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Aesthetics and kinaesthetics[1]

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Abstract: I offer a critical examination of David Freedberg and Vittorio Gallese's (2007) theory that the experience of art involves a form of simulation involving the activation of canonical or mirror neurons. I suggest that there are three problems with this view, and I propose an alternative view based on the enactive theory of social perception and interaction. I conclude: (1) In contrast to Freedberg and Gallese, our reactions to images and artistic representations of actions and objects are not of the same order as our reactions to real actions and objects; (2) Artistic/aesthetic experiences offer affordances that short circuit our ordinary engagements, and make us aware of possibilities not realizable in current or established frameworks.

Recent neuroscientific research on "mirror neurons" (MNs), neurons activated both when we engage in intentional action and when we observe the intentional actions of others, has initiated an ongoing debate in regard to questions about social cognition (e.g., Gallagher 2007; 2008; Gallese 2007; Goldman 2006; Herschbach 2009; Jacob 2010; Zahavi and Gallagher 2008). On one view, MNs are said to constitute simulations through which we are able to understand the actions, or even the mental states, of others (Gallese 2001; 2005; 2007; Goldman 2006). On an alternative view, MNs are an integral part of an enactive perceptual system that contributes to our intersubjective interactions (Gallagher 2007; 2008).

David Freedberg and Vittorio Gallese (2007) have proposed to extend this research to the study of art and aesthetic experience. This particular application follows a tradition that originated at the beginning of the 20th century with the German philosopher Theodore Lipps. Lipps (1903) discussed the concept of *Einfühlung*, which he equated with the Greek term *empatheia*. He attributed our capacity for empathy to a sensory-motor mirroring, an involuntary, "kinesthetic" inner imitation of the observed vital activity expressed by another person. For Lipps, our kinaesthetic imitation also informs our experience of art. Seeing an

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artwork initiates a sense of empathy in the perceiver. Extending this idea to MNs, Freedberg and Gallese write:

> [A] crucial element of esthetic response consists of the activation of embodied mechanisms encompassing the simulation of actions, emotions and corporeal sensation, and … these mechanisms are universal. (2007, 197).

The category "embodied mechanisms" includes both MNs and "canonical neurons" (CNs). The latter are specific neurons that activate when either I reach and grasp a tool or instrument, or I simply *see* the tool or instrument.

According to Freedberg and Gallese (2007), when we empathically engage with a work of art, we have "a sense of inward imitation of the observed actions of others in pictures and sculptures" (p. 197), or of possible uses of represented objects. MNs and CNs are activated so that viewers "might find themselves automatically simulating the emotional expression, the movement or even the implied movement within the representation" (p. 197). This is also the case for architecture and abstract paintings.

> 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. With abstract paintings such as those by Jackson Pollock 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 (Freedberg and Gallese 2007, 197).

I have three worries, reservations, or objections in regard to the claims made by Freedberg and Gallese. But first let me say that I am not a mirror-neuron skeptic. Despite recent questions raised about the existence of MNs in humans (Dinstein, Thomas et al. 2008; Hickok 2009), there is good science to show that something like a mirror system does play a role in human social cognition and understanding of actions (see e.g., Chong et al. 2008; Gazzola and Keysers 2009; Mukamel et al., 2010). In addition, there is some evidence for MN activation when we view images. For example, when subjects view still photos of dynamic actions vs static poses, there is more activation in MN areas: ventral premotor and inferior parietal cortices -- but also the dorsal premotor, SMA, middle cingulate, somatosensory, superior parietal, middle temporal cortices and the cerebellum (Gazzola & Keysers 2008; Proverbio, Riva & Zani 2009). Accordingly, there is good reason to accept the idea that there is MN and CN activation in humans in the case of viewing a painting, sculpture, and perhaps even architecture.

Nonetheless, my three worrisome issues still remain. First, Freedberg and Gallese do not account for the fact that our reactions to images and artistic representations of actions and objects are different from our reactions to *real* actions and objects. Here, by 'real' actions and objects I simply mean 'real' in the ordinary sense that would contrast with images or artistic representations.

Second, as I will argue, simulation is the wrong model for explaining the activation of MNs and CNs. And third, if the Freedberg-Gallese account is right, then either it diminishes art or it diminishes the MN account of social cognition.

