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Visions of the body. Embodied simulation and aesthetic experience

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Abstract. The present contribution is mainly intended to illustrate how some recent discoveries in the field of neurosciences have revolutionized our ideas about perception, action and cognition, and how these new neuro-scientific perspectives can shed light on the human relationship to art and aesthetics, in the frame of an approach known as "experimental aesthetics". Experimental aesthetics addresses the problem of artistic images by investigating the brain-body physiological correlates of the aesthetic experience and human creativity, providing a perspective that is complementary, and not in opposition, to the humanistic one on the arts and the aesthetic.

Key words. Image, mirron neurons, embodiment, intersubjectivity, creativity.

> 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.
>
> John Dewey, *Art as Experience* [1]

1. INTRODUCTION

Humans are not entirely satisfied with the prosaic relation they daily entertain with the world. They are constantly projecting themselves towards the Other, towards what is missing, what is elsewhere in space and time. If we look at the body as the constitutive source of our world experience, concepts like “internal” and “external”, “subject” and “object”, become nothing but verbal placeholders for the dynamic relation our body entertains with the world. The

[1] Dewey (1934): 4.

notions of desire and openness to the world are other ways of describing the same dynamic body-world relationship. These notions allude in different ways to our constitutive search for a constitutively missing other(ness). Such dissatisfaction with the here-and-now of prosaic reality induces humans to re-create the world by imagining it, representing it, or transfiguring it by creating ultra mundane imaginary worlds. Humans can imagine hunting wild game, can represent it pictorially on the walls of a cave, or fuse some animal's features with those of the human body by creating chimerical figures with supernatural powers, like the prehistoric ivory statue of the Lion-Man, found in Germany in the cave of Hohlenstein-Stadel.

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 fruition? 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 accompany human beings since they started asking themselves what does it mean being human.

Different approaches have addressed the problem of images, almost entirely developed and discussed within the humanities. The biological sciences and, in particular, cognitive neuroscience, recently started to empirically investigate art and aesthetics. Neuroscientific approaches to art and aesthetics, are usually referred to as "neuroaesthetics". We owe the notion of neuroaesthetics to the pioneering work of Semir Zeki, a prominent neuroscientist whose work led to major discoveries on vision and the brain (Zeki [1993, 1999]). During the last twenty years Zeki has been investigating the relationship between vision and art. Following Zeki, many neuroscientists started addressing different problems related to aesthetics: some used art to better understand brain function, employing paintings or movie shots as mere stimuli to investigate the neurobiological bases of non art-specific cognitive functions. Others, among which Zeki is still the leading figure, employed brain imaging techniques like fMRI to study the concepts of "aesthetic pleasure" (Ishizu, Zeki [2013]) or "the sublime and beauty" (Ishizu, Zeki [2011, 2014]). More generally, the core interest of this approach is the investigation, on the one hand, of the neural mechanisms underpinning the perceptual analysis of the formal features of art works and of the aesthetic feelings their perception generate in beholders, on the other.

In the present contribution I suggest why and how neuroscience can investigate our relationship with art and aesthetics, framing this empirical approach as "experimental aesthetics". Experimental aesthetics addresses the problem of images from a different and complementary perspective with respect to neuroaesthetics, by means of the scientific investigation of the brain-body physiological correlates of the aesthetic experience we make of the outcomes of human creative expression we now define "art works". The notion "aesthetics" is used here mainly in its bodily account, according to its etymology from *aisthesis*. Aesthetics is thus empirically investigated by privileging the sensorimotor and affective features of our experience of perceptual objects.

Of course, these components of aesthetic experience are just one instantiation of the many levels by means of which images can be experienced and understood. Experimental aesthetics aims to shed new light on the bodily aspects of our reception of images.

The problem of art and artistic images can be framed as a particular case of the broader problem of images *qua* images. From that follows that neuroscience in 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", one can empirically investigate the neurophysiological brain mechanisms that make our interactions with the world possible, detect possible functional antecedents of our cog-

nitive skills and measure the socio-cultural influence exerted by human cultural evolution onto the very same cognitive skills. In so doing we can explain – and eventually revise – with a new subpersonal 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.

