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THE PROBLEM OF IMAGES: A VIEW FROM THE BRAIN-BODY*

abstract

Why do humans create images and what are their features that make them special? How are image-making and the uses of images related? What is the purpose of images? The "problem of images" is addressed through the lens of contemporary neuroscience, arguing why and how neuroscience can investigate our relationship with art and aesthetics, framing this empirical approach as "experimental aesthetics." Recent discoveries are presented that changed our ideas about perception, action, and cognition and the relationship among them, allowing a new look—complementary to the humanistic approach—at the problem of images. A new model of perception and cognition is proposed, called embodied simulation, which reveals the constitutive relationship between brain-body and the reception of human creative expressions.

keywords

aesthetics, embodied simulation, images, neuroscience, vision

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1. Introduction

The production of images and their reception are specific features of the human species. Why do humans produce images? What are the distinctive features making man-made images special? What is the relationship between image-making and the use of images, their purpose and experience? Is there any privileged perspective to address these issues? These and many more questions show how problematic is our relation to images. Indeed, the "problem of images" and its inherent related questions have accompanied human beings since they started asking themselves what it means to be human.

In the last two decades neuroscience has sought to address these issues with its empirical approach. Many scholars in the humanities have argued that the neuroscientific approach to the problem of images, and – more broadly – to art and aesthetics is, on the one hand, unable to reveal anything new and, on the other, may even hinder and/or destroy the wonder and awe normally accompanying our appreciation of art works. Alva Noë's most recent book, *Strange Tools: Art and Human Nature* (2016), constitutes a telling example of this negative attitude. Noë downplays the heuristic value of neuroscience in general, minimizing or even neglecting important results accomplished in a variety of domains. He also argues that neuroscience totally misses the point on art inasmuch it fails to answer the relevant questions, such as why do works of art move us, or why do we value works of art. It is not the purpose of this short essay to offer a detailed reply to Noë's utterly negative stance. It may suffice here to say two things: First, the way Noë portrays neuroscience is, at best, a caricature; second, he seems to conflate a variety of approaches and *explananda*.

Indeed, cognitive neuroscience empirically investigates art and aesthetics using many different approaches, to address different issues and questions: a) by using artistic expressions to understand how the brain works; b) by localizing in the brain -and/or reducing to its functioning- aesthetic concepts (beauty, the sublime, etc.); c) by studying the brain to explain art; d) by studying the brain-body in relation to artistic expressions, in order to understand the constitutive elements of aesthetic experience and the genesis of aesthetic concepts.

I posit that neuroscience can be highly relevant to address the problem of man-made images and aesthetics, particularly if spelled out as in d). In the present article, I suggest – *pace* Noë – why and how neuroscience can investigate our relationship with man-made images, framing this empirical approach as "experimental aesthetics." Experimental aesthetics addresses the problem of man-made images by investigating the physiological correlates of the *aesthetic experience* humans make of works of art. I use the notion of aesthetics according to its etymology from *aesthesis*, that is, by privileging the sensorimotor and affective

features of our experience of perceptual objects. Of course, the sensorimotor components of aesthetic experience are just one of the many levels at which images can be experienced and understood. Experimental aesthetics aims to shed new light on the bodily aspects of our reception of images. A further aim is to investigate whether and to which extent even the reportedly most 'detached' aspects of aesthetic experience, like the explicit evaluation of the formal artistic quality of works of art, are related to embodiment.