1. Difference

One might think that the Freedberg-Gallese story could easily work for photographic images, photo or digital graphic realism, or *trompe l'oeil* painting. Still, there is definitely something different between an actual encounter with real people and things and an encounter with these hyper-realistic art forms since the latter are still representations rather than actually present things or people. If my CNs do get activated when I observe an image of a hammer, and if my MNs do get activated when I observe an image of a person, there must still be some important differences in the complex neural activations that are involved since the image of the hammer or the person is not something I can interact with in the same way that I can interact with a real hammer or real person. What Husserl calls the "I can" is different. For example, presented with an image of a hammer, I can't pick up the hammer and use it as I would a real hammer. Presented with a portrait, I can't interact with the 'person' in the painting in the same way that I can interact with a real person. Would my emotional response to the image of a tiger be the same as it would be if I confronted a real tiger?

One way to put this is to say the hammer offers an affordance for hammering; the image of a hammer does not. A person offers the affordance of social interaction; the image of a person does not. A landscape offers a set of affordances or non-affordances of physical movement; a landscape painting does not. The image or artwork offers a different set of affordances – not hammering, not social interaction, not physical movement – but what? I'll return to this question.

2. Simulation?

Freedberg and Gallese equate MN and CN activation to a subpersonal simulation of the perceived action or affordance. In the context of social cognition, I've argued against the simulationist interpretation of MNs (Gallagher 2007; 2008). In that context, the concept of simulation is derived from the simulation theory (ST) of social cognition. According to ST, I understand another person's mental states through a process in which I put myself in the other person's shoes and run a simulation of what I would think if I were in such a situation. Here, for example, is Alvin Goldman's description of simulation.

> First, the attributor creates in herself pretend states intended to match those of the target. In other words, the attributor attempts to put herself in the target's 'mental shoes'. The second step is to feed these initial pretend states [e.g., beliefs] into some mechanism of the attributor's own psychology … and allow that mechanism to operate on the pretend states so as to generate one or more new states [e.g., decisions]. Third, the attributor assigns the output state to the target …" [e.g., we infer or project the decision to the other's mind].

(Goldman 2005b, 80-81.)

The neuroscience of MNs has been cited as empirical evidence to support ST, and to suggest that the simulation of another person's action may take place as a sub-personal automatic response to observing that action (Gallese 2001; Gallese and Goldman 1998). Gallese captures it clearly in his claim that activation of mirror neurons involves "automatic, implicit, and nonreflexive simulation mechanisms …" (Gallese 2005, 117; also see Gallese 2007). Gallese refers to his model as the "shared manifold hypothesis" and distinguishes between three levels (2001, 45):

> - The *phenomenological level* is the one responsible for the sense of similarity … that we experience anytime we confront ourselves with other human beings. It could be defined also as the *empathic* level ….
> - The *functional level* can be characterized in terms of simulation routines, *as if* processes enabling models of others to be created.
> - The *subpersonal level* is instantiated as the result of the activity of a series of mirror matching neural circuits.

The general idea that MNs involve simulation seems to be the consensus view. Indeed, use of the term 'simulation' is becoming the standard way of referring to mirror system activation. Thus, for example, Marc Jeannerod and Elizabeth Pacherie write:

> As far as the understanding of action is concerned, we regard simulation as the default procedure…. We also believe that simulation is the root form of interpersonal mentalization and that it is best conceived as a hybrid of explicit and implicit processes, with subpersonal neural simulation serving as a basis for explicit mental simulation (Jeannerod and Pacherie 2004, p. 129; see Jeannerod 2001; 2003).

Jean Decety and Julie Grèzes (2006, 6), citing Rizzolatti's position, put it this way:

> By automatically matching the agent's observed action onto its own motor repertoire without executing it, the firing of mirror neurons in the observer brain simulates the agent's observed action and thereby contributes to the understanding of the perceived action.

Goldman (2006) defends a "low-level" form of simulation that is "simple, primitive, automatic, and largely below the level of consciousness" (p. 113), and the prototype for which is "the mirroring type of simulation process" (147).

Neural simulation has also been cited as an explanation of how we grasp emotions and pain in others (Avenanti and Aglioti 2006; Minio-Paluello, Avenanti and Aglioti 2007; Gallese, Eagle, Migone 2007). Oberman and Ramachandran (2007) use the idea of a dysfunction of "simulator neurons" as a way to explain autism.

