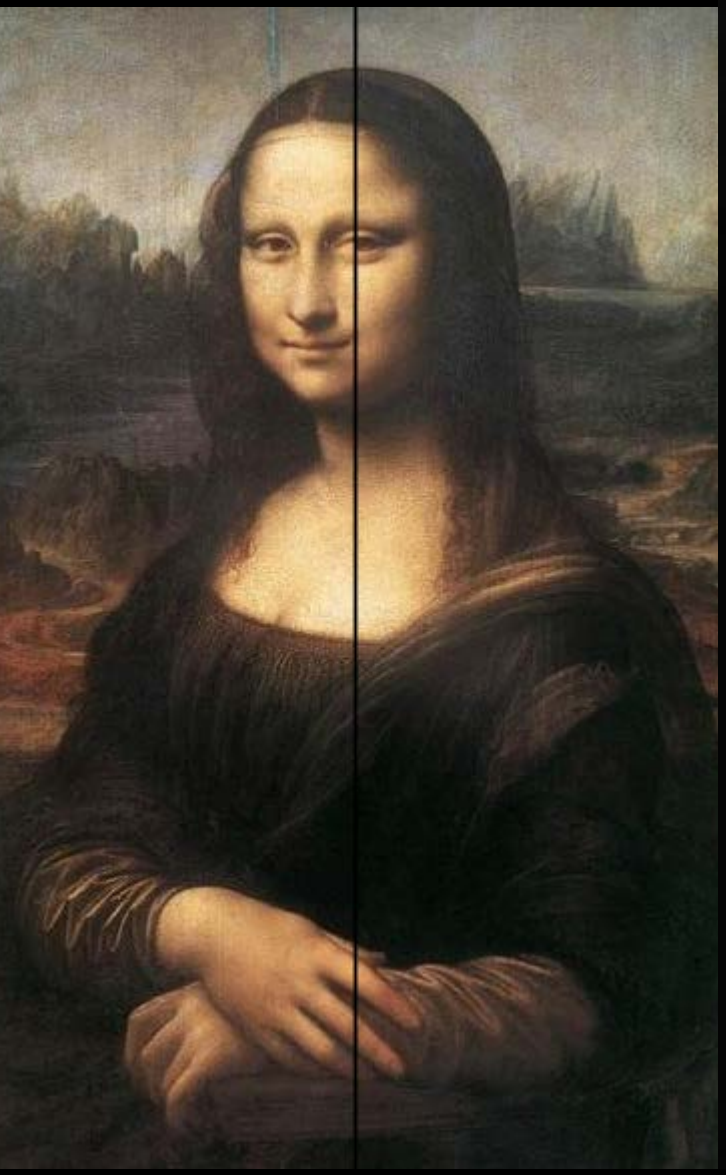

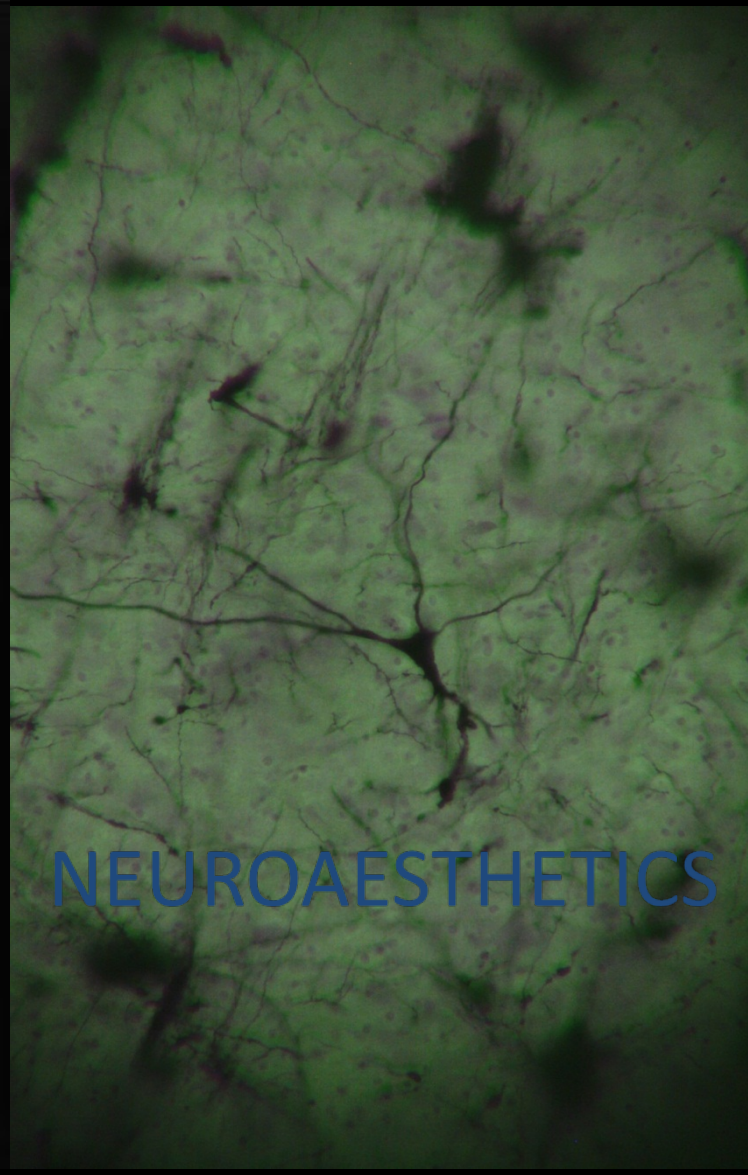

NEUROAESTHETICS

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In neuroaesthetics, models from cognitive psychology are used in studies on *how the brain responds to aesthetic stimuli*.

Zeki's main interest is the organization of the primate visual brain.

In 1994, he began to study the neural basis of creativity and the aesthetic appreciation of art.

In 2001, he founded the Institute of Neuroesthetics, This institute, the first of its kind in the world, is attached to the Wellcome Laboratory of Neurobiology (Vislab) at University College London.

The aims of the institute are:

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•to instill among neurobiologists the virtues of using the products of art to study the organization of the brain;

•to promote the importance of learning more about the brain when approaching topics such as art, morality, religion,

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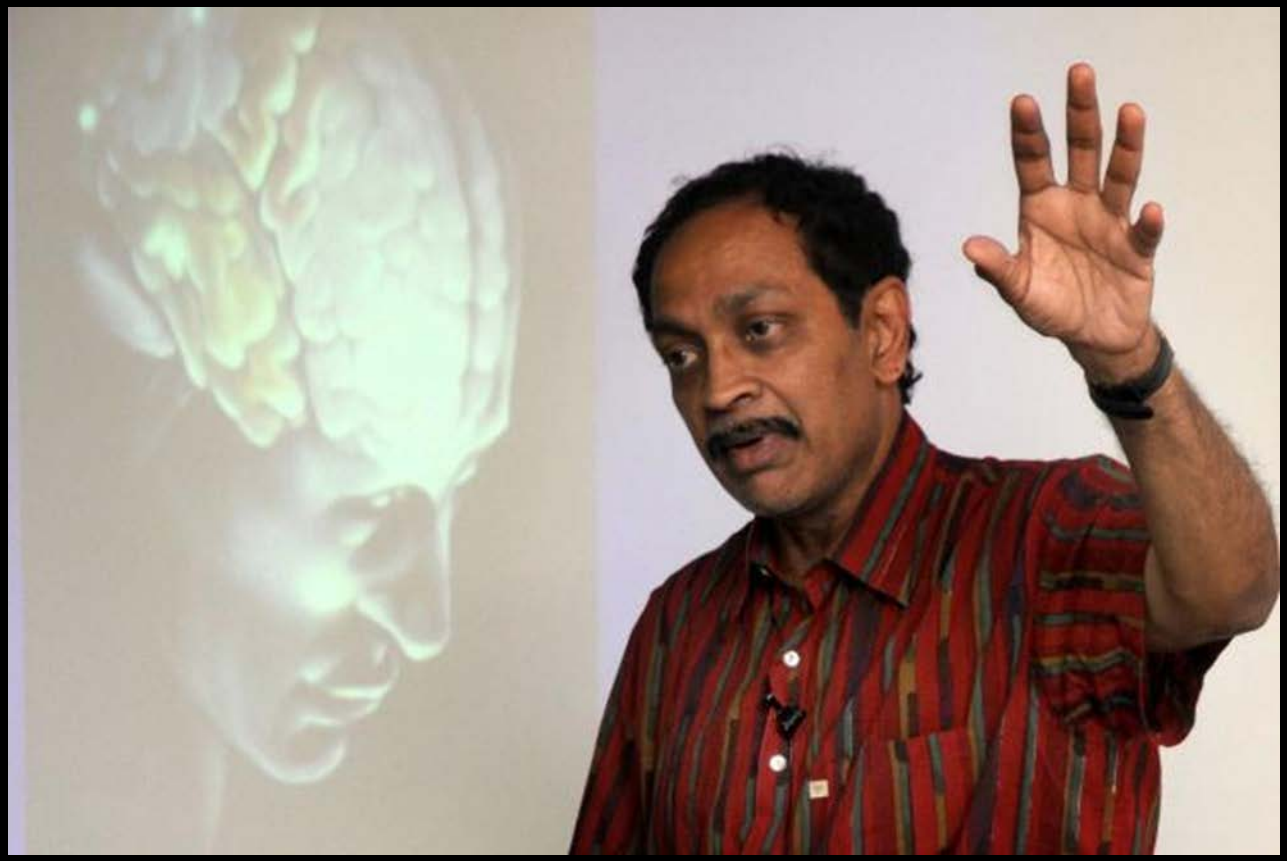

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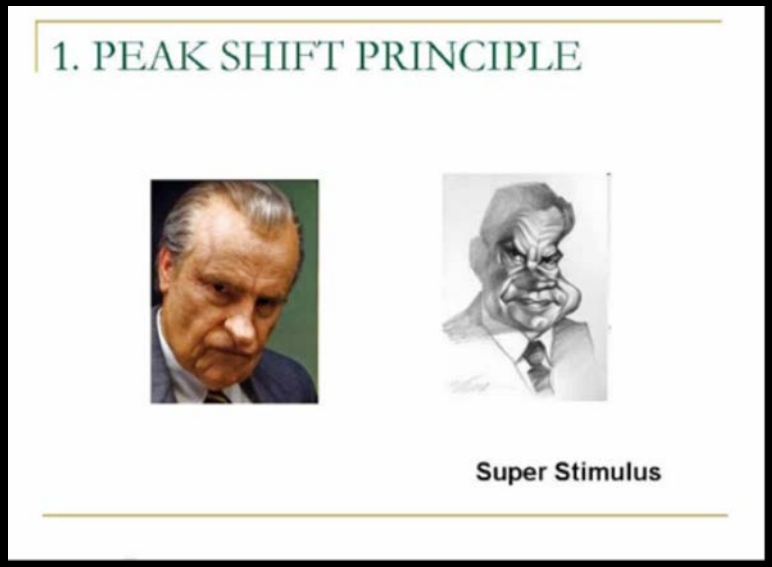
Venus of Willendorf
Indian female temple sculptures
caricature drawings



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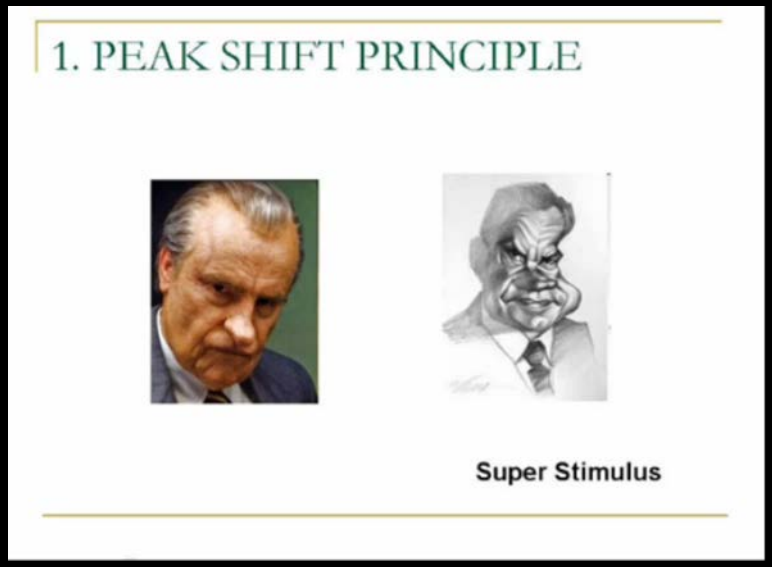

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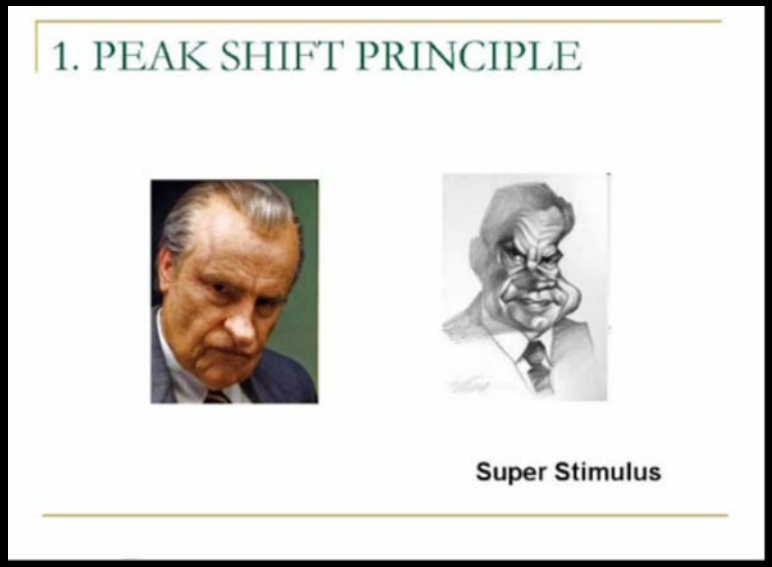

