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The Mirror Neuron Mechanism and Literary Studies: An Interview with Vittorio Gallese

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Keywords:

Mirror Neurons, Mirror Neuron Mechanism, neurocriticism, Vittorio Gallese, neuroscience (I will think of more later)

Abstract:

How do stories often evoke intense feelings and sensations in their readers? This essay explores that question with a new combination of insights from neuroscience and literary theory, while

also assessing the difficulties as well as the potential gains of such interdisciplinary research.

The authors lay the groundwork for a neurocritical embodied narratology that incorporates both the critiques of traditional humanism within literary studies and of classic cognitivism within neuroscience. Their methodological approach focuses on Feeling of Body (in contrast to Theory of Mind), which may be considered the outcome of a basic functional mechanism instantiated by our brain-body system. Feeling of Body is also a foundational aspect of liberated Embodied Simulation, a process enabling a more direct and less cognitively mediated access to the world of narrated others and mediating our capacity to share the meaning of their actions, basic motor intentions, feelings, and emotions, thus grounding our identification with and connectedness to narrated characters. Through case studies of Virginia Woolf's *Mrs. Dalloway* and Dante Alighieri's *Vita nuova*, the authors argue that literary texts rely on Feelings of Body communicated by the authors to their readers, and, in turn, experienced by readers simulating those experiences through the sensory-motor networks common to human beings.



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Interview with Vittorio Gallese

Hannah Chapelle Wojciehowski

Hannah Wojciehowski [HCW]. The discovery of Mirror Neurons has broadened our understanding of human and animal cognition, and has also shed light on our affective lives—including our capacity for empathy and intersubjectivity. Many believe that this discovery has revolutionized the theory of mind. For example, in 2000, the renowned neuroscientist V. S. Ramachandran predicted that “mirror neurons will do for psychology what DNA did for biology” (Ramachandran 2000). How would you describe in the simplest possible terms the Mirror Neuron Mechanism (MNM) in humans and in non-human primates? And also tell us how this set of discoveries came about.

Vittorio Gallese [VG]. Mirror neurons were originally discovered in the macaque monkey brain premotor cortex. They are motor neurons, which means that by definition they activate when the monkey performs purposeful goal-related motor acts with the hand or the mouth or both—for example grasping and holding a piece of food.

We didn't start out looking for mirror neurons. The discovery happened by chance. But what I always say is that it was not completely by chance that we discovered mirror neurons, because we were ready to see them. At that time [the summer of 2001] we were looking for a more quantitative way of testing visual properties within the motor system, which in those days was still considered to be something pretty odd. And therefore we [the Parma group] had a lot of trouble in getting papers published, because people wouldn't accept the idea that motor neurons also showed visual properties. We found, for example, that the same neuron that fires when the monkey performs a goal-related motor act also fires when the monkey looks at the object without any movement aimed to grasp that object.

We were specifically looking for neurons with these properties, neurons that combined motor properties, that controlled the execution of a grasping motor act with the hand, for example, but that would also fire when the monkey was looking at the object, without grasping it. These neurons, which we later on described as ‘canonical neurons,’ carry out the process of visual-motor transformation. It is because of canonical neurons that the hand knows even before starting to move how to interact with an object of given size, shape, or axis of orientation. Anytime we grasp an object, our hand shapes during the transport phase according to the shape, size, and orientation of the object. These canonical neurons translate the shape/size of three-dimensional objects into the motor program required to control our hands as they interact with the same objects.

While investigating canonical neurons, during one experiment we came to realize that some neurons were firing not only when the monkey executed a grasp, but also when the monkey *merely looked* at one of us doing the same action. At first we thought that the monkey was simultaneously performing some abortive movement that we didn't notice. So we spent a lot of time carefully recording the activity of the muscles of the monkey—the muscles that the monkey employs to grasp with the hand, but also the mouth muscles

that the monkey employs to grasp and chew the food. This control experiment demonstrated that while observing the experimenter's action the monkey did not execute any movement—indeed, any trace of any movement. It became clear that it really was a visual response that was specifically triggered by the observation of an action similar to the one that, when executed by the monkey, also made the neurons fire.