There are, however, a number of problems involved with the claim that MNs are simulator neurons. First, there is a definitional problem. ST defines simulation as something that involves both *pretense* and *instrumental control* (where the subject actually controls the simulation routine). Clearly, however, sub-personal MN processes do not involve pretense or instrumental control. In regard to the latter, the experiencing subject does not manipulate or control the activated brain areas -- in fact, we have no instrumental access to neuronal activation. Indeed, in social cognition these neuronal systems do not take the initiative; they do not activate themselves. Rather, they are activated by the other person's action. The other person has an effect on us and *elicits* this activation. We do not initiate activation of MNs; it's the other who does this to us via a perceptual elicitation (Gallagher 2008). In regard to pretense, there is no pretense in sub-personal mirror processes. What these neurons register cannot involve pretense in the way required by ST. Since MNs are activated both when I engage in intentional action and when I see you engage in intentional action, the mirror system is said to be neutral with respect to the agent; no first- or third-person specification is involved in MN activation (Gallese 2005; Hurley 2005; Jeannerod and Pacherie 2004). In that case, it is not possible for them to register *my* intentions as pretending to be *your* intentions; there is no "as if" of the sort required by ST because there is no 'I' or 'you' represented. Even if MNs were not neutral with respect to the agent (that is, even if MNs involved some implicit or temporal characteristics that would specify the agent) that would still not be enough to satisfy a condition of pretense.

Just such worries have motivated some theorists to give up this strong definition of simulation. Goldman (2006), for example, offers a more liberal and minimal definition of simulation. He defends what I'll call the *matching hypothesis*: simulation is minimally a form of matching.

> [We] do not regard the creation of pretend states, or the deployment of cognitive equipment to process such states, as essential to the generic idea of simulation. The general idea of simulation is that the simulating process should be similar, in relevant respects, to the simulated process.… In the case of successful simulation, the experienced state matches that of the target. This minimal condition for simulation is satisfied [in the neural model] (Goldman and Sripada 2005, 208).

This shift in definition, however, does not solve the problem, since there is good behavioral and neurological evidence that MN activation is not equivalent to matching. Here, without going into extensive arguments (see Gallagher 2008 for these arguments), let me simply point out some of the neuroscientific evidence. Dinstein, Gardner et al. (2008) have shown that in certain parts of the brain where

MNs have been shown to exist –specifically *anterior intraparietal sulcus* (aIPS) – areas activated for *producing* a particular hand action are not activated for *perceiving* that hand action in another. Using a paradigm based on the game Paper-Scissors-Rock, they had subjects make specific hand gestures and view the images of another person matching hand gesture. While the hand gestures matched, the brain states did not: "distinctly different fMRI response patterns were generated by executed and observed movements in [*anterior intraparietal sulcus*] … aIPS exhibits movement-selective responses during both observation and execution of movement, but … the representations of observed and executed movements are fundamentally different from one another" (Dinstein, Gardner et al. 2008, 11237)

This lack of matching should not be a surprise, based on the known neuroscientific details about MNs.

- Of MNs activated by a single type of observed action, that action is not necessarily the same action defined by the motor properties of the neuron;
- Approximately 60% of mirror neurons are "broadly congruent," which means there may be some relation between the observed action(s) and their associated executed action, but not an exact match.
- Only about one-third of mirror neurons show a one-to-one congruence.

MN activation, thus, does not necessarily involve a precise match between motor system execution and observed action, but may be involved in "logically related" actions or in anticipating future action (Csibra 2005; Iacoboni et al. 2005). Activation of the broadly congruent mirror neurons may represent a complementary action rather than a similar action (Newman-Norlund et al. 2007, 55). This interpretation also fits with the anticipatory nature of MNs which are activated prior to the completion of action (see Csibra 2010).

These neuroscientific facts point in the direction of an alternative interpretation, that is, an *enactive* interpretation of MN and CN activation.

On the enactive view, our engaged understanding of the world (whether pragmatic or intersubjective) is based not on simulation or matching what we see, but on enactive perceptual and interactive processes. Accordingly, MN and CN activations are part of action-oriented perceptual processes that prime or prepare the system for action and response: CN activation in the perceptual process is *for action,* MN specifically *for intersubjective interaction.* Action understanding (my understanding of your action) is not a passive, observational event; it's an understanding of *what I can do* in response to your action. Action perception does not elicit a simulation or matching state, but a preparation for response. I perceive the other's action as something to which I can respond – a social affordance. This is enactive perception, which does not require that I put myself in the other person's shoes; it's perception for interaction – rather than simulation.