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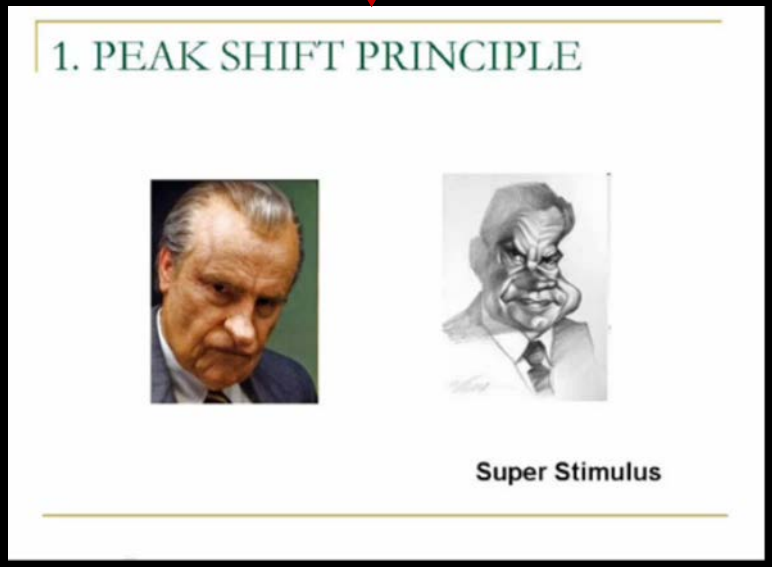

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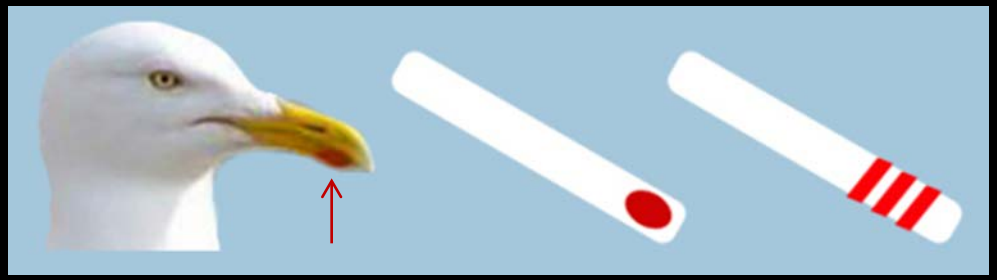

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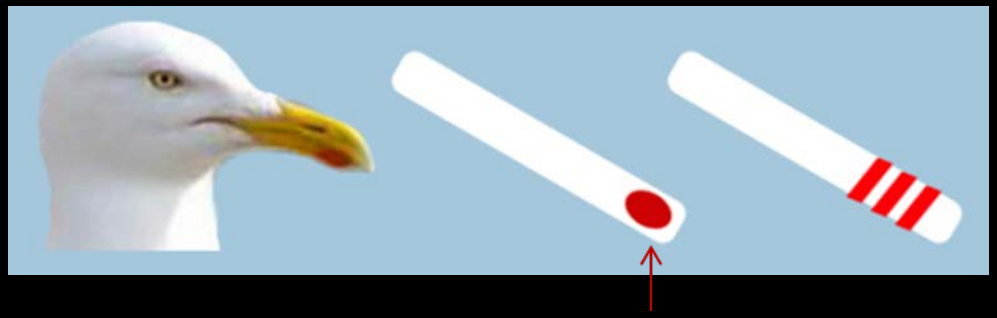

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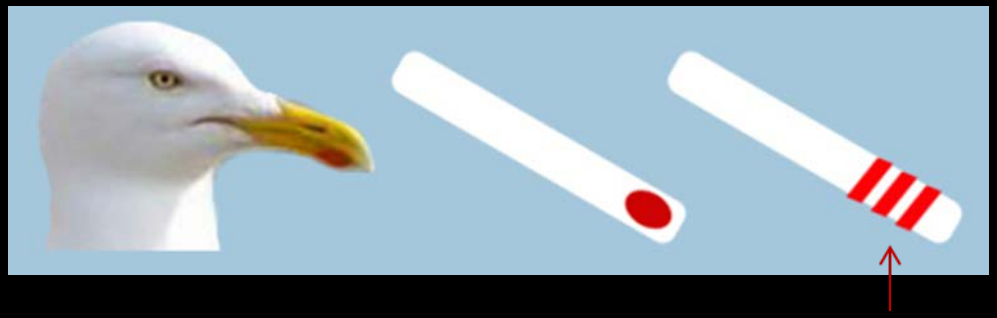

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In the words of Ramachandran: being trained to respond to one particular stimulus will lead to a preference for an exaggerated version of that same stimulus.

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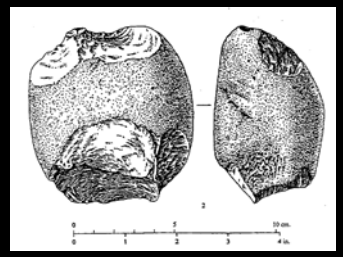
The interactionist view: beauty is grounded in the processing experiences of the perceiver that emerge from the interaction of stimulus properties and perceivers' cognitive and affective processes.

The objectivist view Among the identified features were balance and proportion, symmetry, contrast and clarity.

Intended symmetry:

Acheulean hand axes; 1,7 million years before present (BP)

The Acheulean hand axes (c. 1, 7 mill years BP - 500.000/200.000 years BP) show uniformity across wide geographical locations and throughout a considerable period of time.



a. 2 million year-old stone tools from Olduvai Gorge, Tanzania

b. Acheulean:1, 7 million year-old hand axe from West Natron, Tanzania.

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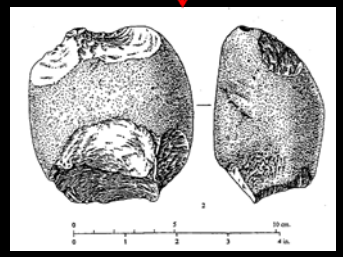

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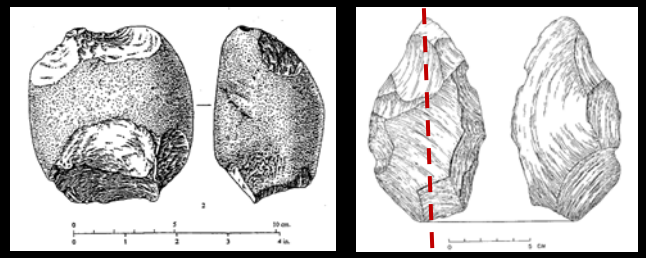

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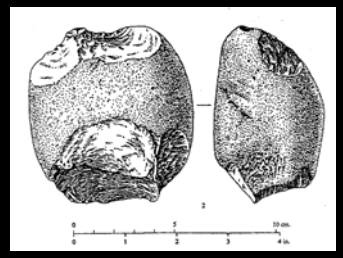
There is also strong evidence that ”symmetry became somewhat more detached from functional dictates in that a *disinterested* or more derived awareness toward symmetry tended to come to the fore” (Hodgson 2011, p. 39).



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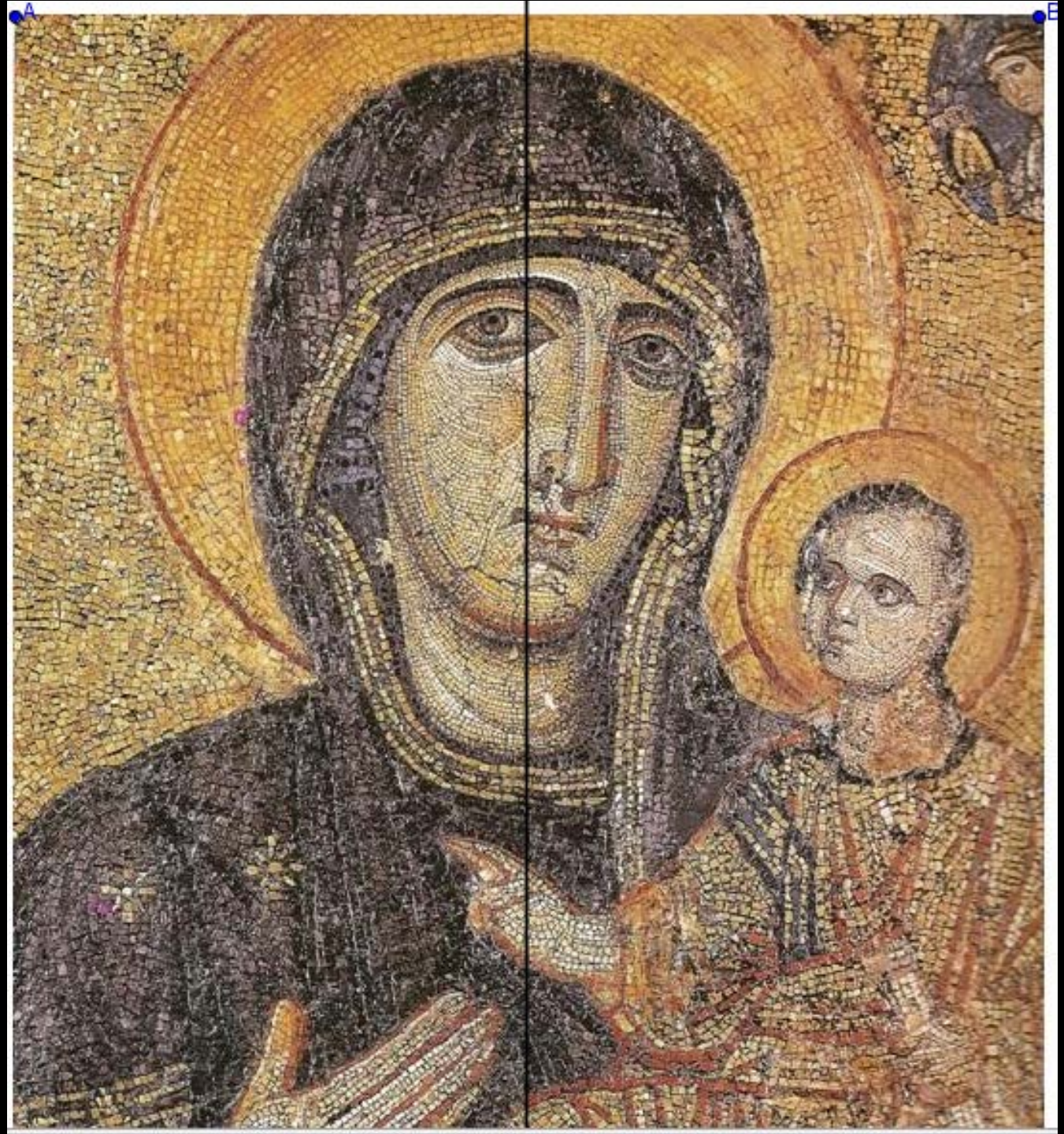
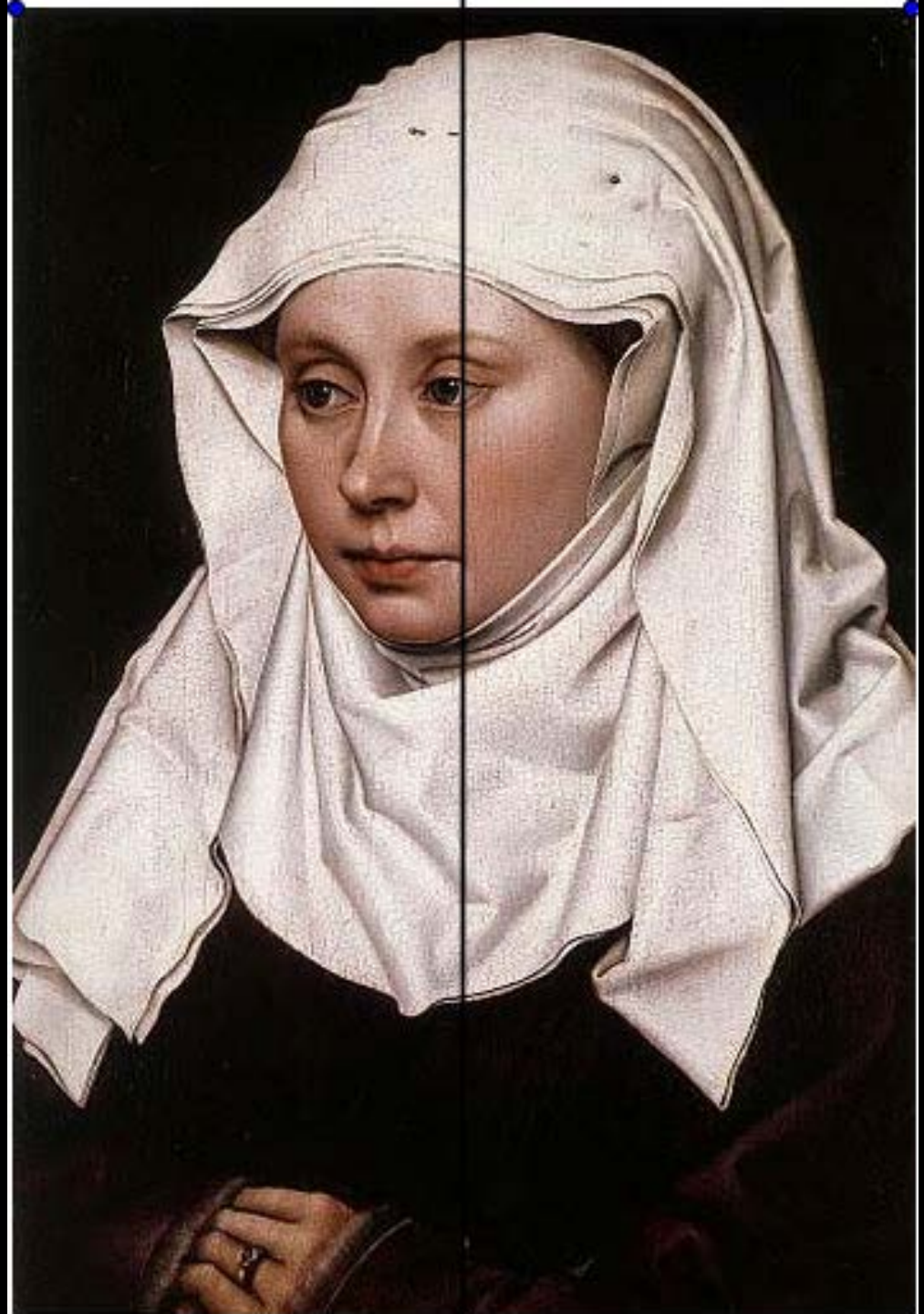
It has been assumed that an increased cognitive sophistication of *hominins* took place during this period (Hodgson, 2009).