As argued by John Dewey, "In order to understand the meaning of artistic products, we have to forget them for a time, to turn aside from them and have recourse to the ordinary forces and conditions of experience that we do not usually regard as aesthetic." (Dewey, 1934, 4). The problem of man-made images can be initially framed as a particular case of the broader problem of images *qua* images (Freedberg & Gallese, 2007). From that it follows that neuroscience by itself is not sufficient to provide a full account of art and artistic images, as they are both strongly culturally and historically determined and situated (Shiner, 2001). Neuroscience, nevertheless, can shed new light on the bodily components of the complex manifold we designate as "aesthetic experience." By means of neuroscience, used as a sort of "cognitive archeology" (Gallese, 1999), we can empirically investigate the neurophysiological brain-body mechanisms enabling our interactions with the world, detect possible functional antecedents of our cognitive skills, and measure the sociocultural influence exerted by human cultural evolution onto the very same cognitive skills. In so doing, we can explain - and eventually revise - with a new sub-personal level of description some of the concepts we normally use when referring to intersubjectivity, aesthetics, and art, as well as to the experience we make of them.

The proposal I am defending here is that the experience of man-made images can be fruitfully approached by clarifying its bodily and neurobiological grounding elements. In so doing, we might eventually acquire a better understanding of what the concepts we normally use when referring to aesthetics and art are made of.

In the following sections, I illustrate how recent discoveries of neuroscience revolutionized our ideas about perception, action, and cognition and the relationship among them, allowing a fresher look—complementary to the humanistic approach—at the problem of images.

My purpose is not to reduce aesthetics to the mere working of neurons, but to enrich our perspective on distinctive aspects defining our human nature.

The new model of perception and cognition I propose, *embodied simulation*, reveals the constitutive relationship between body and creative expression and its reception. Embodied simulation shows that human experience—broadly speaking—should always be understood as a natural form of relational experience. As Siri Hustvedt wrote: "Visual art exists only to be seen. It is the silent encounter between the viewer, 'I', and the object, 'it'. That 'it', however, is the material trace of another human consciousness. [. . .] The painting carries within it the residue of an 'I' or a 'you'. In art, the meeting between viewer and thing implies intersubjectivity. [. . .] The intersubjectivity inherent in looking at art means that it is a personal, not impersonal act" (Hustvedt, 2005, xix).

The first important contribution of neuroscience to the problem of images is a novel notion of visual perception.

2. Against *Visual Imperialism*: Vision as Multimodality

Our vision of the world is complex and – most importantly – it exceeds the mere activation of the so-called visual part of the brain. Neuroscience has shown that vision is multimodal: it encompasses the activation of motor, somatosensory, and emotion-related brain networks. Motor neurons not only cause movements and actions but they also respond to body-related visual, tactile, and auditory stimuli, mapping the space around us, the objects at hand in that very same space, and the actions of others. Cortical motor networks thus provide the bodily-

formatted motor representational content of space, objects, and actions.
The space surrounding our body—peripersonal space—whose limits are the working limits of our arm, is defined by the motor potentialities of our body. Premotor neurons controlling the movements of the upper arm also respond to tactile stimuli applied to it, to visual stimuli moved within the arm's peripersonal space, or to auditory stimuli also originating from the same peripersonal space (Fogassi *et al*., 1996; Rizzolatti *et al*., 1997).
Manipulable objects, when observed, are mapped by the motor brain as potential targets of the interactions we might entertain with them. Premotor and parietal "canonical neurons" control the grasping and manipulation of objects, but also respond to their mere observation (Murata *et al*., 1997; Raos *et al*., 2006).
Finally, mirror neurons (Gallese *et al*., 1996), motor neurons activated during the execution of action and its observation when performed by someone else, map the action of others on the observers' motor representation of the same action (for review, see Rizzolatti *et al*., 2001).
The human brain is also endowed with a mechanism directly mapping action perception and action execution, defined as "Mirror Mechanism" (MM, for further review, see Gallese *et al*., 2004; Gallese, 2014a, b; Gallese and Guerra, 2015; Gallese and Cuccio, 2015). In humans too, the motor brain is multimodal. The brain circuits displaying the MM connect frontal and posterior parietal multimodal motor neurons, most likely analogous to macaques' mirror neurons. These brain circuits map a given motor content like "reach out," "grasp," or "hold" not only when controlling its performance, but also during its perception when performed by someone else, when imitating it, or when imagining performing it, while being perfectly still. In sum, the cortical motor system is not just a mere muscles controller, but an integral part of our cognitive system, the key element of our 'motor cognition' (Gallese *et al.*, 2009).
When acting or imitating someone else's action, the corticospinal pathway is activated, causing the excitation of muscles and the ensuing movements. When, instead, we observe or imagine movements and actions, actual action execution is inhibited. The motor system is activated, but not in all of its components and not with the same intensity as when we actively move our body: action is not produced but only simulated.
The embodied simulation of action likely provides the conditions allowing for the phenomenal quality of the experience of imagined or observed actions. Embodied simulation thus allows a direct apprehension of the relational quality linking to our body space, objects, and the actions of others. The primordial quality turning space, objects, and behavior into intentional objects is their constitution as the objects of the motor intentionality expressed by the motor potentialities of our body (Gallese, 2000, 2014a, 2016; Gallese & Sinigaglia, 2010).
Further research showed that other types of MMs underpin our capacity to directly apprehend the emotions and sensations of others because of a shared representational bodily format. When perceiving others expressing disgust or experiencing touch or pain, some of the same brain areas are activated as when we subjectively experience the same emotion or sensation. We do not fully experience their qualitative content, which remains largely opaque to us; however, embodied simulation enables us to experience others *as* experiencing emotions or sensations we know from the inside, as it were.

