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## Notes Towards a (Neurobiological) Definition of Beauty<sup>1</sup>

### Introduction

There have been many definitions of beauty, but none of them is wholly or even partially satisfactory.

My favourite is the one given by Edmund Burke, partly because it says nothing and partly because it says everything.

In his *Philosophical Enquiry into the Origin of Our Ideas of the Sublime and Beautiful*, Burke wrote that “Beauty is, for the greater part, some quality in bodies acting mechanically upon the human mind by the intervention of the senses” (Burke, 1757). Burke says nothing here about what that “some quality” in bodies amounts to, although he makes an attempt in the pages preceding his definition beginning by specifying what beauty is not. The quality is not, according to him, to be sought in proportion or in perfection, regardless of whether one is considering artefactual beauty, as in buildings, or biological beauty, as in human bodies. For him, both types of beauty have nothing to do with proportion or perfection, and although he knew “that it has been said long since, and echoed backward and forward from one writer to another a thousand times, that the proportions of buildings have been taken from those of the human body”, he nevertheless thought that “the human figure never supplied any architect with any of his ideas”. This dismissal of proportion and perfection would no doubt shock many today; it would have surprised Polykleitos, Vitruvius, Albrecht Dürer, and Leonardo Da Vinci, had they been around when he wrote it; Vitruvius himself claimed to have drawn inspiration from human proportions in his architectural designs; Leonardo in turn, in his *Vitruvian Man*, drew inspiration from the Vitruvian principles of architecture in his rendering of the human body as a “*cosmografia del minor mondo*”, although Burke was probably correct to question whether the final product is beautiful, in spite of its adherence to defined proportions. Nor is beauty to be found, according to Burke, in mathematically

<sup>1</sup> This title is obviously inspired by, and an adaptation of, the title of TS Eliot’s essay *Notes Towards the Definition of Culture*.

determined proportions because “we begin to feel that mathematical ideas are not the true measures of beauty”, a view that Plato would no doubt have strongly objected to if he had not been safely dead when Burke wrote; it is a statement that would probably shock many mathematicians today.

So what are those qualities that characterize beauty? They are, according to him, to be found in size, smoothness, delicacy, variation and colour, a list so vague that hardly anyone will agree to it.

Nor does Burke say anything explicit about beauty as an experience or about the experiencing individual; he does not specify what “mechanically” is; he writes about the “mind” rather than the brain, and he does not qualify what constitutes the “intervention” of the senses. The latter is not surprising; he was writing at a time when even less was known about the brain than is today.

What is surprising and sets his definition apart is that, in spite of this vagueness and in spite of his dismissal of features that, to many, are essential to the experience of beauty, his definition is very specific in specifying that the brain, with its sensory apparatus, is critically involved in the experience of beauty. This is really the starting point for a neurobiological definition of beauty. Indeed, two-thirds of Burke’s definition revolves around the brain, if one accepts that the mind is a direct product or result of brain activity produced by the signals that the senses channel to the brain. Hence, the value of Burke’s definition lies, for me, in acknowledging explicitly the critical role played by the brain in the experience of beauty.

### **Beauty and “Aesthetic Emotion”**

I would, if I could, rather eschew use of the term “beauty” and write and speak instead of the “aesthetic experience” or “aesthetic emotions” as Bell (1914) did. However, “beauty” is a useful shorthand term to describe an experience that although, like consciousness, is difficult to define, is nevertheless a term that the overwhelming majority of people understand, again like consciousness. It is therefore easier to communicate using the term beauty. Moreover, the term “aesthetic emotion”, taken at face value, equates the intensity of the aesthetic experience and the emotional experience. The relationship between the two has indeed been the subject of much debate, with some thinking that the two are separate and others that they are inseparable (Wimsatt & Beardsley, 1949; Costelloe, 2004; Kant, 1790; Goodman, 1976; Tolstoy, Pevear & Volokhonsky, 1995). Moreover, Bell’s view that the “aesthetic emotion” constitutes a special emotion, which defines a work of art is not shared by others like Roger Fry who believed instead that art communicates ordinary emotions (Guyer, 2014). Until such issues are resolved, the use of the term “aesthetic emotion” must be severely qualified. Finally, it is worth noting that, given the wide acknowledgement of non-beautiful

qualities in aesthetic experience (Danto, 2002), it is perhaps wise not to replace an age-old word like beauty, which most understand.