Throughout the history of art, we more or less find that in portraits in 3/4 profile, the symmetry line passes through one of the eyes. This holds even for the Picasso cubist paintings.


A
B

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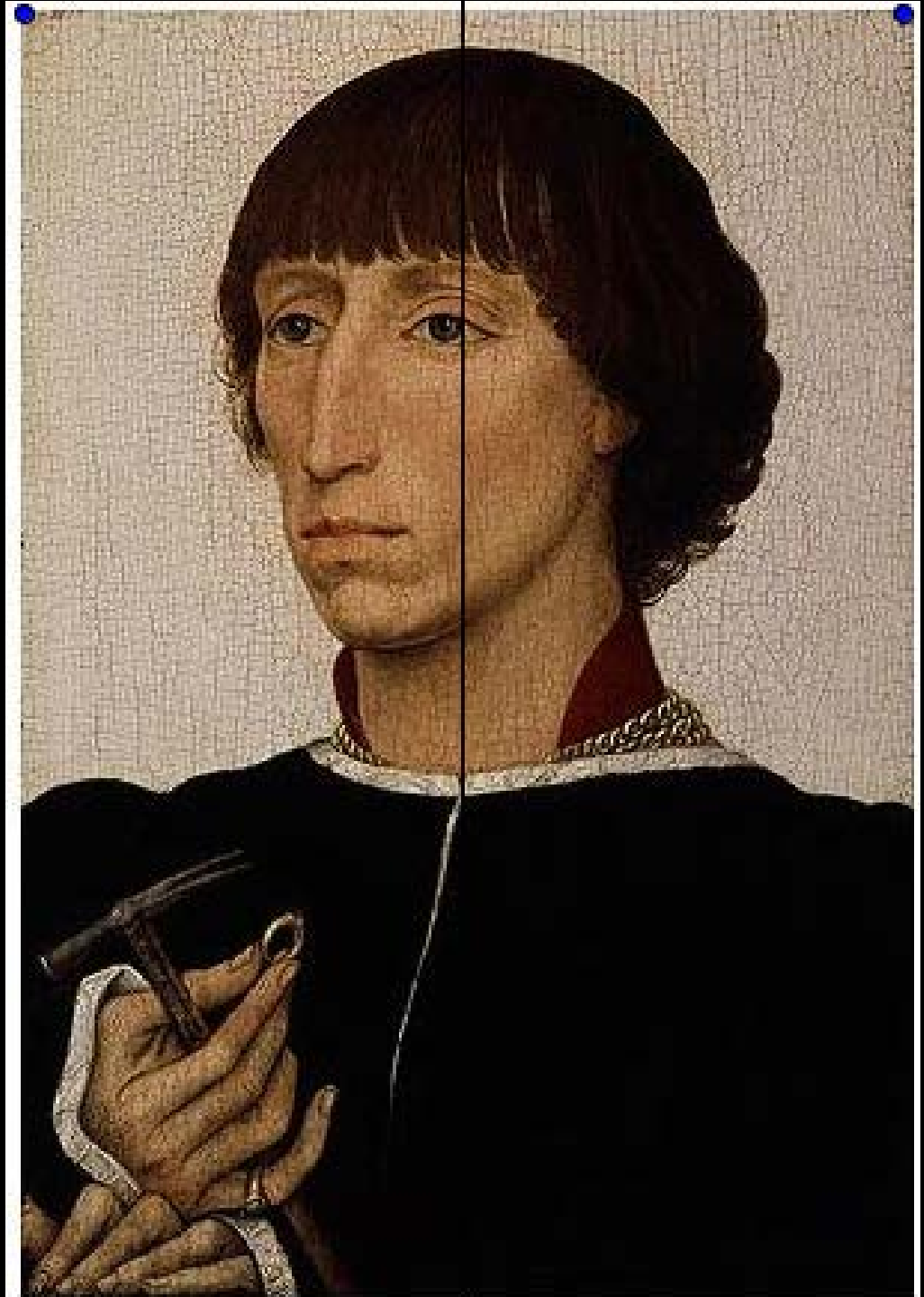

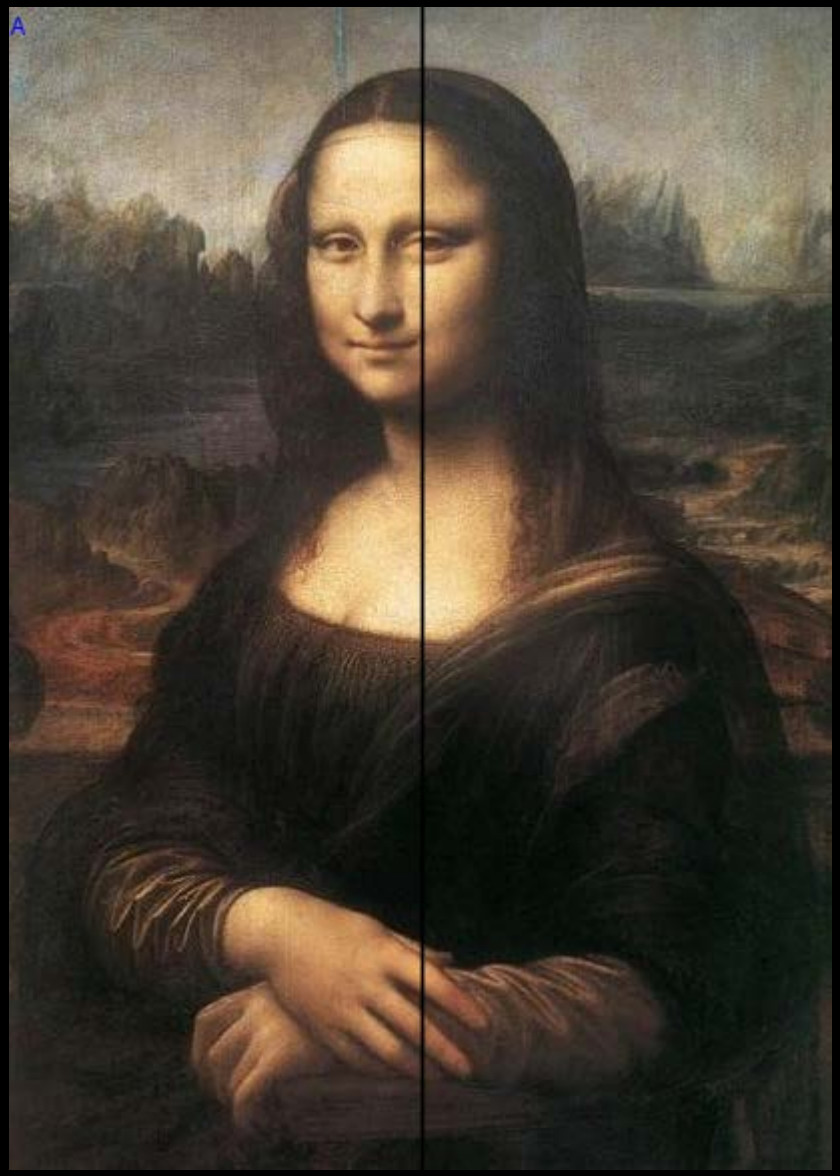
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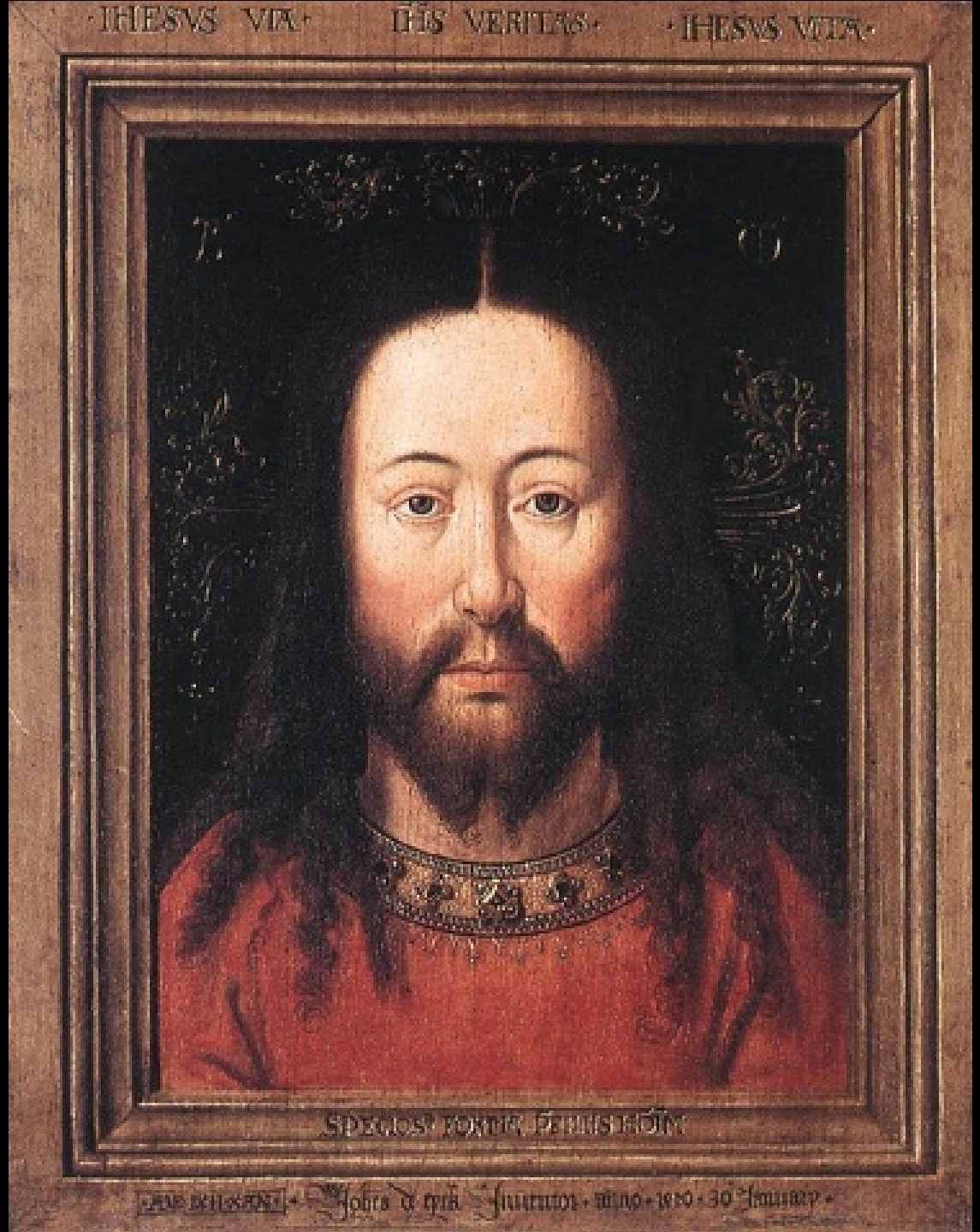
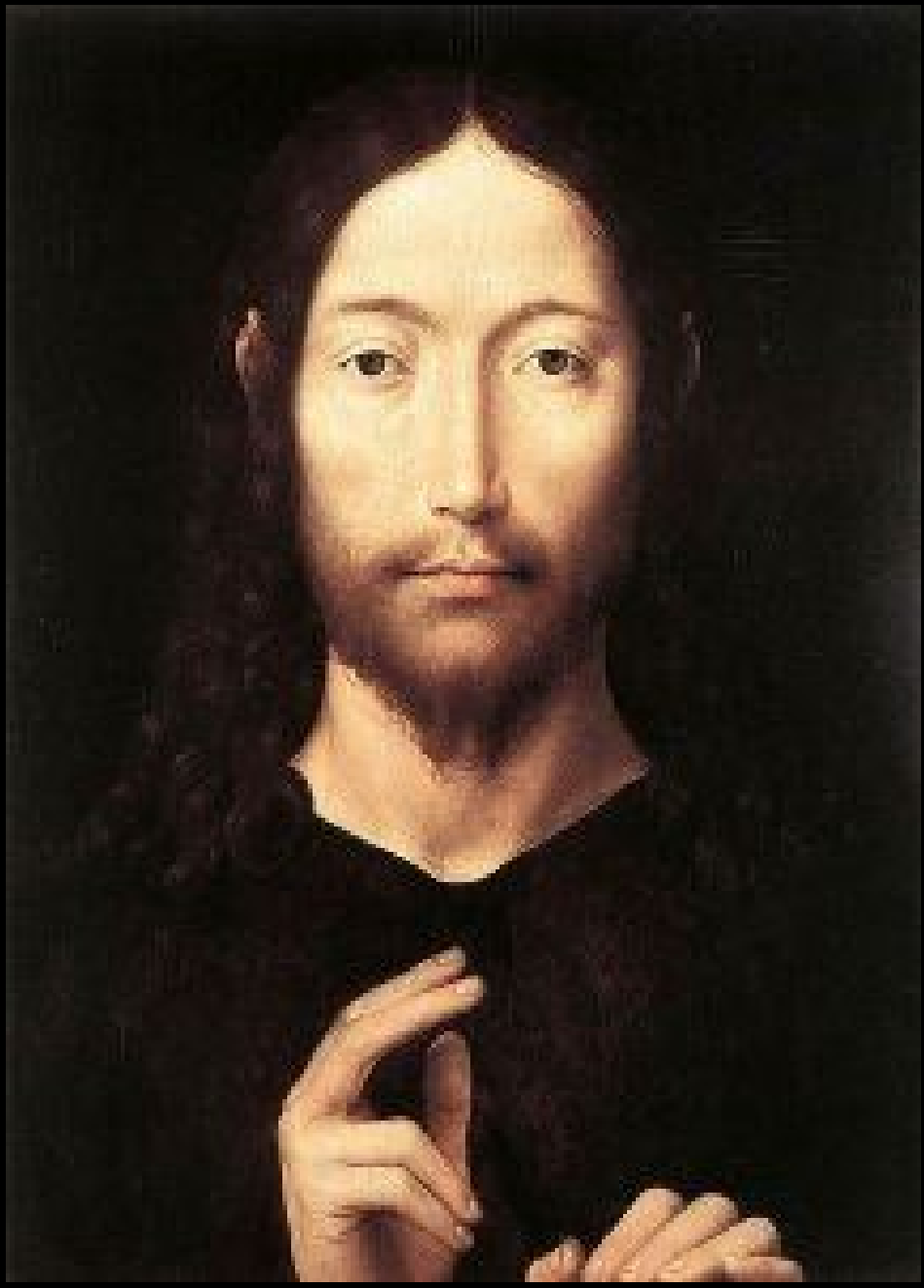

IHESVS VIA · IHS VERITAS · IHESVS VITA ·
SPECIOSVS FORMA PRE FILIIS HOMINVM




1500
AD
Albertus Durerus Noricus
ipsum me propris hic effin-
geham coloribus quam
anno XXVIII.

The question can be raised:

Is a symmetric face associated with divinity, and is it so because of qualities that lie in the symmetric form itself?