3. Embodied Simulation: Intersubjectivity as Intercorporeality

The discovery of mirror neurons gives us a new empirically founded notion of intersubjectivity, first and foremost conceived as intercorporeality—the mutual resonance of intentionally meaningful sensorimotor behaviors. Our understanding of others as intentional agents does not exclusively depend on language, but also on the relational nature of action. In many situations, we can directly grasp the meaning of other people's basic actions thanks to the motor equivalence between what others do and what we can do.
Intercorporeality thus becomes the main source of the basic knowledge we entertain of others.

Motor simulation instantiated by neurons endowed with the MM is probably the neural correlate of this human faculty, describable in functional terms as "embodied simulation" (Gallese, 2005, 2014a, 2016; Gallese & Sinigaglia, 2011). The variety of MMs present in our brain, thanks to the "intentional attunement" they generate, allows us to recognize others as other bodily selves, enabling basic forms of intersubjective communication and mutual implicit understanding (Gallese, 2014a, 2016).
Embodied simulation provides a unified theoretical framework for all of these phenomena. Our social interactions become meaningful by means of reusing our own mental states or processes in functionally attributing them to others (for the notion of reuse, see Gallese, 2014a, 2016). In this context, simulation is conceived of as a nonconscious, pre-reflective functional mechanism of the brain–body system whose function is to model objects, agents, and events. This mechanism can be triggered during our interactions with others, being plastically modulated by contextual, cognitive, and personal identity-related factors.
As we have seen in the previous section, embodied simulation is also triggered during the experience of spatiality around our body and during the contemplation of objects. The functional architecture of embodied simulation seems to constitute a basic characteristic of our brain, making possible our rich and diversified experiences of space, objects, and other individuals, being at the basis of our capacity to empathize with them.
Altogether these results suggest that empathy, or at the very least many of its bodily qualities, might be underpinned by embodied simulation mechanisms. Empathy can be conceived of as the consequence of our natural tendency to experience interpersonal relations first and foremost at the implicit level of intercorporeality.
Embodied simulation not only connects us to others; it connects us to our world, a world populated by natural objects, man-made objects, and other individuals, a world in which most of the time we feel at home. The sense we attribute to our lived experience of the world is grounded on the affective-laden relational quality of our bodily action potentialities, enabled by the way they are mapped in our brains.

