expertise in art are asked to rate paintings on aesthetic preference, they may pursue different strategies for determining their evaluations. To the extent that those strategies may vary from those used by novice s participants (especially to the extent that they engage emotion), one would expect to acquire a different pattern of results from those obtained by Vartanian and Goel (2004). Therefore, a potentially fruitful study would involve an exploration of the extent to which the neural correlates of aesthetic preference may vary as a function of expertise in the visual or fine arts.

Conclusion

Our results demonstrated that activation in several cortical regions that have been implicated in processing emotion and reward covaried as a function of aesthetic preference ratings. These results suggest that cortical structures that mediate emotions are engaged when participants untrained in the visual arts rate paintings on aesthetic preference. Future work should aim to dissociate the neural correlates of aesthetic preference and aesthetic judgment as a function of expertise in the visual arts.

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