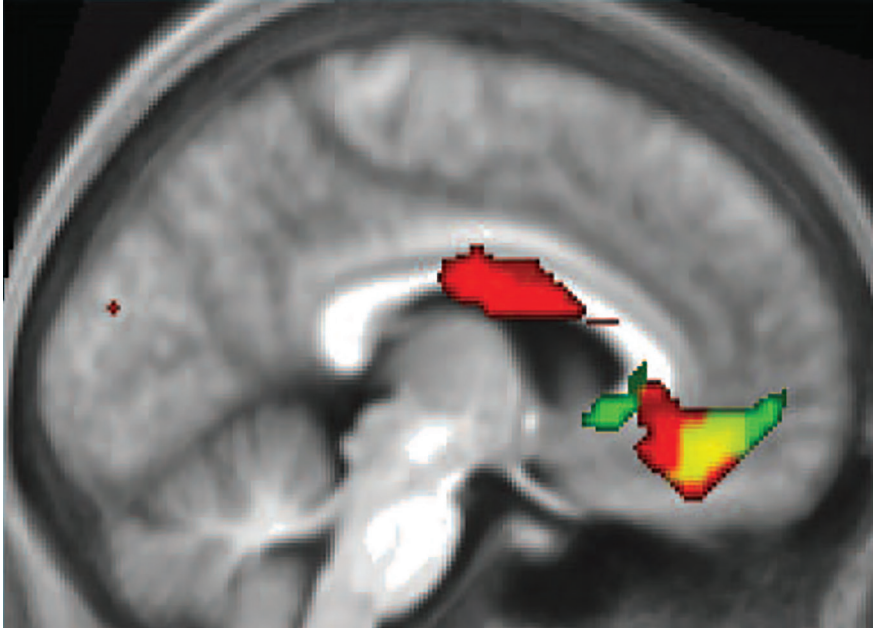
### **A Neurobiological Definition of Beauty**

In approaching a definition of beauty, perhaps a useful question to begin with is to ask what all objects that are experienced as beautiful have in common. This really is the fundamental question that Clive Bell addressed in his book *Art*. For Bell, there must be a common factor in all works that arouse the “aesthetic emotion” for “... either all works of visual art have some common quality, or when we speak of ‘works of art’ we gibber”. The discovery of this “common factor” would, for him, “... solve what I take to be the central problem of aesthetics” (Bell, 1914; note that Bell was equating art with beauty, which is not my position). No such common factor has ever been identified, except in neurobiology.

Perhaps, therefore, a much more useful approach to the definition of beauty would be one that has its source in the results of neurobiological studies of the experience of beauty derived from different sources; these include sensory (Ishizu & Zeki, 2011), moral (Tsukiura & Cabeza, 2011) and highly cognitive (Zeki, Romaya, Benincasa & Atiyah, 2014) ones, as well as sensory experiences that have harmonious relationships (in colour) (Ikeda et al., 2015) and opposite emotional valences (such as joy and sorrow) (Ishizu & Zeki, 2017). The experience of beauty, and even a memory of it (Tsukiura & Cabeza, 2011), derived from all these sources correlates with activity in a given, specific, part of the emotional brain, namely, field A1 of the medial orbitofrontal cortex (A1mOFC) (Figure 1). Moreover, the activity there that correlates with the aesthetic experience is quantifiable (Kawabata & Zeki, 2008a; Ishizu & Zeki, 2011), since it is directly proportional to the declared intensity of the aesthetic experience. Note that such an activity is unspecific with regard to the stimulus that triggers the experience, since the triggering stimulus could be sensory, internal (as in moral) or highly cognitive (as in mathematical beauty) and, in the latter instance, can even be an idea generated *de novo* by the brain.