HCW. How did you decide on the name “mirror neurons” to describe the function of these new cells that you had discovered?

VG. We thought that the metaphor of mirroring captured one basic functional aspect of these neurons: they fire when *I do something* or when *I see you doing the same thing*. That discovery—that naming—marked the beginning of a very important shift in the goals of our research. Before that point, we were already interested in multi-modal integration, that is, how the brain combines and integrates different sensory modalities in relation to objects we may potentially interact with. We had been investigating problems of visuo-motor control—for example, how we locate objects in space correctly, how we direct our reaching trajectories, and how our brains translate the image of an object into the most suitable motor command to interact with it.

After the discovery of mirror neurons, we became progressively more interested in intersubjectivity, in how we understand each other. The discovery pushed me back to my previous cultural interests in philosophy, which by that point had become highly relevant, because the topic we were addressing had very strong philosophical implications. I think everybody here agrees that as soon as you leave behind more prosaic problems, such as how my hand recognizes the shape of a glass of wine in order to not let it slip or drop, and move to questions such as what does it mean to understand what others are doing, all of a sudden you're in the middle of a number of hot topics still very energetically debated within philosophy of mind, for example, or within the cognitive sciences.

HCW. Your own recent work has moved in a highly philosophical direction. Your path-breaking theory of embodied simulation has revolutionized our understanding of intersubjectivity. Could you summarize your theory of embodied simulation and empathy in relation to the human MNM?

VG. It's not always on purpose that you try to put yourself in the mental or emotional shoes of the other, so to speak; rather, it is something that often happens automatically, non-consciously—something that can then be modulated cognitively and consciously. In other words, you don't understand the type of emotion that another person is experiencing by relying in the first place on inference by analogy. You don't need to rely on introspection. Empathy, then, is not a matter of reasoning that in a similar situation perhaps you would behave in a similar way, and that therefore you would map what you would do into the mental shoes of the other as you recognize it. That is the original

formulation of simulation theory, at least according to Alvin Goldman. In my view, this is a very interesting and efficient way to explain many aspects of mind reading.

Empathy, though, is something else. Empathy is the result of a *direct experience* of another person's state (action, emotion, sensation), thanks to a mechanism of embodied simulation that produces within the observer a corporeal state that is—to some degree—shared with the person who expresses/experiences that state. And precisely the sharing of some of the corporeal states between observer and observed allows this direct form of understanding, which we can define as “empathic.”

HCW. Would you say, then, that we are always having other people's emotional experiences, at least to some degree, through this automatic process of embodied simulation? Or that we are at least disposed or 'wired' for what some have called 'co-feeling'?

VG. No, we don't always have other people's emotional experiences. I do not mean that through empathy we experience the specific content of other's experiences. But I may experience the other as having an experience that I immediately grasp because I'm re-using my own neural resources that normally underpin my being in a similar state (acting, feeling pain, disgust, being caressed, etc.).

By “having a direct experience” of others' emotional states I mean that we normally understand what others are feeling. This form of understanding, though, is neither an inference by analogy nor a judgment. It is a sort of acquaintance from within, capitalizing upon the fact that the shared neural code mapping both my emotional expression and your emotional expression is coupled with the activation of some of the neural correlates of *my* phenomenal experience of that particular state. When I see your disgust, or when I read a narrative on somebody else's disgust, the same region within my anterior insula (a deep sector of the frontal lobe) is activated as when I feel real disgust. However, I am “disgusted” *in my insula*, which does not necessarily overlap with the disgust I experience when facing disgusting objects. Experientially speaking, I see a dimensional distinction between one's own and others' emotional experiences. At the level of the brain, there are cortical areas that are similarly activated by our genuine emotional experience and by our perception of the expression of emotions from others. But there are also other cortical areas that uniquely activate during my emotion and not during your emotion and vice versa. The crucial point is that shared activations ground an apparently external stimulus (your emotion) on my personal experiential acquaintance with the same emotion.