Does our biologically determined preference for symmetry imply that holiness *must* be represented *an face*, i.e. in the most symmetric manner?

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Does our biologically determined preference for symmetry imply that holiness *must* be represented *an face*, i.e. in the most symmetric manner?

Or is it just a convention that determines that Christ shall be represented *an face*?

The person is authoritarian

The person is including

The person is monitoring

The person is caring

The person is trustworthy

The person is scaring

The person is harmonic

The *an face* gazing at you is more authoritarian, but also more credible, more caring, more trustworthy, more harmonic, and more including.

The profile looking at you is the more scaring and monitoring, reversed when looking away.

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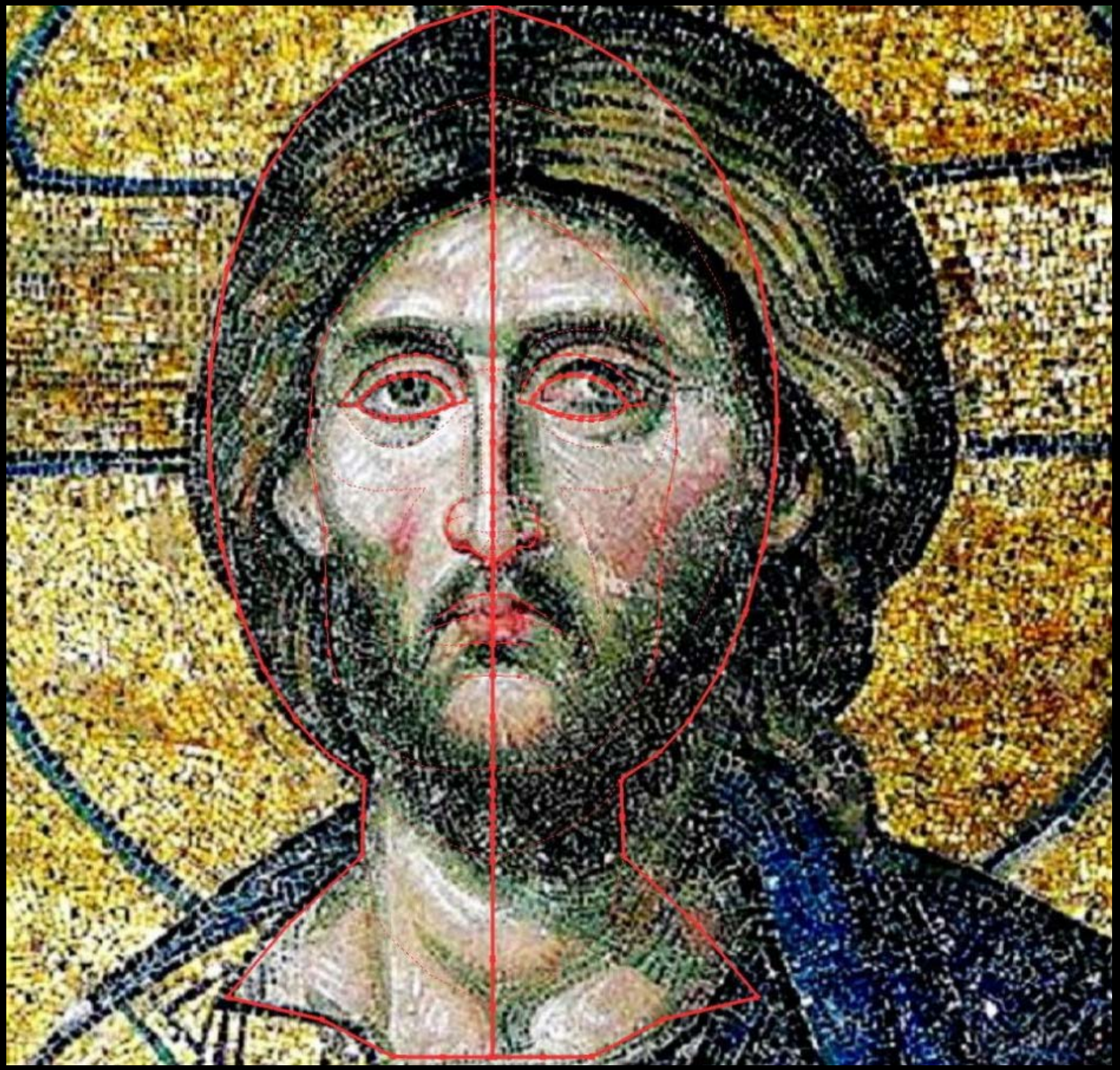
The profile <u>looking at you</u> is the more scaring and monitoring, reversed when looking away.

But how can we explain the strong asymmetry selected by the icon painters for a representation of Christ the Pantocrator?


© Pete Krupi



Byzantine perspective: cubism *avant la lettre*;

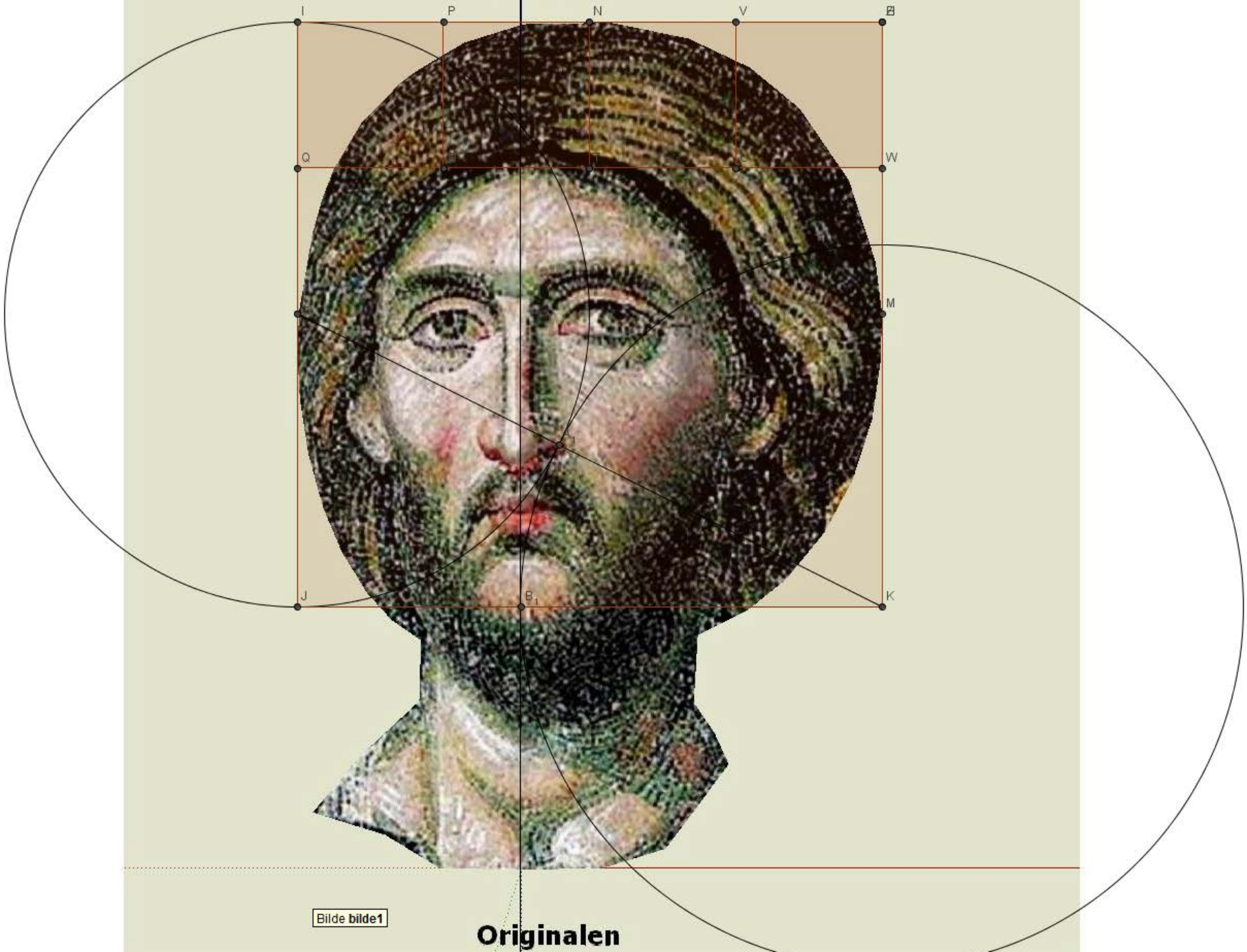
A movement on the borders of the perceptually impossible.

Lev Zhegin (1970) on Byzantine perspective:

“Reverse perspective is the result of the summarizing of the viewer’s perception under the conditions of a multiplicity of viewpoints”

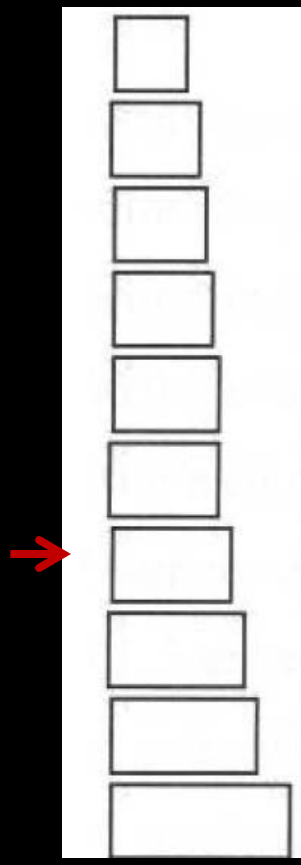
(Iazik zhivopisnogo proizvedeniia: uslovnost' drevnego iskusstva (The Language of the Work of Art: Conventionality of Ancient Art), Moscow 1970, p. 42.)

Med perspektiv 200mm



Originalen

Pioneer studies by the German physiologist Gustav Theodor Fechner (1876) demonstrated that subjects rated geometrical figures with golden proportions as more beautiful than other figures.



Ratio *l: w*	*Rating: most beautiful*	*ugliest*
A:1.00	3.0%	27.8%
B:0.83	0.2%	19.7%
C:0.80	2.0%	8.4%
D: 0.75	2.5%	2.5%
E: 0.69	7.7%	1.2%
F: 0.67	20.6%	0.4%
G: 0.618	***35.0%***	***0.0%***
H: 0.57	20.0%	0.8%
I: 0.50	7.5%	2.5%
J: 0.40	1.5%	35.7%

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It has, however, been strongly questioned whether a biological and inherited mechanism alone can explain these features, or whether they are the result of the frequent appearance in our culture of forms with golden proportions, ranging from huge aesthetic monuments, those of art and architecture, to the golden rectangle form of credit cards of modern daily life.

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In a recent fMRI study on the brain response to Classical and Renaissance sculptures, Di Dio *et al*. (2007) demonstrate that subjects viewing sculptures in the scanner will *rate* canonical sculptures higher than those digitally manipulated, whereas the modified images were generally scored with a negative rating.

Viewing canonical sculptures gives increased activation in distinct areas of the cerebral cortex.