A recent empirical study by Caggiano et al. (2009) supports this interpretation. Rhesus monkeys were presented with a display of action in two different conditions: in one case, in peripersonal space (that is, reachable space) and in the other case, in extrapersonal space, which they could not reach without locomotive movement. Brain imaging showed differential activation of MNs in premotor cortex for peripersonal space vs extrapersonal space. As the authors suggest,

> A portion of these spatially selective mirror neurons … encode space in operational terms, changing their properties according to the possibility that the monkey will interact with the object. These results suggest that a set of mirror neurons encodes the observed motor acts not only for action understanding, but also to analyze such acts in terms of features that are relevant to generating appropriate behaviors (2009, 403).

On the enactive view one might go further to suggest that action understanding is precisely in the form of understanding the features of that action that are relevant to appropriate responses. This is not simulation. I do not anticipate interaction by replicating the other agent's state, but by enactively responding to the possibilities that the other's actions afford.

If the enactive interpretation is correct, then it suggests why our reactions to images and artistic representations of actions and objects are different from our reactions to real actions and objects. The difference is a difference in the way we can and do enactively respond to, e.g., the artistic representation vs the presence of a real person, corresponding to differences in the actions that the artwork vs the real person affords.

3. Diminishment of art or social cognition

The Freedberg-Gallese account motivates a third worry: If their account were right, and specifically, if they were right in their claim that MN activation for art generates the same kind of empathy as found in social cognition, then either it diminishes art or it diminishes the MN account of social cognition. On the one hand, if our reactions to artistic representations were summarized by MN/CN activation (considered as empathic simulation or matching), it suggests that aesthetic experience is no different from our everyday experience of persons and objects. On the other hand, if activation of the mirror system in response to others were the same as in the case of observing images and artistic representations, or especially of seeing the qualitative aspects of brush strokes, architectural features, etc., then MN activation would not be specific to intersubjective interaction, a claim that Gallese and others have consistently been defending.

Doesn't the fact that art affords something different than that afforded by objects and people, suggest that neuronal processes involved in these different kinds of engagement are different, and each special in their own way? Since I can't pick up the hammer represented in the painting; since I can't interact with the person portrayed in the painting, I experience the work of art in the mode of an anticipatory kinaesthetics that I can never fulfill or satisfy in the way that I may be able to satisfy if the hammer or the person is present. In this respect, one might say that the work of art falls short of actuality, or, perhaps more positively, the work of art transcends actuality in that it presents me with enactive possibilities that remain only possibilities that cannot be actualized[2] – without going through some further process – that is, without moving outside of the representational frame, e.g., by finding the actual person portrayed in the painting and interacting with her.

My embodied-enactive perception of art involves the kinaesthetic-anticipatory response to a non-realizable (non-practical, non-interactionable) affordance. It seems appropriate to think that this non-realizability is somehow registered/recognized in the motor system. That is, it seems possible that the non-realizability implicit (or explicit) in art registers in the motor system and generates a feeling different from our encounter with tools or others – not a priming for action or interaction, but for an experience of the purely possible or maybe even the impossible. This kind of affordance short circuits – it does so in a way that comes back to me and makes me aware of my possibilities, and does so in a way that disrupts my ordinary engagements. This is a positive accomplishment of art.

An enactive phenomenological aesthetics

The enactive approach outlined here is consistent with several traditional phenomenological approaches to aesthetics. Consider first the embodied approach to aesthetic experience taken by Merleau-Ponty, who Freedberg and Gallese themselves cite. As Merleau-Ponty says in his essay on Cezanne,

> We live in the midst of man-made objects, among tools, in houses, streets, cities, and most of the time we see them only through the human actions which put them to use. We become used to thinking that all of this exists necessarily and unshakably. Cezanne's painting suspends these habits of thought and reveals the base of inhuman nature upon which man has installed himself. This is why Cezanne's people are strange, as if viewed by a creature of another species. (Merleau-Ponty 1964, 15-16).

To the extent that art suspends our habits of thought, it differentiates itself from our everyday encounters – with others or with worldly things. It reveals something different in a way that shakes and challenges our everyday attitudes.

The Heideggerian analysis suggests a similar way of thinking. Heidegger understands art, not as something ready-to-hand (an instrument to be used – which involves our primary and everyday way of being-in-the-world), and not as something present-at-hand (an object for cognition – a derivative way of regarding the world, mistaken as primary by philosophers like Descartes). Rather, Heidegger (1993) regards art as something revelatory of being – and specifically, we could say, revelatory of being-in-the-world itself – that is, revealing of our own possibilities – as well as, perhaps, impossibilities.