I think you also learn through a top-down cognitive control to reduce the emotional impact of what the other is experiencing, because otherwise you wouldn't be able to cope with it. Human infants *learn* how to distinguish between their own and others' emotional states, whose borders in the beginning are more blurred. And indeed many of the people who professionally are constantly involved with the physical or psychological pain of others suffer burnout syndrome, or require psychological aid, because they are constantly exposed to this. Now we believe we understand why, because we are starting to uncover the mechanism that mediates this relationship from an emotional point of view. It's

something that can nevertheless be cognitively modulated, provided you can down-regulate it; the way it works also strongly depends on your own personal history.

HCW. Your own memories, your thoughts, your history.

VG. Yes, your memories, your thoughts, the quality and quantity of social relationships you have experienced, your attachment history, and a variety of influences that derive from your interpersonal life history.

HCW. What psychological and philosophical traditions have influenced your thinking the most? Or in which traditions would you locate your own recent, multi-disciplinary research on embodied mind?

VG. My main readings of those topics used to be analytic. I was reading John Searle, Daniel Dennett, and other philosophers with a similar outlook. After the discovery of mirror neurons I felt the desire to return to Merleau-Ponty, so I went back to the *Phenomenology of Perception*, and I said, “Wow, this is much more related to what we are doing.” And then, second, came a letter from a French phenomenologist, Jean-Luc Petit, who learned about the discovery of mirror neurons through a review paper on motor cognition written by Marc Jeannerod, a highly influential French cognitive psychologist. He [Petit] said, “This is incredible. You should read Husserl. This is highly related to the notion of *Einfühlung*.”

From that moment onwards I added Husserl to my reading list. And then later on I also shyly approached other authors like Edith Stein, Martin Heidegger, Hannah Arendt, Jan Patočka, Paul Ricoeur, etc. And I must also add the cultural critic René Girard.

HCW. Girard is a towering figure in literary studies. In several of your recent articles, you make some very original connections between your own neuroscientific research and René Girard’s literary and cultural analyses. Could you explain your current interest in Girard’s work—specifically his theory of mimetic desire? Some believe that his theories anticipate your research, or that your research lends support to his theories.

VG. I became interested in Girard’s concept of mimetic rivalry originating in mimetic desire. I found it to be a very good antidote against a simplistic usage of the scientific evidence on the human MNM to herald the notion that we human beings are naturally good and inclined to altruism. Mimesis has at least two sides. The darkest one is precisely the one described by Girard. But, of course, as soon as I entered into Girard’s world I realized the wide implication of his theory for a variety of topics, including aesthetics.

HCW. The concept of mimesis has a long history, of course. In the Poetics, Aristotle talks about the most satisfying kinds of stories and plots, modes of characterization, possible identifications between audience and protagonists, and so on. He says that stories need to have a beginning, middle, and end; that they should have a climax and resolution that produce catharsis in a viewer. He talks about tragic characters and how they fall, etc. Do you think it would be possible to extrapolate from MNM research a theory of storytelling, a cognitive theory of storytelling, of plotlines, and, of course, mimesis? People are actually working on this, but I'm wondering how you think about it.

VG. I think the gap is really huge. We are not ready to make that jump. We are ready to start thinking about that jump, and how we can eventually reduce the gap by using neuroscientific research as a way to develop a dialogue with scholars in the humanities, and sit around the table and discuss trying hard to reduce the distance between the languages that we employ to talk about these topics.

HCW. This is a very speculative moment, isn't it? What I see here is a renewed potential for people in the sciences, social sciences, and humanities to talk to each other in productive ways.

VG. I think that whenever people talk of multi- or interdisciplinarity, the first problem to be solved is the language, the linguistic barrier, and the jargons that we employ. Often we use the same words but with totally different implications. Take "representation," for example. It's a polysemic word that according to the context you are in can mean totally unrelated things. So I think, of course, we are not there. Maybe we won't ever be there, but I think it's stimulating and certainly it's a lot of fun. It's exciting trying to think about topics normally addressed by the humanities, having a look at what neuroscience is telling us about how we function in the world.

HCW. What do you think might be the neurological basis of the phenomenon of theatrical catharsis that Aristotle talks about?

VG. I think it's still too early to answer that question. But I think that one way to reduce the distance between these frames could perhaps be provided by Girard, because Girard finds a pretty unexpected analogy between comedy and tragedy, because both deal with conflict—and actually comedy, in his treatment, is even more effective than tragedy in portraying the mimetic rivalry that, according to Girard, characterizes human social relationships and interactions.