179. *Doryphorus (Spear Bearer)*. Roman copy after an original of c. 450–440 B.C. by Polyclitus. Marble, height 6′ 6″. National Museum, Naples

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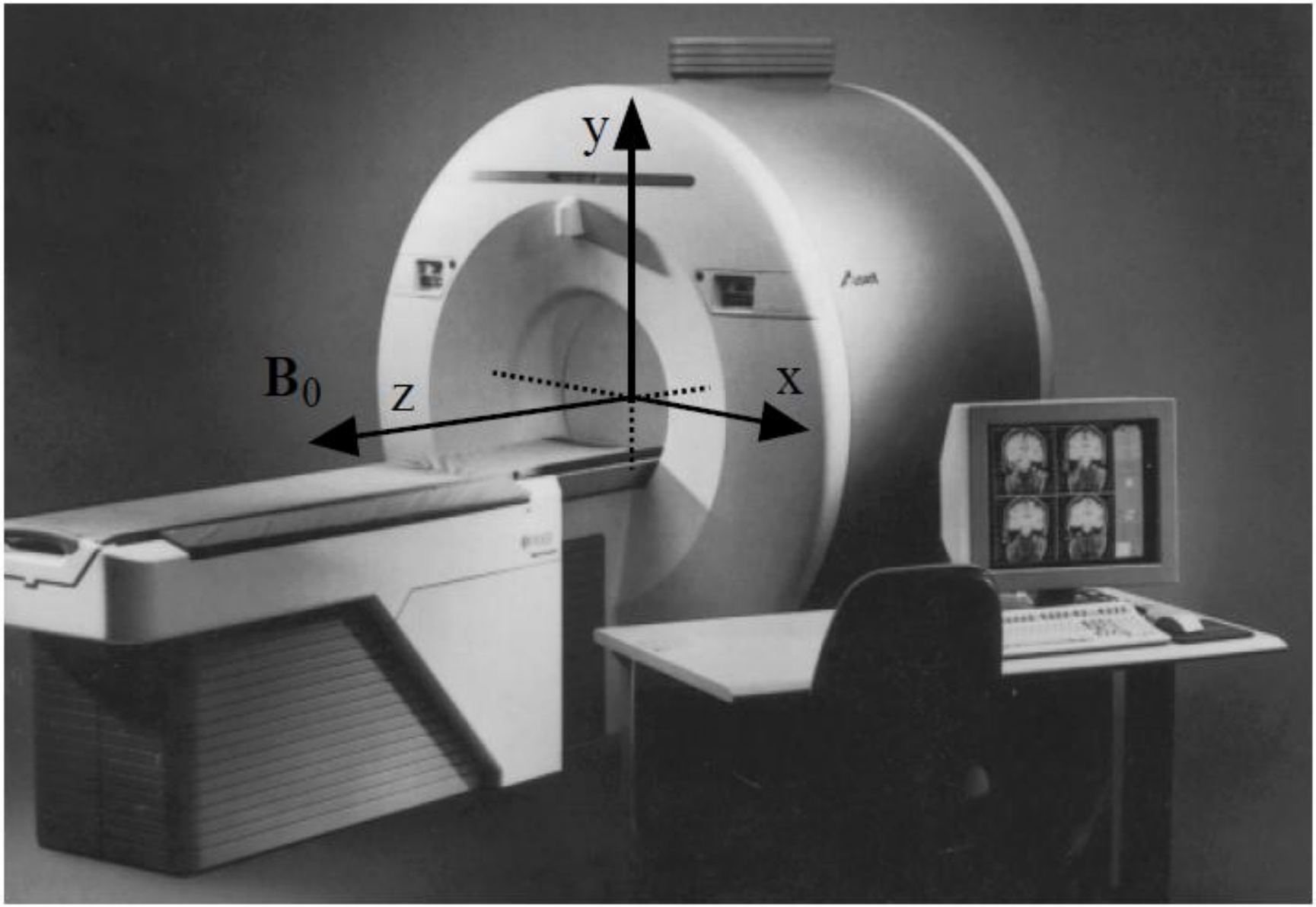
The Golden Beauty: Brain Response to Classical and Renaissance Sculptures

Cinzia Di Dio[1,2], Emiliano Macaluso[2], Giacomo Rizzolatti[1]*

1 Dipartimento di Neuroscienze, Università di Parma, Parma, Italy, 2 Fondazione Santa Lucia, Neuroimaging Laboratory, Rome, Italy

Is there an objective, biological basis for the experience of beauty in art? Or is aesthetic experience entirely subjective? Using fMRI technique, we addressed this question by presenting viewers, naïve to art criticism, with images of masterpieces of Classical and Renaissance sculpture. Employing proportion as the independent variable, we produced two sets of stimuli: one composed of images of original sculptures; the other of a modified version of the same images. The stimuli were presented in three conditions: observation, aesthetic judgment, and proportion judgment. In the observation condition, the viewers were required to observe the images with the same mind-set as if they were in a museum. In the other two conditions they were required to give an aesthetic or proportion judgment on the same images. Two types of analyses were carried out: one which contrasted brain response to the canonical and the modified sculptures, and one which contrasted beautiful *vs.* ugly sculptures as judged by each volunteer. The most striking result was that the observation of original sculptures, relative to the modified ones, produced activation of the right insula as well as of some lateral and medial cortical areas (lateral occipital gyrus, precuneus and prefrontal areas). The activation of the insula was particularly strong during the observation condition. Most interestingly, when volunteers were required to give an overt aesthetic judgment, the images judged as beautiful selectively activated the right amygdala, relative to those judged as ugly. We conclude that, in observers naïve to art criticism, the sense of beauty is mediated by two non-mutually exclusive processes: one based on a joint activation of sets of cortical neurons, triggered by parameters intrinsic to the stimuli, *and* the insula (objective beauty); the other based on the activation of the amygdala, driven by one's own emotional experiences (subjective beauty).

Citation: Di Dio C, Macaluso E, Rizzolatti G (2007) The Golden Beauty: Brain Response to Classical and Renaissance Sculptures. PLoS ONE 2(11): e1201. doi:10.1371/journal.pone.0001201



The functional magnetic resonnance immagining fMRI scanner

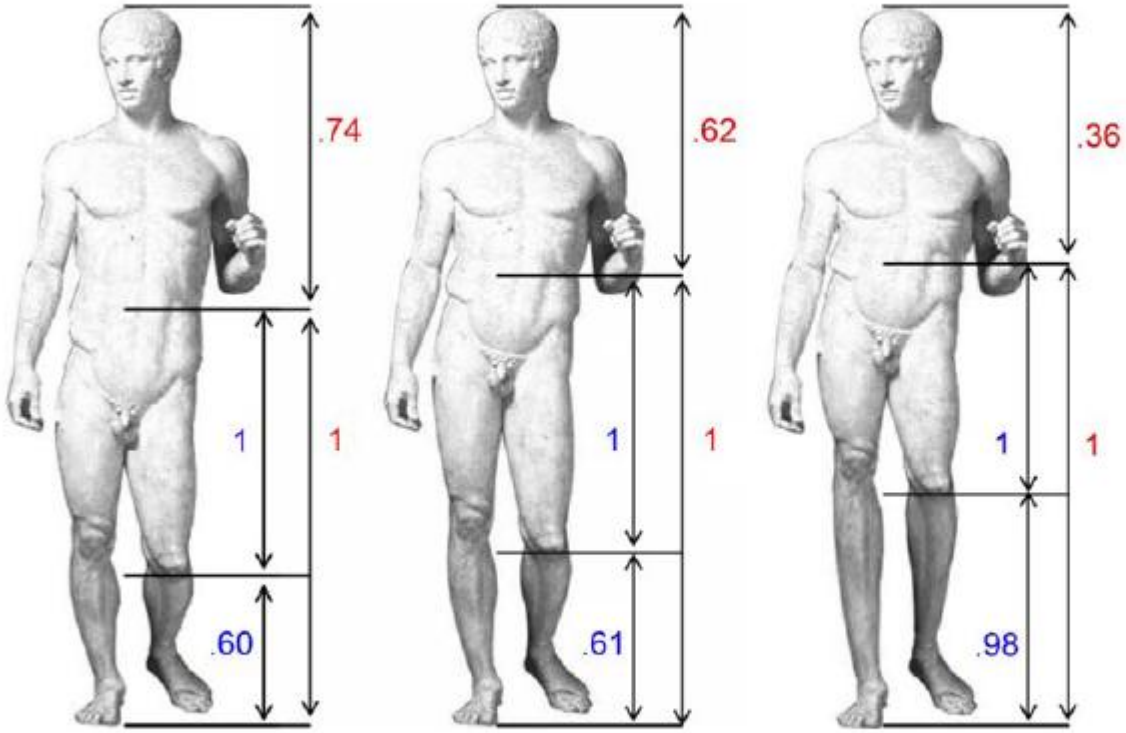
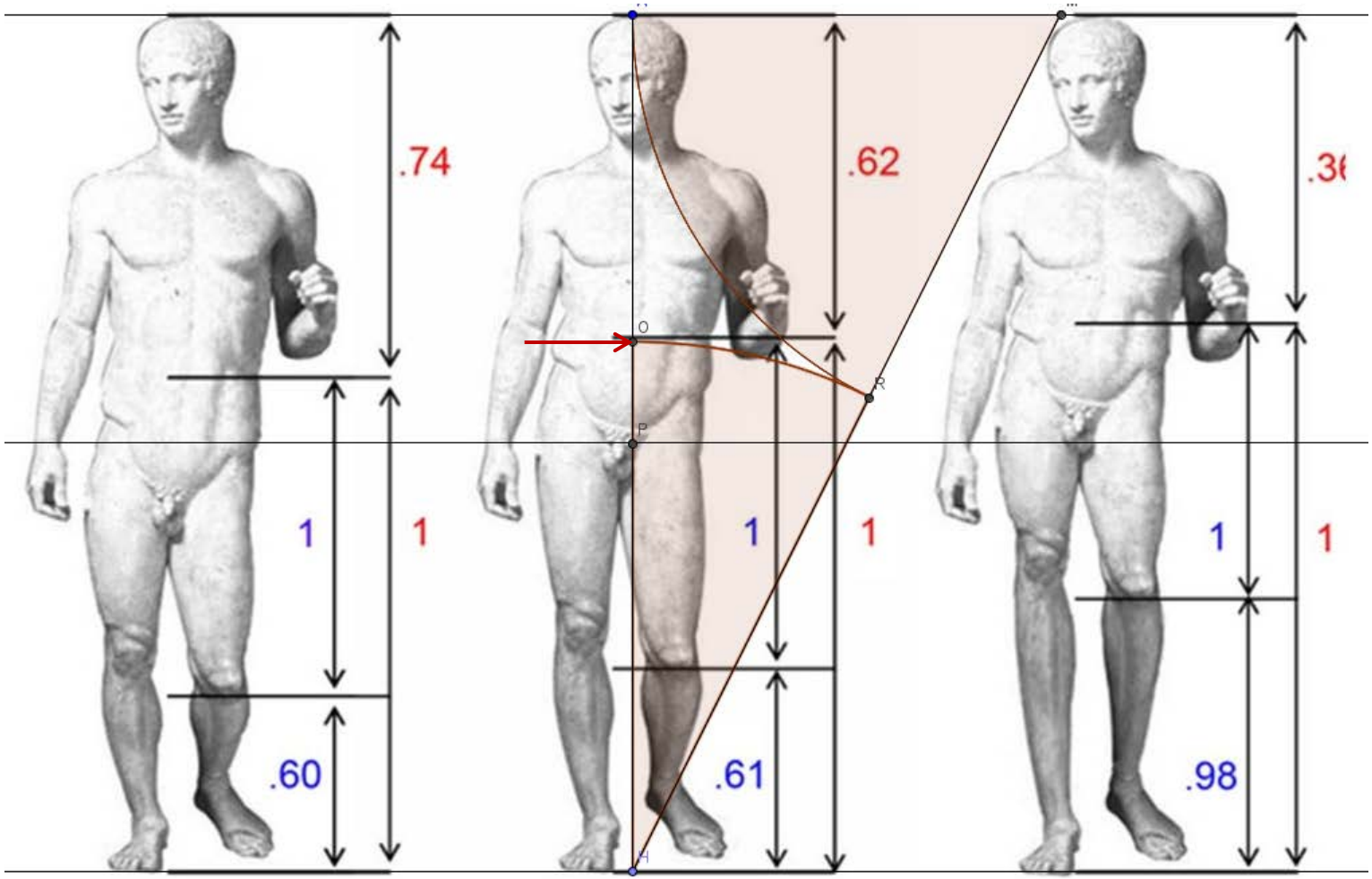


Figure 1. Example of canonical and modified stimuli. The original image (Doryphoros by Polykleitos) is shown at the centre of the figure. This sculpture obeys to canonical proportion (golden ratio = 1:1.618). Two modified versions of the same sculpture are presented on its left and right sides. The left image was modified by creating a short legs:long trunk relation (ratio = 1:0.74); the right image by creating the opposite relation pattern (ratio = 1:0.36). All images were used in behavioral testing. The central image (judged-as-beautiful on 100%) and left one (judged-as-ugly on 64%) were employed in the fMRI study.