4. Embodied Simulation and Experimental Aesthetics

Experimental aesthetics emphasizes the social performative nature of human creative expressions. By addressing human forms of creative expression in terms of social performativity, experimental aesthetics can fully exploit the heuristic value of embodied simulation.
Indeed, embodied simulation can be relevant to aesthetic experience in at least two ways: first, because of the bodily feelings triggered by the works of art we relate to, by means of the MMs they evoke. In such a way, embodied simulation generates the peculiar "seeing-as" characterizing our aesthetic experience of the images we look at. Second, because of the potential intimate relationship between the symbol-making gesture and its reception by beholders. The embodied simulation of the hand gestures that produced the image enables its experience (Freedberg & Gallese, 2007; see also Gallese & Di Dio, 2012; Gallese, 2012, 2014a, b; Gallese & Gattara, 2015).
Our scientific investigation of visual arts began with this second aspect. We investigated the link between the expressive gestures of the hand and the images those gestures produced in three distinct experiments with high-density electroencephalography (EEG). We recorded beholders' brain responses to graphic signs like letters, ideograms, and scribbles, or to abstract artwork by Lucio Fontana and Franz Kline.
The results of the first study showed that observing a letter of the Roman alphabet, a Chinese ideogram, or a meaningless scribble, all written by hand, activates the beholders' motor representation of their hand (Heimann, Umiltà & Gallese, 2013). In the two other studies, we demonstrated that a similar motor simulation of hand gestures is evoked when looking at the

cuts on canvas by Lucio Fontana (Umiltà *et al*., 2012), or at the dynamic brushstrokes on canvas by Franz Kline (Sbriscia-Fioretti *et al*., 2013).

The visible traces of the creative gestures activate in the observer the specific motor areas controlling the execution of the same gestures. Beholders' eyes catch not only information about the shape, direction, and texture of the cuts or strokes; by means of embodied simulation they breach into the actual motor expression of the artist when creating the artwork. The sensorimotor component of image perception, together with the jointly evoked sensory and emotional reactions, allow beholders to *feel* the artwork in an embodied manner.

A possible criticism of this model could point out the supposed passivity of its account of aesthetic experience, where beholders seem to be relegated to a deterministic empathic receptivity, hence losing sight of the peculiar individual quality of aesthetic experience, largely determined by one's individual taste, background, memories, education, and expertise. A second objection frequently raised against empathic–mimetic accounts of aesthetic experience consists of opposing the ambiguity and indeterminacy of art's symbolic content to the supposedly mechanistic quality of empathic responses, hence incapable of capturing the potential intrinsic ambiguity and polysemic quality of works of art.

It is possible to challenge these criticisms by arguing that there is ample proof that MMs and embodied simulation are dynamically modulated and affected by contingent and idiosyncratic factors. Indeed, several studies showed that one's previous experiences, memories, and expertise strongly determine the intensity of activation of MMs and the ensuing perceptual contents. (For recent reviews, see Gallese, 2014a, 2016; Ammaniti & Gallese, 2014; Gallese & Guerra, 2015.)

Embodied simulation, by virtue of its diachronic plasticity and modulation, might also be the vehicle of the projective qualities of our aesthetic experience, where our personal and social identity, the context, our mood and disposition literally shape the way we relate to perceptual objects. Embodied simulation, if conceived of as the dynamic instantiation of our implicit memories, can relate perceptual objects to beholders with a specific, unique, and historically determined quality. I submit that this projective quality of embodied simulation can do justice to both objections.

5. Liberated Embodied Simulation and Aesthetic Experience

Being human not only means to experience physical reality, but also to conceive possible worlds, to surrender to imagination and fictional worlds. An interesting topic for neuroscience to investigate is how our brain–body enables us to navigate in real and fictional worlds, constantly switching between them. Embodied simulation, a new model of perception and cognition, also reveals that the human experience of man-made images—broadly speaking—should always be understood as a natural form of relational experience. We live in relation to other people and objects present in our real world, but we live as well in relation to people and objects that are part of imaginary fictional worlds, which in the course of our cultural history we came to identify as art. Both kinds of relationships are rooted in our brain–body. The very same forms of sociality enabling artistic expressions and their reception are, at their basis, a further exemplification of intersubjectivity, conceived of as intercorporeality.