We enjoy watching comedy and tragedy as much as we do because we see a conflict re-enacted—a conflict from which we feel safe, because we stare at it from a safe distance. That distance is imposed by the architectonics of the theater itself, where everything happens onstage, and we sit in the *cavea* or in an armchair, far from where the

action takes place. So it's a blend, so to speak, of identifying with the conflict while simultaneously feeling it from a safe distance. We understand that we are not affected by it. Perhaps this is why many years ago when looking for my seat at the Teatro Regio of Parma I felt totally uneasy when I discovered that Judith Malina (it was a Living Theater performance) was sitting in the seat beside mine completely tied to it with ropes. I felt uneasy because in that precise moment the safe distance between the actor and me was completely annihilated. This is also why contemporary theatrical performances are so powerful and disturbing at the same time.

In a sense catharsis is a way of reducing the impact of mimetic violence by ritualizing it. Theater is a further form of ritualization, since from Girard's perspective, rituals stem from the necessity to temper the violence that is intrinsic to any social group because of mimetic desire and mimetic rivalry. Theater is an evolution of this ritualization of violence, which apparently is still even more remote from the original violence that pushed humans to develop rituals, and therefore mythology, religion, and culture. But, according to Girard, the roots can be traced back to the same problems we intrinsically have as human beings, or perhaps that were even experienced by primates.

HCW. This idea of controlling violence through ritual seems very Girardian, and also Freudian, if we think of Totem and Taboo. But if ritual and performance succeed in controlling our violent tendencies, do they do something else, as well? I think most literary critics and theorists would say that they do.

VG. We reciprocate, we mirror what we see, but just to a certain extent. We are not fully absorbed. So, to put it in cognitive terms, we have a suspension of disbelief and of reality-testing which lasts for the couple of hours that we sit in the audience, but simultaneously we know it is a temporary intermission from our daily lives. To put it in my terms, we are free to let our simulations go, without having to bother to be prepared to counteract what is happening on stage, just because it is theater, it is not reality. Paradoxically, though, these staged events, passions, conflicts, etc., are more powerful than events happening in real life. Perhaps this happens because we can fully simulate them. In a sense we mirror the conflicts happening on stage more effectively than those happening on the street because we feel safe.

HCW. And in a constructive and therapeutic way, perhaps. Let's talk about characterization in theatrical works. You mention in your 2008 essay "Il corpo teatrale" that: "L'emozione dell'altro è costituita e compresa dall'osservatore grazie a un meccanismo di simulazione incarnata che produce nell'osservatore uno stato corporeo condiviso con l'attore di quell'espressione. È, per l'appunto, la condivisione dello stesso stato corporeo tra osservatore e osservato a consentire questa forma diretta di comprensione, che potremmo definire 'empatica'" (24).¹ So empathy between the observer and the observed arises from this shared and quite direct experience.

¹ The emotion of the other is established within and understood by the observer thanks to a mechanism of embodied simulation that produces within the observer a corporeal state shared with the person who

VG. Right.

HCW. But in a theatrical experience, it's not just self and other, it's self and others. And all of these different characters are variables in a kind of play of emotions inside of us that the playwright, as well as the actors, are manipulating, and giving us the opportunity to see and imagine from multiple points of view, more or less at the same time, or in very close sequence. That seems to really complicate the puzzle a lot, because there aren't just two people, but many.

VG. Right. To complicate things even more, we must take into account that also there are other series of intersubjective relations going into a theatrical play, because you have the relationship between the author and the character. Moreover, you have the relationship between the actor and the character through the author, and the relationship between the actor and the role he's playing, and the reactions of people watching the performance that he then uses. There's an actor onstage, and there's someone sitting in this dark hall watching what's going on onstage, but the actor herself entertains a very complex relation with the character, which is also part of the staging of the performance, as is the actor's relation to the audience. The character can be said to be performed when the actor has taken into account these feelings that come from the audience.

HCW. It's almost as if character is magnified by the presence of multiple people witnessing the performance.