doi:10.1371/journal.pone.0001201.g001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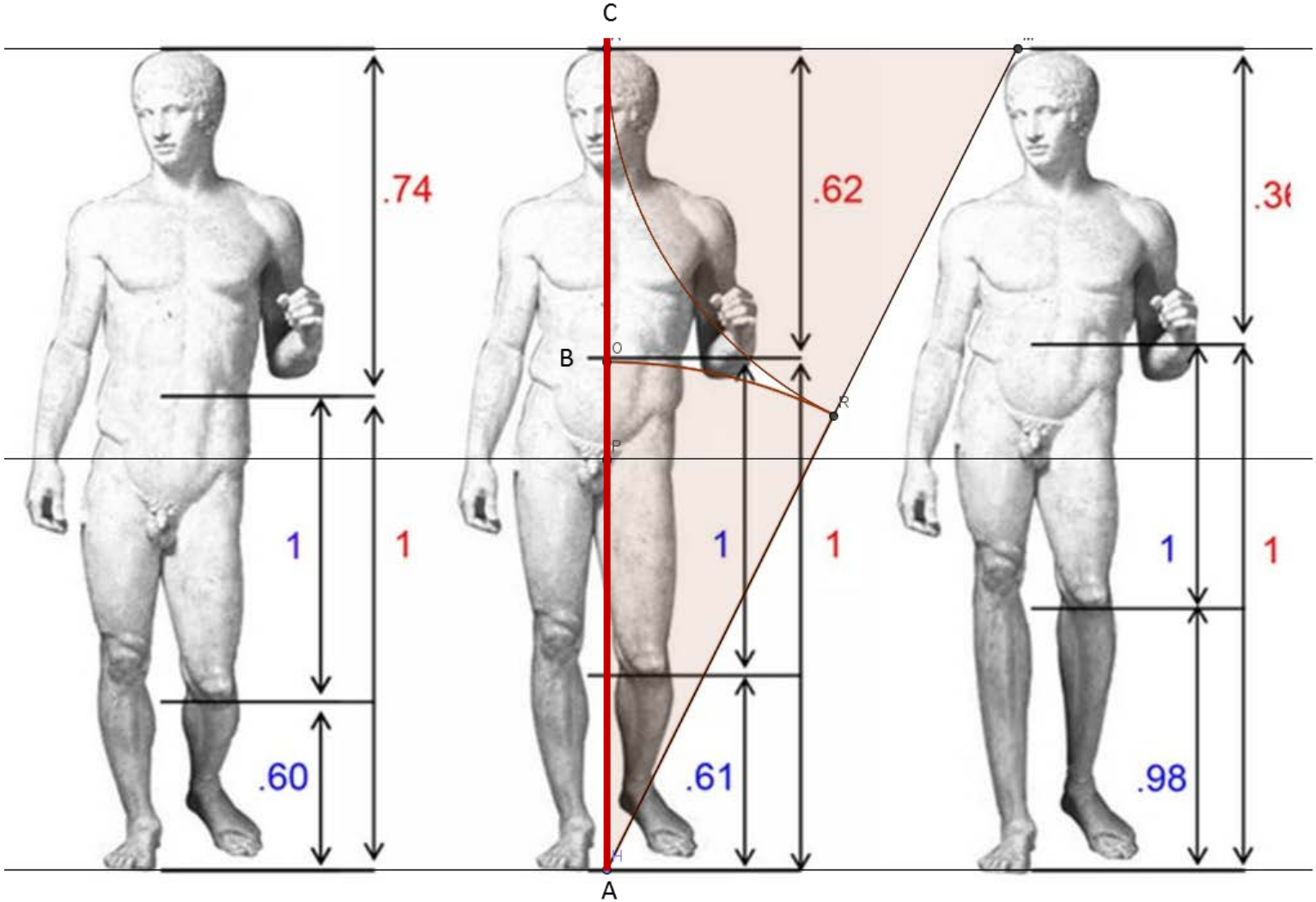
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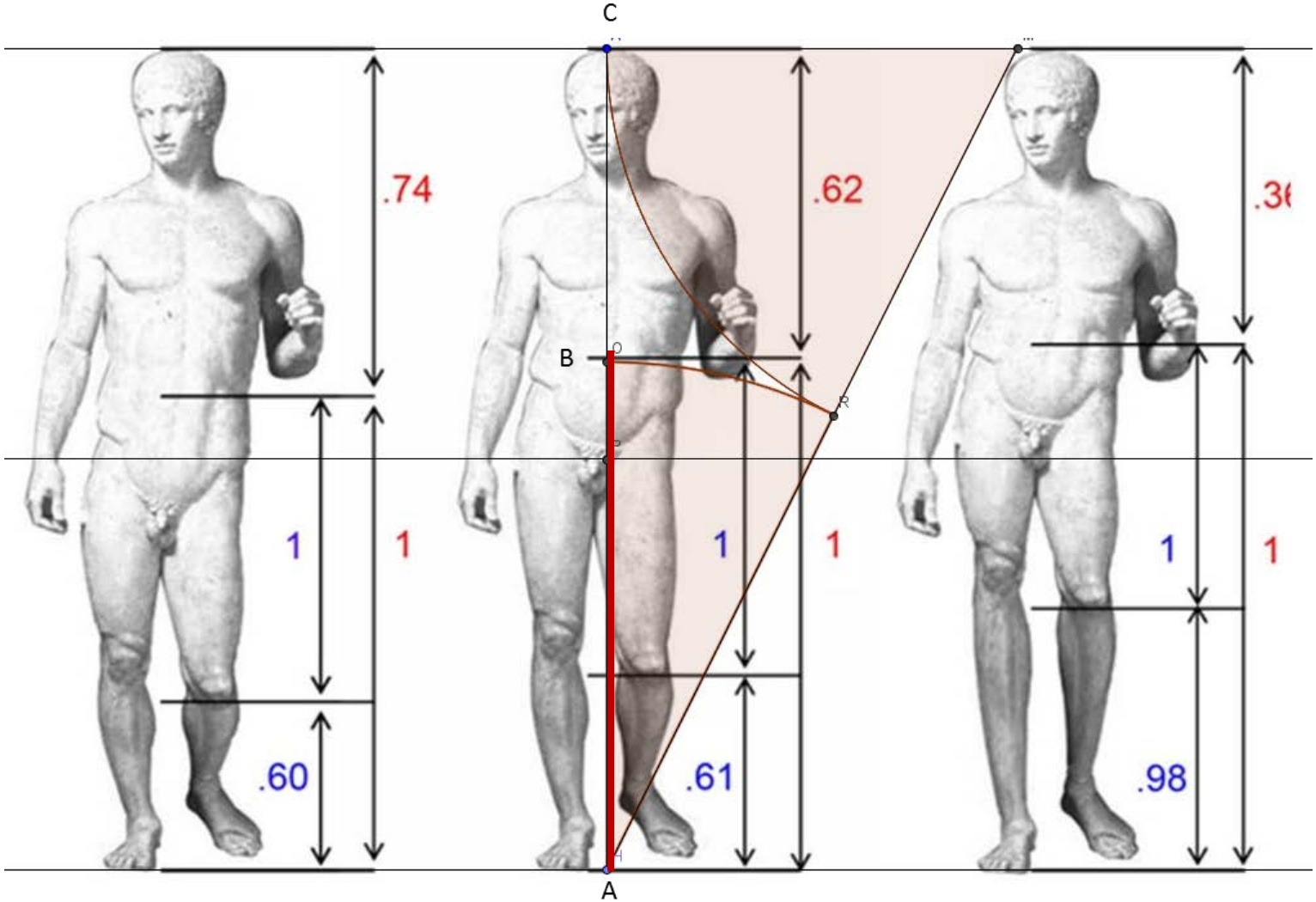
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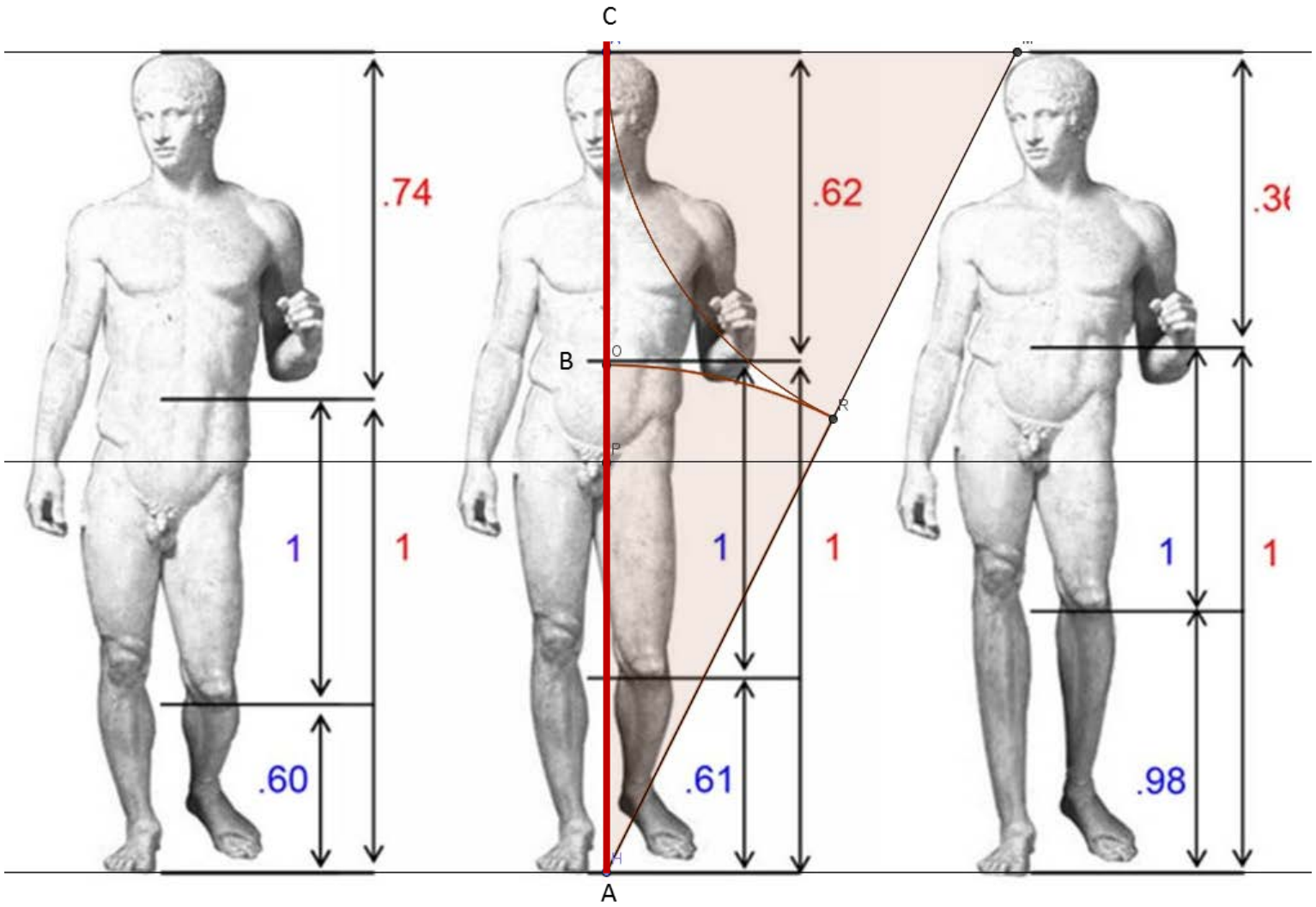

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The Golden Beauty: Brain Response to Classical and Renaissance Sculptures

Cinzia Di Dio[1,2], Emiliano Macaluso[2], Giacomo Rizzolatti[1]*

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Is there an objective, biological basis for the experience of beauty in art? Or is aesthetic experience entirely subjective? Using fMRI technique, we addressed this question by presenting viewers, naïve to art criticism, with images of masterpieces of Classical and Renaissance sculpture. Employing proportion as the independent variable, we produced two sets of stimuli: one composed of images of original sculptures; the other of a modified version of the same images. The stimuli were presented in three conditions: observation, aesthetic judgment, and proportion judgment. In the observation condition, the viewers were required to observe the images with the same mind-set as if they were in a museum. In the other two conditions they were required to give an aesthetic or proportion judgment on the same images. Two types of analyses were carried out: one which contrasted brain response to the canonical and the modified sculptures, and one which contrasted beautiful *vs.* ugly sculptures as judged by each volunteer. The most striking result was that the observation of original sculptures, relative to the modified ones, produced activation of the right insula as well as of some lateral and medial cortical areas (lateral occipital gyrus, precuneus and prefrontal areas). The activation of the insula was particularly strong during the observation condition. Most interestingly, when volunteers were required to give an overt aesthetic judgment, the images judged as beautiful selectively activated the right amygdala, relative to those judged as ugly. We conclude that, in observers naïve to art criticism, the sense of beauty is mediated by two non-mutually exclusive processes: one based on a joint activation of sets of cortical neurons, triggered by parameters intrinsic to the stimuli, *and* the insula (objective beauty); the other based on the activation of the amygdala, driven by one's own emotional experiences (subjective beauty).

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The subjectivist view: This view dates back to the Sophists; it maintains that beauty is in the eye of the beholder, i.e. taste cannot be debated)

Semir Zeki's group in London has recently documented (2011) that music and visual artworks that by each person are considered to be beautiful (subjective beauty) activates the same area in the brain, the medial orbitofrontal cortex (mOFC).

http://www.youtube.com/watch?v=NlzanAw0RP4

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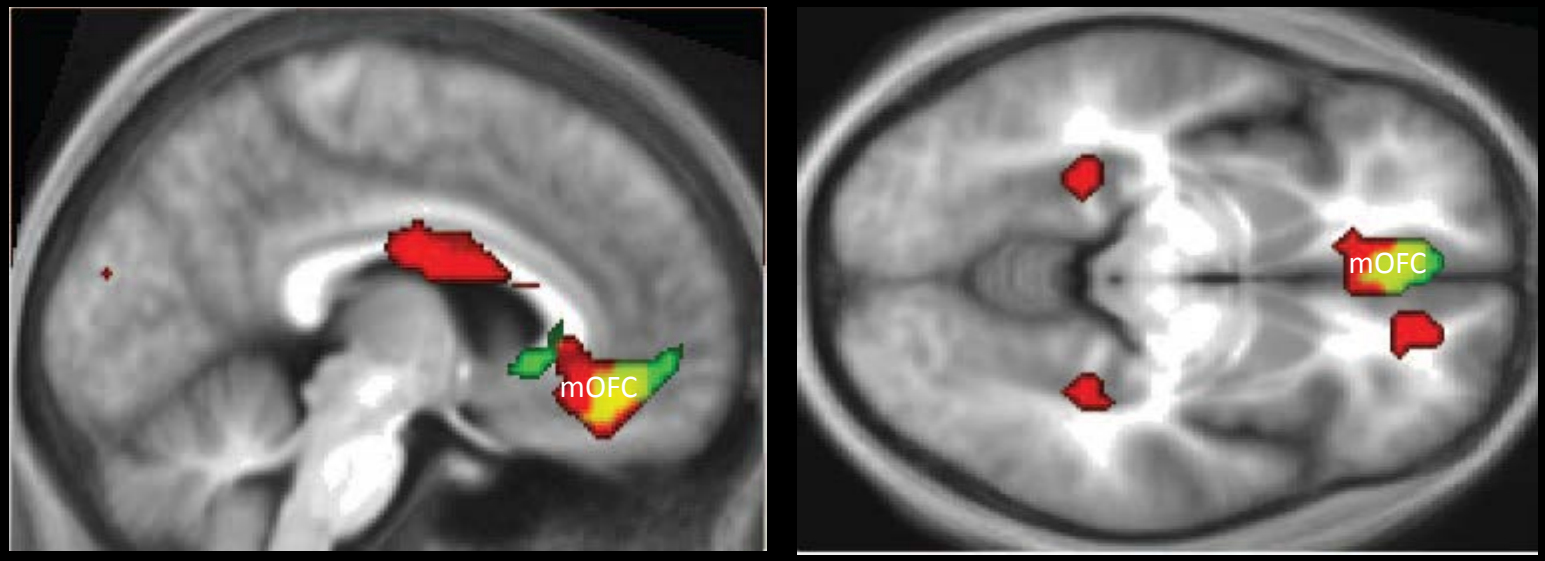
This has led the researchers to formulate a brain-baised theory of beauty: «Almost anything can be considered to be art, but only creations whose experience has, as a correlate, activity in mOFC would fall into the classification of beautiful art».

http://www.youtube.com/watch?v=NlzanAw0RP4


mOFC
mOFC

The interactionist view: beauty is grounded in the processing experiences of the perceiver that emerge from the interaction of stimulus properties and perceivers' cognitive and affective processes.