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[2] Also, of course, it presents me with other possibilities that could be actualized with the physical art piece itself, as distinguished from the artwork. E.g., I could remove it from its current place and put it someplace else; I could purchase or sell it, etc.

Consider further the view taken by Husserl in his notion of anticipatory kinaesthetics for perception. Husserl (1973) emphasized the importance of kinaesthesia for embodied perception, and noted especially the kinaesthesia linked to extra-ocular movements as one's eyes scan the world. Such kinaesthetic response – or in neuroscientific terms, motor resonance – is reflective of the "I can" – that is, of my possibilities for action. The aesthetic kinaesthetic response, however, would be different from our everyday kinaesthetic response, precisely because the "I can" would be different for artistic works than for other people or things.

Husserl's phenomenological considerations anticipated, in a certain way, Yarbus's (1967) experiments on saccadic eye movements, and together they suggest a possible empirical study. Yarbus presented subjects with a painting that shows six women and the arrival of a male visitor; subjects are then asked to do certain tasks.

1. View the picture at will
2. Judge the age of the people in the painting
3. Guess what the people had been doing prior to the arrival of the visitor
4. Remember the clothing worn
5. Remember the position of the objects in the room
6. Estimate how long it had been since the visitor was last seen by the people in the painting.

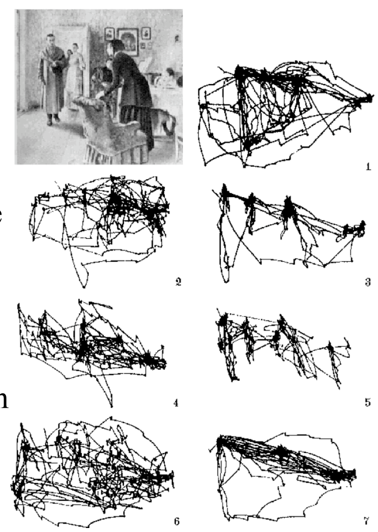

Figure 1: Yarbus's scan patterns

In response to each question there was a typical visual scan pattern (Fig. 1). The eyes scanned different patterns in the painting depending on the task. We would expect the different scan patterns to be accompanied by different kinaesthetic patterns.

Using a similar experimental paradigm Holsanova (2006) showed subjects an image (figure 2) and simply asked them to tell a story about it.

Figure 2: A motif from Nordqvist 1990.

Holsanova showed that eye scan patterns of subjects viewing the painting vary in correlation to the different narrative descriptions of the scene. Where their eyes go, there goes the story. Their viewing is dynamic and enactive -- they see the picture in terms of actions – and as they narrate it, they anticipate lines of action that are not depicted; they see possibilities that are only potential in the image itself. Saccades and scan paths anticipate the items mentioned in the narrative – narrative follows the scan paths. Again, the supposition is that kinaesthetic patterns – motor patterns – the activation of the motor system – enactively correlate with the scan paths – not just following them or simulating or matching what is there on the canvas, but anticipating the possible lines of comprehensible narratives. Anticipatory kinaesthesia is not simply the shadow of movement – it can be the foreshadowing of movement.

To show that our perception of the artwork is not enactively equivalent to our perception of other persons or objects, one might introduce a further condition into Holsanova's study:

1. Use a scenario similar to the Holsanova study, where the narrative is based on an image.
2. Use a quasi-theatrical setting with live models, real people with whom one could potentially interact, arranged in the same way as represented in the image

The hypothesis: comparative analysis of the scan paths (and patterns of kinaesthesia/motor system resonance) would show differences between the image and the live setting even for similar narratives. One reason for the hypothetical difference is that real people stare back; they see us, or potentially see us, unlike people represented in images. Just that, and perhaps even just their presence, has an effect that is different from non-seeing images, and calls forth a response (and a motor resonance) on our part that is correspondingly different.

Conclusions

I have argued that our reactions to images and artistic representations of people and actions and objects are not of the same order as our reactions to real people, actions and objects. Freedberg and Gallese fail to account for this difference. Aesthetic experiences offer affordances that short circuit – in a way that comes back to the perceiving agent, disrupting ordinary engagements, and creating possibilities that are not realizable in current or established frameworks. We gain this insight if we take an enactive view and give up the simulationist interpretation of mirror/canonical neuronal activation. And if we do, we find phenomenological support for a view of aesthetic experience that is also open to empirical verification.

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