VG. Definitely, together with the other intersubjective relationships. There's also another very interesting intersubjective relationship, which makes you as a single individual a member of a public audience. This puts you in a different relationship with what is being staged, just through the mere fact that you are sharing that experience with people who are simultaneously entertaining the same relationship but from a slightly different vantage point than you.

HCW. What's the difference between actually witnessing, in a sense face-to-face, a performance of some sort and reading a book that describes human encounters?

VG. Well, we don't know enough about what is going on when we read a fictional narrative. All the experiments done so far with brain imaging techniques have intrinsic limitations. But it's not just intrinsic limitations. I mean, people were up to different

performs that expression. And precisely the sharing of the same corporeal state between observer and observed allows this direct form of understanding, which we can define as "empathic."

things. Most of the people investigating language with the tools of neuroscience are interested in locating aspects of language *in* the brain. So there are people up to semantics, up to morphological aspects, grammatical, syntactical aspects, phono-articulatory aspects. Usually what they test in their experiments are very short strings of words, which supposedly would tap into one of the aspects that they would be more interested in investigating.

I'm aware of a few behavioral studies, which I quote in some of my previous papers. For example the philosopher Amy Coplan has discussed the role of empathy in the reading of fictional narrative. In a recent essay, she describes cognitive experiments on readers that confirm that we tend to view the action of the story from the perspective of the main character or of the narrating ego, so to speak (2004). We remember more accurately those objects that are described as being anchored to the protagonist's egocentric perspective.

HCW. Because of the perspective from which the story is told?

VG. Exactly. To what extent that differs from the same events witnessed while one is sitting in a movie theater, or watching a theatrical performance, or even watching real-life events, we don't yet know. We know already, though, that there is a difference between watching someone grasping an object and *reading* about someone grasping an object. With reading, you still see a clear and specific activation of your own motor system; however, you don't see a facilitatory effect. But you see an inhibitory effect. We described that in a couple of papers in 2005 and 2008, the first one appeared in *Cognitive Brain Research*, and the last one appeared in *Brain and Language* (Buccino et al. 2005; Sato et al. 2008). The idea is that there's a lot more indeterminacy in a linguistic description, broadly speaking. But we are miles away from answering your specific question. I'm trying to answer your question on the basis of what we already know.

So my point is the following. When I see someone *doing* something, I'm facing the specific agent aiming at the specific goal, accomplishing it in a specific way.

HCW. Could you explain more about how that process works in daily life?

VG. If I see someone grasping a cup, I see a specific guy or lady approaching the object following a specific trajectory with a specific kinematics, grabbing the object in a very specific and peculiar way. While when I read "he/she grasped the cup," who is "he" or "she"? How? What kind of cup? A coffee mug? An espresso cup? By the main body? By the handle? Our idea is that when you read about that action, a multiplicity of motor representations that are nevertheless semantically linked to the content of the sentence are simultaneously activated. Which leads to reciprocal inhibition and a delay in your reaction time when you press the button following the instruction "please press when you read an action-related sentence."

But there's even a more intriguing question. Even if you stay within the visual domain, what's the difference between watching a fight in the street and watching a staged fight on stage?

HG. Or on TV

VG. Or in a movie. I've been discussing that recently with colleagues of mine. There's a kind of framing effect when you specifically pay a ticket or you sit on your couch and turn on the TV. And for the next couple of hours you totally focus on what's going on. Besides that, the staged fight in the drama or in the movie occurs between people you know a great deal about, because there is a narrative introducing the characters to you. Such a narrative is lacking most of the time when you witness events occurring to people with whom you are not acquainted.

HCW. So this framing effect contributes to the temporary intermission that you spoke of earlier?

VG. Yes. In fiction, events are framed, first, so you are more focused. Second, you know why those people may kiss each other or fight each other, because that particular event occurs within a narrative flow, so there are antecedents. Usually there is a story, and as the story develops, you learn a lot more about the character, so that you are also in the position to anticipate future events. Most of this knowledge is clearly lacking if you see a fight while you are sitting in the subway or on a train, or you are on the other side of the street.