The feeling of pleasure in a stimulus is greater if the stimulus is processed easy, i.e. when there is a *fluent processing* of the stimulus.

Processing fluency is defined as the subjective experience of ease with which an incoming stimulus can be processed.

What increases the prosessing speed?

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The processing fluency increases if the stimulus is symmetrical and if it has a high degree of contrast and clarity.

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The processing fluency will also be increased if the stimulus has been so frequently seen that it can be considered to be prototypical.

Research Article

Prototypes Are Attractive Because They Are Easy on the Mind

Piotr Winkielman,[1] Jamin Halberstadt,[2] Tedra Fazendeiro,[3] and Steve Catty[2]

[1]University of California, San Diego; [2]University of Otago, Dunedin, New Zealand; and [3]University of Denver

ABSTRACT—*People tend to prefer highly prototypical stimuli—a phenomenon referred to as the* beauty-in-averageness *effect. A common explanation of this effect proposes that prototypicality signals mate value. Here we present three experiments testing whether prototypicality*

beauty-in-averageness effect is often theoretically explained as reflecting a biological predisposition to interpret prototypicality as a cue to mate value (Symons, 1979). For example, facial, as well as bodily, prototypicality may be predictive of current or prior health, lending individuals with a prototypicality prefer-


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Is art foremost a stimulus for our cognitive processes, or has it also a strong emotional impact?

Opinion TRENDS in Cognitive Sciences Vol.11 No.5

Motion, emotion and empathy in esthetic experience

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The implications of the discovery of mirroring mechanisms and embodied simulation for empathetic responses to images in general, and to works of visual art in particular, have not yet been assessed. Here, we address this issue and we challenge the primacy of cognition in responses to art. We propose that a crucial element of esthetic response consists of the activation of embodied mechanisms encompassing the simulation of actions, emotions and corporeal sensation, and that these mechanisms are universal. This basic level of reaction to images is essential to understanding the effectiveness both of everyday images and of works of art. Historical, cultural and other contextual factors do not preclude the importance of considering the neural processes that arise in the empathetic understanding of visual artworks.

Introduction

> 'The painting will move the soul of the beholder when the people painted there each clearly shows the movement of his own soul...we weep with the weeping, laugh with the laughing, and grieve with the grieving. These movements of the soul are known from the movements of the body.' ([1], p. 80).

Although no consensus has been reached on how to define art, the problem of the nature of art (however so defined) has attracted the interest of cognitive neuroscientists who opened a field of research named 'neuroesthetics' [2,3]. Other attempts have been made to derive invariant universal perceptual rules to explain what art is, and what esthetic pleasures we derive from it, on the basis of psychophysical and neurocognitive knowledge of the visual part of the brain (see, for example, Refs [2,4–8]).

Here, we pursue a different strategy. First, we 'bracket' the artistic dimension of visual works of art and focus on the embodied phenomena that are induced in the course of contemplating such works by virtue of their visual content. We illustrate the neural mechanisms that underpin the empathetic 'power of images' [9] and show that embodied simulation and the empathetic feelings it generates has a crucial role (Box 1). Second, we address – within the same empathetic framework – one aspect of the effects of works of art, namely the felt effect of particular gestures involved in producing them.

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Available online 7 March 2007.

Most spectators of works of art are familiar with feelings of empathetic engagement with what they see in the work itself. These feelings might consist of the empathetic understanding of the emotions of represented others or, most strikingly, of a sense of inward imitation of the observed actions of others in pictures and sculptures. These observations raise two questions: how relevant is empathy to esthetic experience, and what are the neural mechanisms involved?

Empathy in esthetic experience

We begin with examples of the ways in which viewers of works of art report bodily empathy. For instance, in the case of Michelangelo's *Prisoners*, responses often take the form of a felt activation of the muscles that appear to be activated within the sculpture itself, as if in perfect consonance with Michelangelo's intention of showing his figures struggle to free themselves from their material matrix (Figure 1). In looking at scenes from Goya's *Desastres de la Guerra*, bodily empathy arises not only in responses to the many unbalanced figures, where viewers seem to have similar feelings of unbalance themselves, but also in the case of the frequently horrific representations of lacerated and punctured flesh (e.g. Figure 2). In such instances, the physical responses seem to be located in precisely those parts of the body that are threatened, pressured, constrained or destabilized. Furthermore, physical empathy easily transmutes into a feeling of empathy for the emotional consequences of the ways in which the body is damaged or mutilated. Even when the image contains no overt emotional component, a sense of bodily resonance can arise. These are all instances in which beholders might find themselves automatically simulating the emotional expression, the movement or even the implied movement within the representation.

Simulation occurs not only in response to figurative works but also in response to the experience of architectural forms, such as a twisted Romanesque column [10]. With abstract paintings such as those by Jackson Pollock (Figure 3a), viewers often experience a sense of bodily involvement with the movements that are implied by the physical traces – in brushmarks or paint drippings – of the creative actions of the producer of the work. This also applies to the cut canvases of Lucio Fontana (Figure 3b), where sight of the slashed painting invites a sense of empathetic movement that seems to coincide with the gesture felt to have produced the tear.

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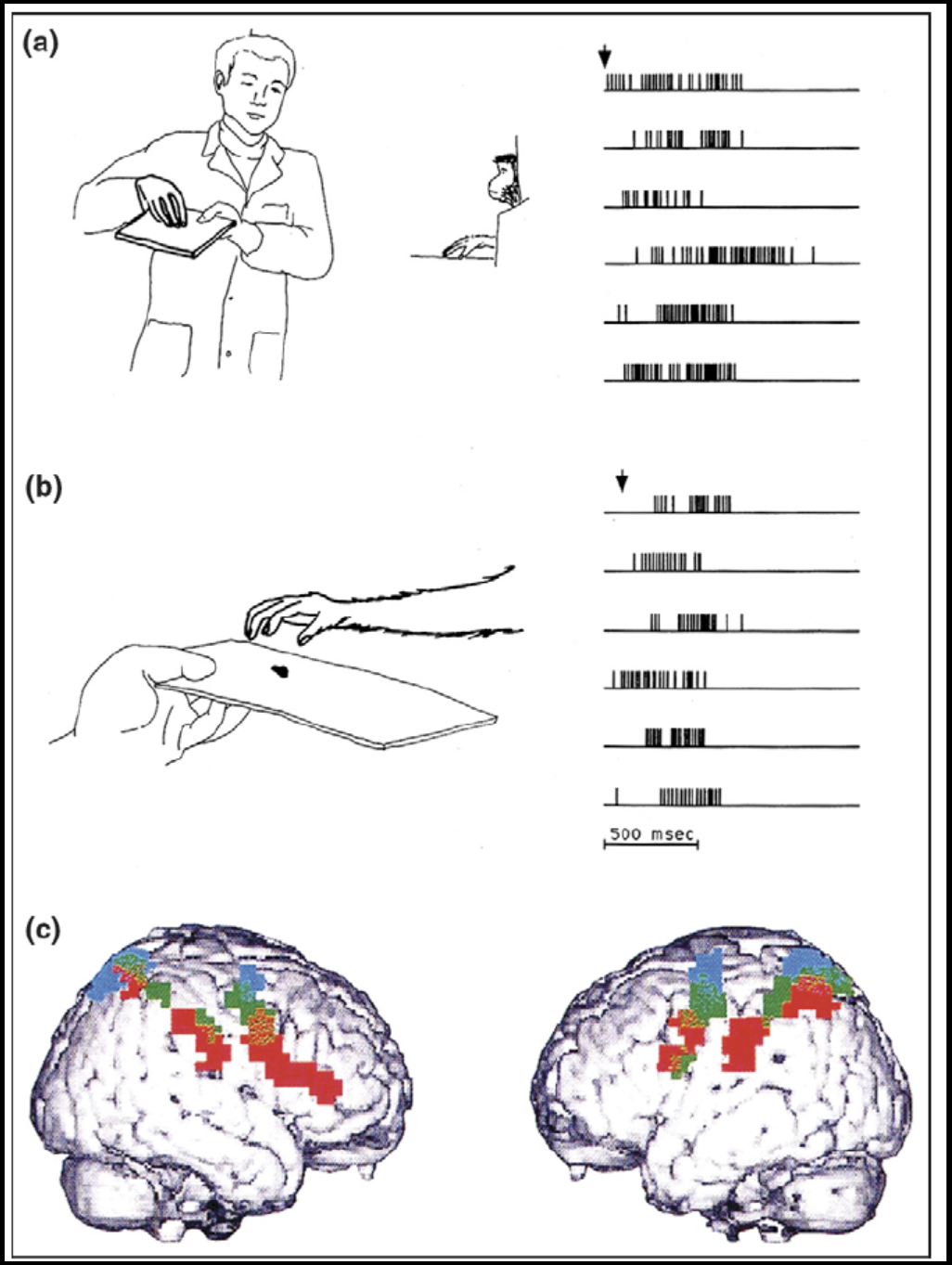


mirroring mechanisms

mirror neurons

embodied mechanisms

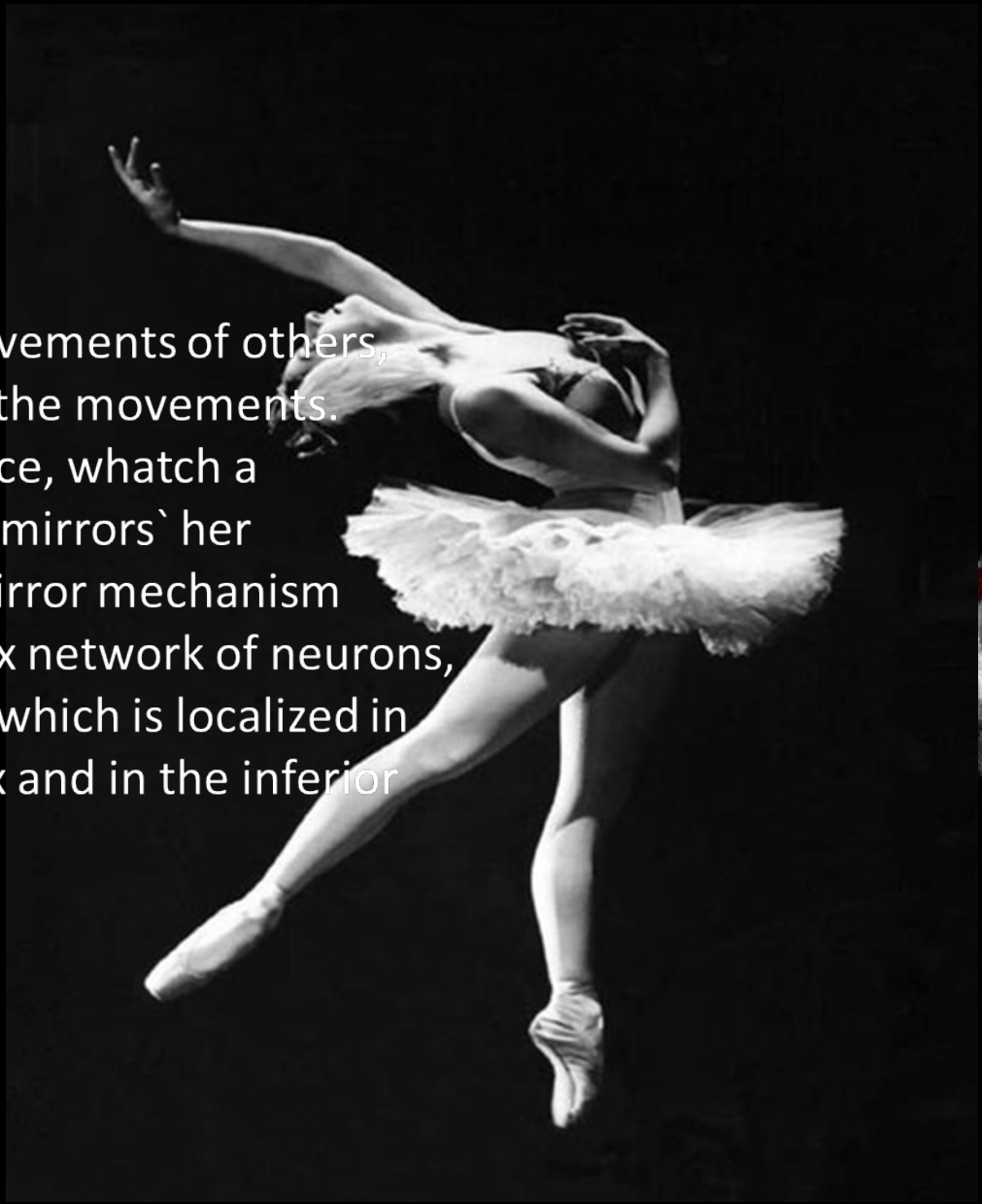
empathetic responses

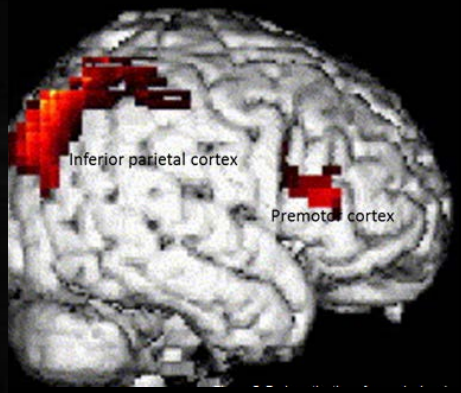
Vittorio Gallese and David Freedberg address this issue and challenge the primacy of cognition in responses to art. They propose that a crucial element of esthetic response consists of the activation of embodied mechanisms encompassing the simulation of actions, emotions and corporeal sensation, and that these mechanisms are universal.