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. The purpose is not to reduce aesthetics to the mere working of a bunch of neurons, but to enrich our perspective on human nature.

The new model of perception and cognition I propose, embodied simulation [Gallese (2003, 2005, 2014); Gallese, Sinigaglia (2011); Gallese, Cuccio (2015)], reveals the constitutive relationship between body and creative expression, showing 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).

We live in relation with other people, objects and landscapes that are present in our real world, but we live as well in relation with people, objects and landscapes that are part of the imaginary fictional worlds displayed by the arts. Both kinds of relationship are rooted in our brain-body system, and if we aim to grasp the basis of the complexity and the multimodality these relationships entail, we have to get back to the brain and body.

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

2. CHALLENGING VISUAL IMPERIALISM: VISION AND MULTIMODALITY

Our vision of the world is far more complex than the mere activation of the 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 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 performed by someone else, map the action of others on the observers' motor representation of the same action[2].

Also the human brain is endowed with a mechanism directly mapping action perception and execution, defined "Mirror Mechanism" (MM)[3]. In humans too the motor brain is multimodal. The brain circuits displaying the

[2] For review, see Rizzolatti, Fogassi, Gallese (2001).

[3] For review, see Gallese et al. (2004); Gallese (2014); Ammaniti, Gallese (2014); Gallese, Cuccio (2015).

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", "hold" not only when controlling its performance, but also when perceiving it while being performed by someone else, when imitating it, or when imagining performing it, in spite of being perfectly still. In sum, the cortical motor system is not just a mere muscles controller, but integral part of our cognitive system (Gallese et al. [2009]).

When acting or imitating someone's else action, the cortico-spinal 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 space, objects and the actions of others to our body. 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]; Gallese, Sinigaglia [2010]; Gallese [2014a, 2016]).

Further research has demonstrated 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[4] our own mental states or processes in functionally attributing them to others. In this context simulation is conceived of as a non-conscious, 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.

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

[4] For the notion of reuse, see Gallese (2014a, 2016).

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 nature of human creative expressions. The very same forms of sociality that enabled artistic expression are at their basis a further exemplification of intersubjectivity conceived of as intercorporeality. 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 art works 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, in virtue of the motor representation that produces the image and, by means of simulation, enables its experience [Freedberg, Gallese (2007); see also Gallese, Di Dio (2012); Gallese (2012, 2014 a,b,c); Gallese, Gattara (2015)]. When looking at a graphic sign, we unconsciously simulate the gesture that has produced it.

Our scientific investigation of experimental aesthetics applied to visual arts began with this second aspect. We investigated in three distinct experiments by means of high density Electroencephalography (EEG) the link between the expressive gesture of the hand and the images those gestures produced. We recorded beholders' brain responses to graphic signs like letters, ideograms and scribbles, or to abstract art works 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 (Heiman, 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 sensory-motor 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 to 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 expe-

rience, consists of opposing the ambiguity and under determinacy of art's symbolic content to the supposedly mechanistic quality of empathic responses, hence falling short of capturing the potential intrinsic ambiguity and polysemic quality of art works.

I think 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[5] .

Embodied simulation, in virtue of its diachronic plasticity and modulation, might be also 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 a given perceptual object. Embodied simulation, if conceived of as the dynamic instantiation of our implicit memories, can relate perceptual objects to beholders with specific, unique and historically determined quality. I submit that this projective quality of embodied simulation can do justice of both objections.