However, I think this is not the only difference between real-life events and fictitious narrative events. I think there is another difference, which at the least is probably equally important. In real life you are potentially, too, a protagonist of the event. You stare at the guys; they look at you, and say, "what's the matter with you?" And all of a sudden they punch you, instead of punching themselves. So you can get involved, potentially. In a sense your motor system, besides simulating what you see, is also simultaneously ready to react. This reaction is totally bracketed, so to speak, or very unlikely when you sit in a movie theater and watch the story. You know by definition that you won't be affected, that it's fiction. All you have to do is dive into it. In a sense it is possible that your emotional involvement is even greater with respect to the real situation because you are safe, as we discussed before in relation to Girard.

HCW. So you are more emotionally involved with a representation than you are with a similar situation in your daily life? That seems counter-intuitive.

VG. This is what Girard discusses when he speaks of classic theater. The action occurs at a safe distance from you. You are involved, but not completely. Since you are not physically completely involved, you can get emotionally more involved. You see what I mean?

HCW. Yes, maybe. But what about this? Don't you think you're emotionally involved with multiple characters, in other words, not just the protagonist, with whom we have the strongest identification, but with everybody on stage? You have multiple identifications. We see from multiple perspectives. I mean, this could be part of the involvement, that you're really drawn in by each person that you see, even though you're probably most likely to identify with the protagonist, though not necessarily. And identifications may shift from line to line, from scene to scene, from expression to expression.

VG. Yes. That also may easily occur in real-life situations, you know. You gaze from one person to the other, for example, when you are following a conversation. All of a sudden you're drawn into what's going on, and so you alternate your attention between the two people talking to each other. In real life, too, you can continuously switch, thus, in a sense, identify more with one character or the other. To be honest, we know very little of these topics from a neuroscientific point of view. Most of the research that has been done so far deals with dyadic interactions. This is mainly determined by technical limitations.

But I think that even with the present limitations we could do a lot more in this respect. Indeed there are already colleagues of mine like Guenther Knoblich, Nathalie Sebanz, and Harold Bekkering who are investigating more complex forms of social interactions, like joint actions. We are going to learn a lot in the near future about this fundamental aspect of social cognition. But what marks the difference is that, in cognitive terms, you may wish to define what we are discussing as "suspension of disbelief." I'm trying to translate this definition of what is going on when you are involved with fiction in a more embodied way. Regarding what people call suspension of disbelief, I consciously convince myself that it is a fiction, but I want to be totally involved with it. I call it *liberated* embodied simulation. Although I know it's fake, it doesn't prevent me from laughing, crying, feeling pain, or being terrified, even though I know nothing will happen; it's a bi-dimensional thing. I can decide to walk out of the movie theater whenever I want.

HCW. Fascinating. Now I'd like to take up a different aspect of identification. Do you see any risks in the ways that people might apply the theories of empathy and identification that you and others have pioneered? Is there a risk, for example, of defending the ways that people may identify with members of their own ethnic, racial, or sexual group (or any other group)?

VG. People don't need neuroscience to experience ethnic or racial conflict in our world. Certainly we tend to resonate more with somebody to the extent that we perceive she/he

to be more similar to us. In a sense we are naturally equipped to look for mirrors in which we recognize ourselves more easily, and therefore we tend to get away from somebody we do not identify with, somebody looking different. But it does not follow from that that racism is biologically grounded. Quite the opposite. It is just because of our human nature that we can discern that below superficial differences lies the same human being, no matter what the color of the skin or the spoken language may be.

The mirror mechanisms we are investigating would seem to suggest that the glass is half full. We share mechanisms that are telling us we are naturally wired to meet the other. And that the definition of our own self-identity is a contrastive notion that would make no sense if there were no others through whom we could develop our own personal identities. There is no way to develop our own personal identities properly without learning to cope with others. We mirror the people around us, but certainly we also take different paths from others. Identity is always contrastive. There is no self without an other. Subjectivity is constitutively intersubjectivity; subjectivity stems from intersubjectivity.

HCW. Your last point is similar to the credos of structuralism. Ferdinand de Saussure theorized the differential nature of the linguistic sign, which means only in relation to what it is not.

VG. Yes, but that's different.

HCW. Maybe, but it was applied by structuralists and poststructuralists to everything in the universe.

VG. Are structuralism and poststructuralism still popular in literary theory?