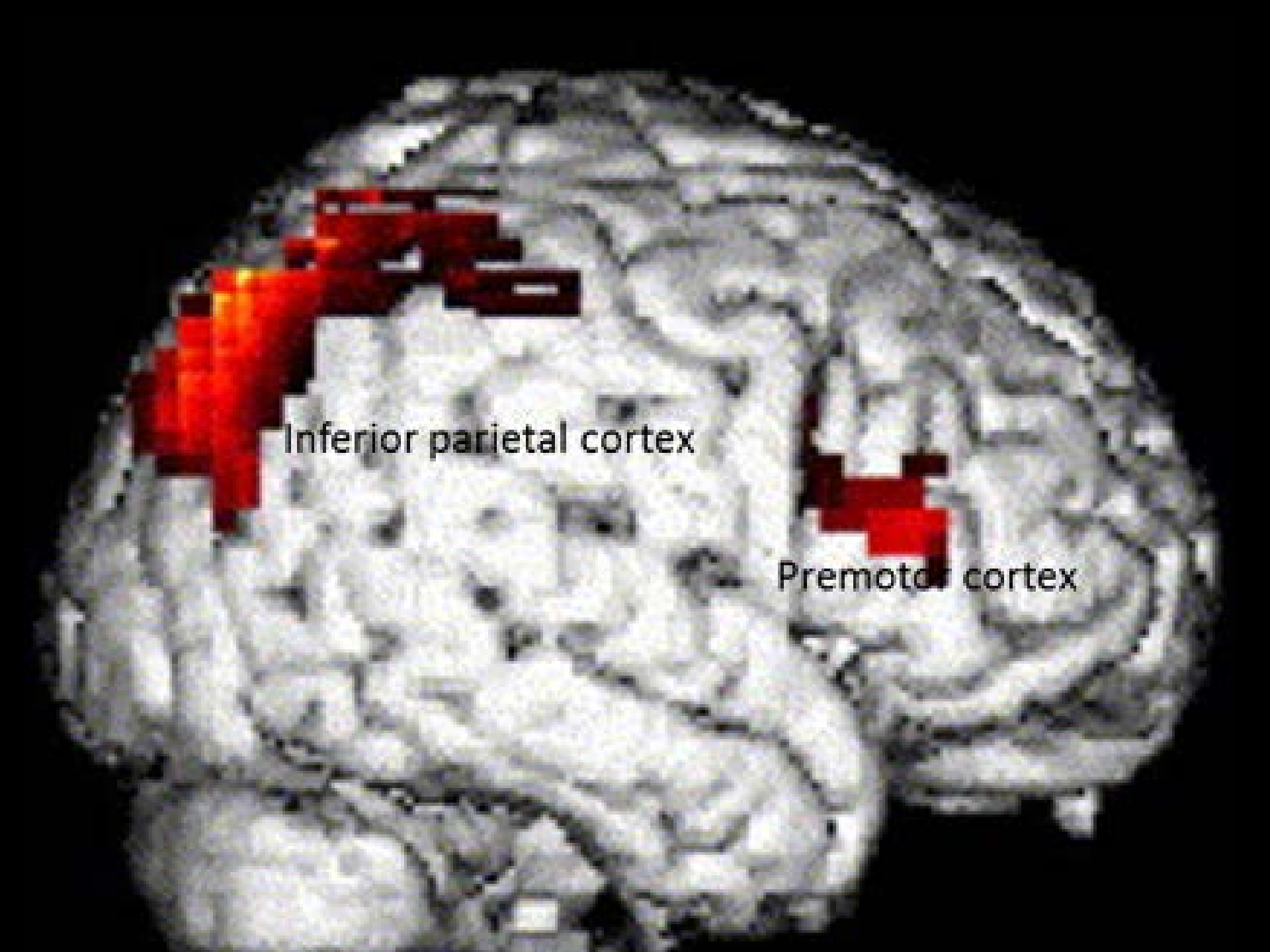
¿Qué han que hacer mas?

PROVOKATIV KUNST: *I 2010 hadde Mark McGowan en utstilling på Elevator gallery i London der han spikret fast foten sin i galleriveggen. Utstillingen het «The impossibility of art in the mind*

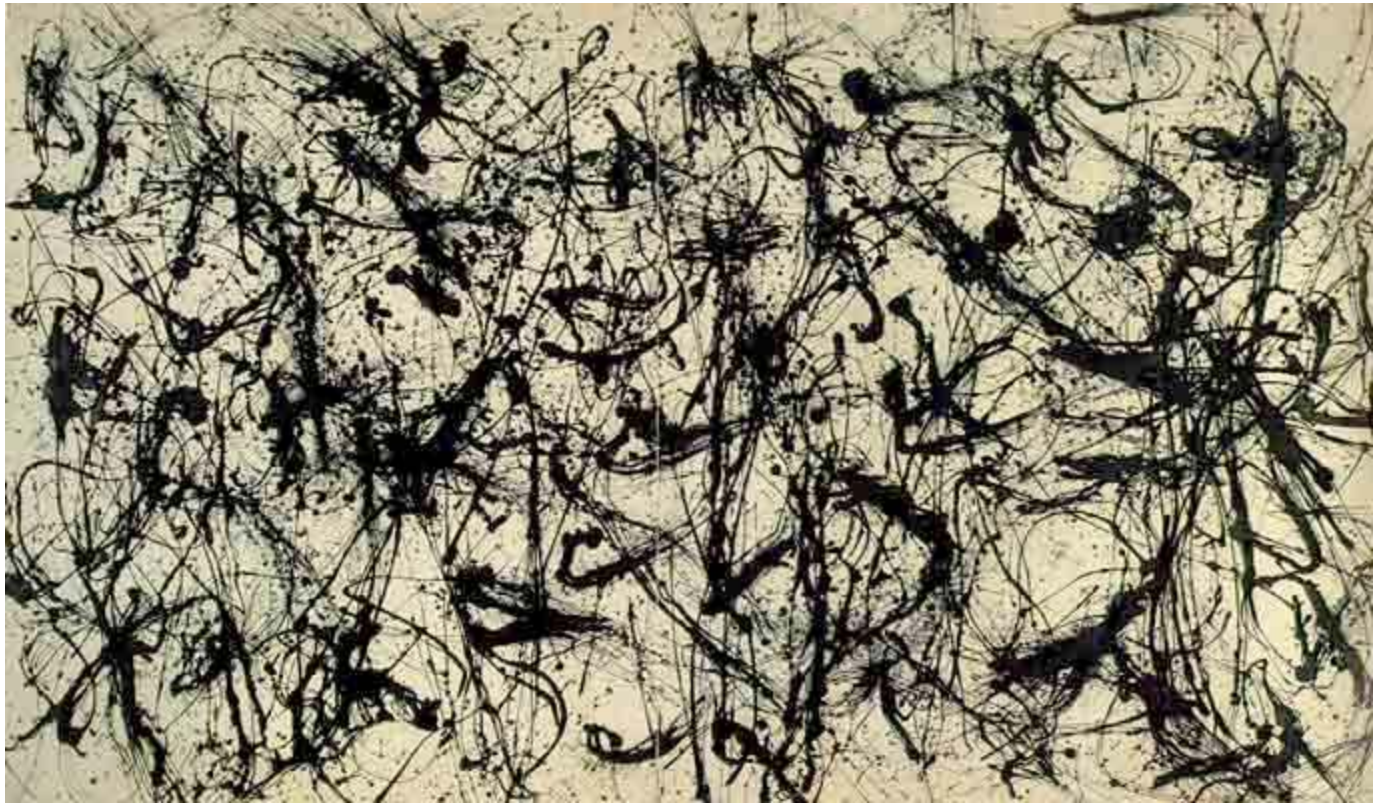
When observing movements of others, our brain «mirrors» the movements. When we, for instance, whatch a ballerina, our brain ´mirrors` her movements. This mirror mechanism consists of a complex network of neurons, the mirror neurons, which is localized in the prefrontal cortex and in the inferior parietal cortex.






Inferior parietal cortex
Premotor cortex

Jacksom Pollock, actionpainting. Do our brain mirror his movements?



Do you feel the movement of brushstrokes in the final work?

“We propose that even the artist’s gestures in producing
the art work induce the empathetic engagement of the
observer, by activating simulation of the motor program
that corresponds to the gesture implied by the trace.

Do you feel the movement of brushstrokes in the final work?

“We propose that even the artist’s gestures in producing
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The marks on the painting or sculpture are the visible traces of goal-directed movements; hence, they are capable of activating the relevant motor areas in the observer’s brain.

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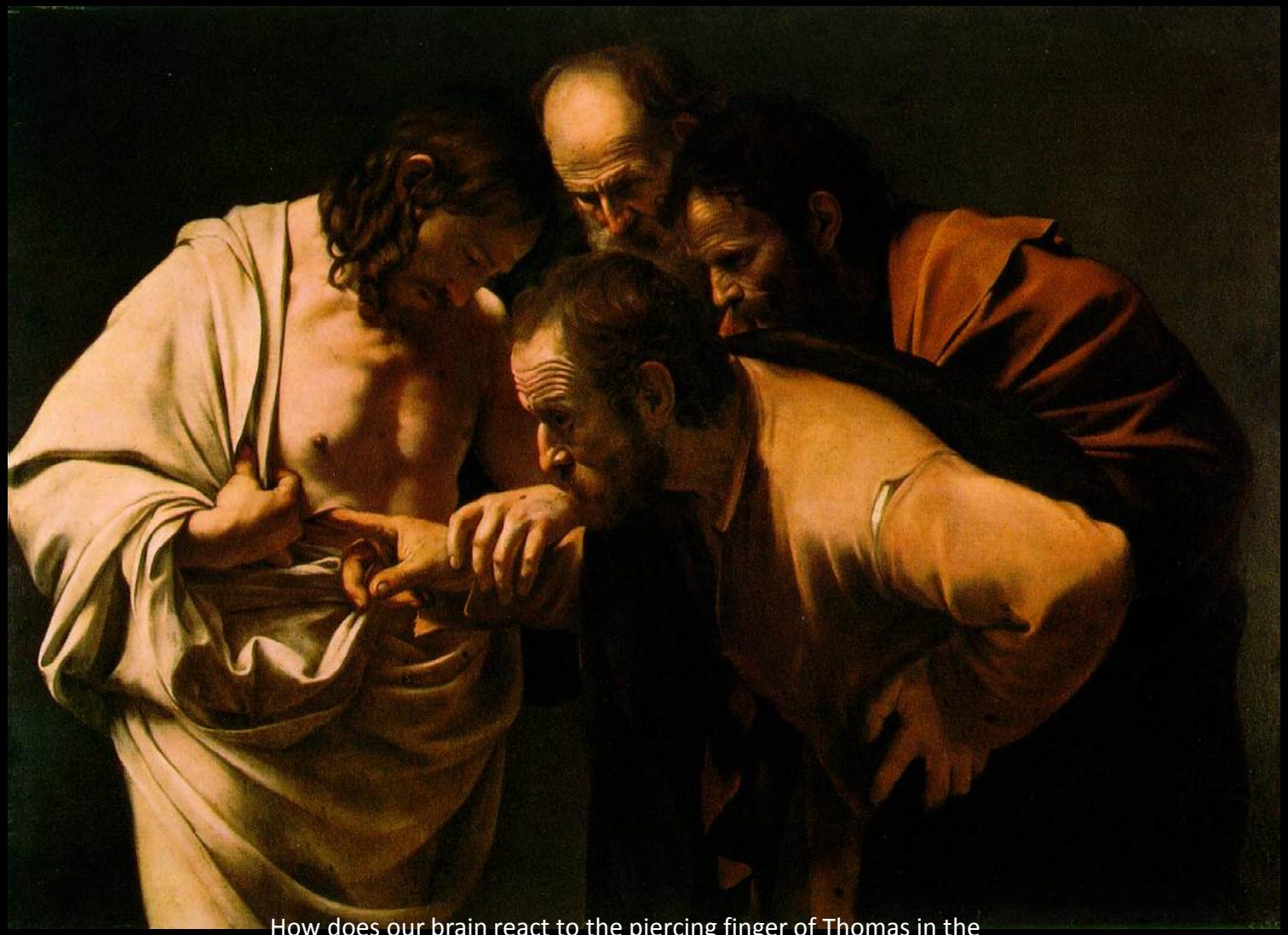
Despite the absence of published experiments on this issue, the mirror-neuron research offers sufficient empirical evidence to suggest that this is indeed the case" (D. Freedberg, V. Gallese, 2007, p. 202).


E. Munch



How does our brain react to the piercing finger of Thomas in the breast of Christ in this painting by Caravaggio? The discovery of the mirror mechanisms in the brain tells us that we react physically, the mirror neurons mirror the movements, elisiting the empathic feelings that fills us as response to artworks or scenes from life, such as those mediated by TV.