Neuroscience allows us to understand how the line between what we call reality and the imaginary and imagined worlds of fiction is much less sharp and clear than one might think. Indeed, experiencing an emotion and imagining it are both underpinned by the activation of partly identical brain circuits, although differently connected, when engaged in these different cognitive and phenomenal situations. Similarly, to see something and to imagine it, to act and imagining to act, share the activation of partly common brain circuits. A recent high-density EEG study showed that the brain circuits that inhibit action execution are partly the same as those that allow us to imagine to act (Angelini *et al*., 2015). All these examples of

dual activation patterns of the same brain circuits represent a further expression of embodied simulation and neural reuse (Gallese, 2014a, 2016).

A further advantage of embodied simulation consists of the possibility of addressing human forms of creative expression in terms of social performativity. Indeed, the biocultural approach to art and aesthetics, heavily influenced by cultural anthropology, emphasizes the performative character of human creativity. The anthropologist Tim Ingold wrote: "Hunters and gatherers of the past were painting and carving, but they were not "producing art." ... We must cease thinking of painting and carving as modalities of the production of art, and view art instead as one rather peculiar, and historically very specific objectification of the activities of painting and carving" (Ingold, 2000, 131). Similarly, Ellen Dissanayake wrote: "Art is not an ornamental and dispensable luxury, but intrinsic to our species. ... Art as a behavioral complex is an inherited tendency to act in a certain way, given appropriate circumstances" (Dissanayake, 1992, 224).

However, there is a clear distinction between how we experience the real world and the worlds of fiction. Our relationship with fictional worlds is double-edged: on the one hand, we pretend them to be true, while, on the other, we are fully aware they are not.

In spite of the fact that the body is at the core of our perceptions, of our understanding, and of our imagination, the relationship with fictional worlds is still mainly explained in purely cognitive terms, that is, following Coleridge, in terms of suspension of disbelief. This explanation, however, is at best partial. It was proposed that embodied simulation can be relevant to our experience of fictional worlds because of the feeling of body they evoke, by means of the potentiation of the mirroring mechanisms they activate (Wojciehowski & Gallese, 2011; see also Gallese, 2011, 2012, 2014b; Gallese & Guerra, 2015). Through this potentiation, embodied simulation generates the specific attitude informing our aesthetic experience, boosting the bodily memories and imaginative associations fictional content can awake in our minds, thus providing the idiosyncratic character of its appreciation.

How is such potentiation achieved? One important context-dependent aspect characterizing our relationship to fictional worlds deals with our distancing from the unrelated external world, which remains at the periphery of our attentional focus, very much like the frames surrounding the images we are beholding. According to my hypothesis, such distancing, this temporary suspension of the active grip on our daily occupations, liberates new simulative energies. Our experience of fictional worlds, besides being a suspension of disbelief, can thus be interpreted as a sort of "liberated embodied simulation." When adopting such aesthetic attitude, our embodied simulation becomes liberated, that is, it is to a large extent freed from the burden of modeling our actual presence in daily life (Gallese, 2011, 2012; Wojciehowski & Gallese, 2011; Gallese & Guerra, 2015). Through an immersive state, in which our attention is focused on the fictional world, we can fully deploy our simulative resources, letting our defensive guard against daily reality slip for a while.

Finally, I posit that when engaged with fictional worlds, the contextual bodily framing — our being still— additionally boosts our embodied simulation. Being still enables us to fully deploy our simulative resources at the service of the immersive relationship with the fictional world, thus generating a greater feeling of body. Being forced to inaction, we are more open to feelings and emotions. The specific and moving experience generated when immersed in fictional worlds is thus likely also driven by the sense of safe intimacy with a world we not only imagine, but also literally embody.