5. LIBERATED EMBODIED SIMULATION AND AESTHETIC EXPERIENCE

As argued in Introduction, being human not only means to experience physical reality, but also to conceive possible worlds, to surrender to imagination and to fictional worlds. An interesting topic for neuroscience is to determine how our brain-body system enables us to navigate in real and fictional worlds, constantly switching among them. Embodied simulation, as 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 with other people and objects present in our real world, but we live as well in relation with 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 relationship are rooted in our brain-body system. 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 in these two 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 that allow us to imagine to act (Angelini et al. [2015]). All these examples of dual activation pattern of the same brain circuits represent a further expression of embodied simulation and the related notion of neural reuse (Gallese [2014a, 2016]).

A further advantage of embodied simulation consists in the possibility to address human forms of creative expression in terms of social performativity. Indeed, the bio-cultural approach to the naturalization of 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 intrin-

[5] For recent reviews, see Gallese (2014a, 2016); Ammaniti, Gallese (2014); Gallese, Guerra (2015).

sic to our species. […] Art as a behavioral complex is an inherited tendency to act in a certain way, given appropriate circumstances" (Dissanayake [1992]: 224).

Embodied simulation is congruent with this approach and can be relevant to shed new light on aesthetic experience in at least two ways: first, because of the bodily feelings triggered by the outcomes of human symbolic expression, by means of the embodied simulation 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 intimate relationship between the creative gesture and its reception by beholders, in virtue of the motor representation that produces the image and, by means of simulation, enables its experience [Freedberg, Gallese (2007); see also Gallese, Di Dio (2012); Gallese (2012, 2014b); Gallese, Gattara (2015)].

However, there is a clear distinction between our experience of the real world and our experience of 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. When beholding a painting at an art museum, for example, several powerful framing effects take place. First, we find ourselves in a context where the images hanging on the wall are supposedly art works. Second, once we let the art work capture our attention, the frame surrounding it almost disappears, as we are fully absorbed by the image.

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)]. In such a way, embodied simulation generates the specific attitude informing our aesthetic experience. Such potentiation supposedly boosts 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 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. Our being still simultaneously enables us to fully deploy our simulative resources at the service of the immersive relationship with the fictional world, thus generating an even greater feeling of body. Being forced to inaction, we are more open to feelings and emotions. The specific and particularly moving experience generated when immersed in fictional worlds is thus likely also driven by this 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", in a way similar to the way we were looking at the world during that early period of our development, in which,

because of our poor motor autonomy, our interactions with the world were mainly mediated by the embodied simulation of events, actions, and emotions animating our social landscape. Probably we learn to calibrate gestures and expressions and to match them with experiences of pleasure/displeasure observing them in others, thanks to embodied simulation and its plasticity.

When we relate to fictional worlds, like when contemplating art, our relative immobility is not anymore the consequence of the immaturity of our sensorimotor development, but the outcome of our deliberate decision. However, immobility, that is, a greater degree of motor inhibition, probably allows us to allocate more neural resources, 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 dreaming activity, are paralleled by massive inhibition of the muscle tone in our body.

During the aesthetic experience of fictional worlds, our experience is almost exclusively mediated by a simulative perception of the events, actions and emotions representing 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 explain the difference between our "aesthetic attitude" towards fictional worlds and our ordinary consciousness of prosaic reality.

6. CONCLUSIONS

The creative expressive processes characterizing our species, in spite of their progressive abstraction and externalization from the body, keep their bodily ties intact. Creative expression through image-making is tied to the body not only because the body is the image-making instrument, but also because it is the main medium allowing the experience of man-made images.

We can now look at the aesthetic-symbolic dimension of humans not only from a semiotic-hermeneutic perspective, but starting from the dimension of bodily presence. According to Hans Gumbrecht (2004), aesthetic experience involves two components: one deals with meaning, the other one 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 percentage in every cultural object. When presence predominates, world objects chiefly acquire their sense in virtue of their intrinsic sensorimotor inherence to perceivers, and not through interpretation.

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. With the project of naturalizing aesthetic experience the outcomes of human creative expression can be viewed and interpreted in ways less conditioned by 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-visibilist" 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 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 to 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 understanding why and how creative expression and what we now designate as art are among the most fundamental expressions of human nature[6].

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