Hence, within the limits of the sources of the aesthetic experience that have been studied, we can perhaps give not so much a definition of beauty as a key necessary condition for a definition of beauty. It is, however, a definition that is strictly neurobiological: *Beauty is an experience that correlates quantitatively with neural activity in a specific part of the emotional brain, namely, in the field A1mOFC; the more intense the declared experience of beauty, the more intense the neural activity there.*

This of course does not mean that, elsewhere in the brain, all objects that are experienced as beautiful result in identical activity, but only that, in addition to differences in brain activity that correlate with experiences of different kinds of beauty, there is a common area, A1mOFC, which appears always to correlate



**Fig. 1** Mid-sagittal section through the human brain to show the brain activity in field A1 of the medial orbitofrontal cortex (A1mOFC) that correlates with the experience of musical (green) and visual (red) beauty. The yellow region corresponds to field A1mOFC. The experience of beauty derived from other sources (including highly cognitive sources, such as mathematics) also correlates with activity in the same part of the emotional brain. From Ishizu, T and Zeki, S (2011). PLoS One, 6, e21852 doi:10.1371/journal.pone.0021852.

with the experience of beauty, regardless of source. Hence, again within a strictly neurobiological context and following Bell's logic, we can say that such a definition outlines a very prominent and probably very secure path towards solving the central problem of aesthetics, namely, what all things that arouse the aesthetic emotion or the experience of beauty have in common.

### **The Inalienable Companions of Beauty**

Yet the solution raises critical issues, due to what I refer to as the inalienable companions of beauty. These are summarized as follows:

1. ***Beauty as an abstract concept:*** That the experience of beauty derived from such different sources should all correlate with activity in the same part of the brain makes of that experience something abstract, at least in neurobiological terms. However, it also raises the question of what brain mechanisms distinguish the experience of beauty derived from one source from that derived from another source. There is, as yet, no experimental answer to this question. Perhaps, the answer should be sought in the fact that the experience of

beauty derived from different sources activates different brain regions, with AI/mOFC acting as a common area.

2. ***Desire and decision-making:*** The experience of beauty is intimately linked to desire (Kawabata & Zeki, 2008a) and to choice and value-based decision-making (Wallis, 2007). Indeed, the same general part of the brain is involved critically during the experience of desire (Kawabata & Zeki, 2008b) and during decision-making. However, it remains to be seen, through future experimentation, whether there are distinct subdivisions within the medial orbitofrontal cortex (mOFC) that are critical for these linked but distinct experiences.
3. ***Pleasure and reward:*** The experience of beauty, being a rewarding and pleasurable experience, can also not be separated from reward and pleasure, both of them experiences which have, as correlates, activity in the mOFC (Berridge & Kringelbach, 2013; Grabenhorst & Rolls, 2011). However, the converse is not true, in that the experience of pleasure and reward can be separated from the experience of beauty. The fact that all three experiences correlate with activity in the same part of the brain, namely, the mOFC, once again raises the question of how reward and pleasure are distinguished from the experience of beauty. With reward, it is possible that distinct subdivisions of mOFC are implicated, while with pleasure, it may be useful to entertain a different possibility. The experience of pleasure and reward, just like the experience of beauty, is linked to activity in the mOFC quantitatively, that is to say the greater the declared experience of pleasure or beauty, the more intense the activity in mOFC. These are hypothetical suggestions that simply point to a future possibility that the distinguishing feature between pleasure and beauty may be sought in a difference in intensity of activity in the mOFC.

Hence, the neurobiological definition of beauty that I gave earlier raises other, unresolved, questions of a neurobiological nature. However, it is gratifying to know that the questions thus raised are very similar to the unresolved ones raised in philosophies of art and aesthetics (Graham, 2005).

### **Acknowledgment**

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### **Summary**

Humans know when they themselves experience beauty, even though the term itself has been difficult to define adequately for a variety of reasons. Given this centuries' old failure to give an adequate definition of beauty, perhaps the time has come to enquire whether the experience of beauty, regardless of its source, can be defined in neural terms.

**Keywords:** Beauty, aesthetic emotion, medial orbitofrontal cortex (mOFC).

# Anmerkungen auf dem Weg zu einer (neurobiologischen) Definition von Schönheit.

## Zusammenfassung

Wenn Menschen selbst die Erfahrung von Schönheit machen, dann wissen sie es, obwohl es bisher aus einer Vielzahl von Gründen schwierig war, den Begriff selbst angemessen zu definieren. Vor dem Hintergrund dieses jahrhundertelangen Scheiterns an einer adäquaten Definition von Schönheit ist es nun vielleicht an der Zeit zu untersuchen, ob die Erfahrung von Schönheit, unabhängig von ihrem Ursprung, in neuronalen Begriffen definiert werden kann.

**Schlüsselwörter:** Schönheit, ästhetisches Gefühl, medialer orbito-frontaler Cortex (mOFC).

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