When we relate to fictional worlds, our attitude towards their content can be characterized as a sort of "neotenic look," somehow similar to the way we are looking at the world during that early period of our development in which, because of our poor motor autonomy, our interactions with the world are mainly mediated by the embodied simulation of events,

actions, and emotions animating our social landscape. During the first months of our extra-uterine life, while observing others' behaviors, thanks to embodied simulation and its plasticity we learn to calibrate gestures and expressions and to match them with experiences of pleasure and displeasure.

When we relate to fictional worlds, as when we contemplate works of art, our relative immobility is no longer the consequence of the immaturity of our sensorimotor development, but the outcome of our deliberate decision. However, immobility, that is, motor inhibition, probably allows us to allocate more neural resources to the service of our beholding, intensifying the activation of bodily formatted representations and, in so doing, making us adhere more intensely to what we are simulating. Perhaps it is no coincidence that some of the most vivid fictional experiences we entertain, as those occurring during dreams, are paralleled by the massive inhibition of our muscles.

During the aesthetic experience of fictional worlds, our experience is mediated by the simulative perception of the events, actions, and emotions that form the content of fiction. For example, when watching a movie or reading a novel, we not only focus our attention on them, but our immobility enables us to fully deploy our embodied simulation resources and put them at the service of our immersive relationship with the story. This hypothesis can plausibly contribute to explaining the difference between our "aesthetic attitude" towards fictional worlds and our ordinary consciousness of prosaic reality.

6. Conclusions

The creative processes characterizing our species, in spite of their progressive abstraction and externalization from the body, keep intact their bodily ties. Creative expression, through image-making, is tied to the body not only because the body is the image-making instrument, but also because the body is the main medium allowing the experience of man-made images. Through the lens of neuroscience, we can now look at the human aesthetic–symbolic dimension also from the dimension of bodily presence. According to Hans Gumbrecht (2004), aesthetic experience involves two components: one deals with meaning, the other with presence. The notion of presence entails the bodily involvement of image beholders through a synesthetic multimodal relationship with the artistic/cultural artifact, whose perception is qualified by Gumbrecht as "haptic vision." According to Gumbrecht, every culture can be analyzed and studied from the double perspective of meaning and presence, because both can be found in variable percentages in every cultural object. When presence predominates, world objects chiefly acquire their sense by virtue of their intrinsic sensorimotor inherence to perceivers. The added value experimental aesthetics can bring to the debate in aesthetics consists in revitalizing the scientific study of artistic styles, focusing on their biological bodily roots. By empirically investigating aesthetic experience, the outcomes of human creative expression can be viewed and interpreted in ways less conditioned by the contemporary Western cultural and aesthetic canon, because such influences can be specifically studied, thus granting their thorough understanding.

Contemporary neuroscience shows that what we see is not the simple "visual" recording in our brain of what stands in front of our eyes, but the result of a complex construction, whose outcome is the result of the fundamental contribution of our body with its motor potentialities, our senses and emotions, our imagination, and our memories. We must definitely abandon the outdated concept of solipsistic and "purely visual" vision. Vision is a complex experience, intrinsically synesthetic, that is, made of attributes that largely exceed the mere transposition in visual coordinates of what we experience any time we lay our eyes on something. The expression "laying the eyes" indeed betrays the haptic quality of vision: our eyes are not just optical instruments, but are also a "hand" touching and exploring the visible, turning it into something *seen by someone*.

With the aid of neuroscience, we can better test the supposed universality of human artistic expression and, most importantly, challenge its allegedly unique logocentric origin. Cognitive neuroscience can surrender us from the forced choice between the totalizing relativism of social constructivism, which doesn't leave any room for the constitutive role of the body in cognition, and the deterministic scientism of some quarters of evolutionary psychology, which aims at explaining art exclusively in terms of adaptation and modularity.
Experimental aesthetics can shed new light -from its own peculiar perspective and methodology- on the aesthetic quality of human nature and its natural creative inclination. In so doing, it will help us understand why and how creative expression, and what we now designate as art, are among the most fundamental expressions of our species.

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