HCW. No, but their residues are there. The heyday of poststructuralism was in the 70s and 80s. It was also anti-foundationalist, since almost any kinds of value claims that people had made about literature and culture were strongly called into question. It happened in lots of different disciplines. There was a sustained critique of ideology that went on for almost forty years.

Now there is a different turn in literary studies towards the cognitive. And people are even calling it the cognitive turn, in which we are doing a 180° turn once again back toward something like structuralism—an embodied structuralism, perhaps. So instead of looking at a cultural field, as Levi Strauss did, in which there are certain rules operating—the rules of the game that people are trained to follow—now the structuralism seems to be neural.

VG. Of course, “neural” can mean many different things, because you can use the “toys” that we normally employ to do our research, like fMRIs, leading you to dramatically different conclusions according to the theoretical framework that you start from. For example, people who try to locate in the brain the module through which you can theorize about the mind of others, as if intentions, beliefs, and desires were objects located in a brain box. That’s high-tech phrenology in my view.

HCW. Yes, that’s definitely a risk—that is, of making sweeping assumptions about what those blobs of color may indicate.

VG. Because it’s a kind of *petitio principii*. Many colleagues start by already having in mind an idea of how the mind works. Thus, they think the only thing that remains to be done is to locate in the brain the boxes they employ to describe how the mind supposedly works. But it doesn’t tell you anything, because they start presumptuously from the idea that we understand others by applying theories. But this idea is not necessarily true, or at least it is not the entire truth.

You can use the same fMRI machine, publish in the same journal, use the same jargon, but you may end up with a completely different picture of human nature, of human cognition—very different.

HCW. So even in the sciences, it would seem, there are fundamental problems of interpretation that seem, at least at this point, inescapable.

On a different note, are you optimistic about the future? And particularly about what MNM research might do to help people face the problems that they’re dealing with now, and that they’ve always dealt with—our aggression, our destructiveness, our capacity for empathy and love, our moral dilemmas. Will this science help us be better people?

VG. Well, yes and no. On the one hand I believe that our discovery has the potentiality to open new perspectives on old problems. Indeed this is already happening. I think we can generate new experiments to investigate the potentialities of the MNM to shed new light on pathologies like autism and schizophrenia, to investigate new approaches to neuro-rehabilitation, etc. On the other hand, I do not think science is effective in telling people what they have to do. What really matters in helping people change their mental attitudes or lifestyles is not science. It’s politics. It would be certainly better if politics could be informed by an objective and unprejudiced vision of reality informed by scientific evidence. But this is clearly not happening. Do you think science has a huge impact on everyday life of our fellow human beings, besides being at the origin of the technology we employ or the way we heal ourselves?

HCW. I do.

VG. I don't.

I think science is a small piece of the overwhelming amount of information that we absorb everyday. There's very little room left for a serious attempt to bring to the people the results of scientific investigation.

HCW. Maybe it's just because I'm in literary studies that I think that science has a lot more weight in influencing what happens out there in the world.

VG. Everyone sufficiently informed knows that we can't keep going on forever with our current model of economic development. Do you think that such awareness has had any impact so far on the policies of the major countries who decide the fate of the planet? I don't think so. Do you think that what we learn from scientists about CO² emissions in the atmosphere helped the Kyoto Protocols go any better? I don't.

HCW. Good point. Rational thought does not seem to be driving political and economic life these days. Nevertheless, don't you think that there are strong ethical implications to your research, regardless of whether or not people choose to act on it?

VG. Yes, indeed. To the extent that cognitive neuroscience enables us to broaden our knowledge about the human condition, it certainly has ethical implications. I see it as a double-edged sword: on the one hand cognitive neuroscience can shed light on how we make our decisions and how those decisions can possibly be influenced by the cognitive framing that public discourse creates.

On the other hand, however, the very same results can enable or invite manipulative uses of that information by hegemonic forces within society.

HCW. What might you say to literary and cultural theorists, and to students who might be reading your work for the first time? What would you like them to think about?

VG. Well, it would be good to consider how it is possible to think about art, creativity, or aesthetic experience from a variety of viewing angles. What makes us who we are is a very complex and multi-layered manifold. I think that the contribution that approaches like mine or of other colleagues may provide to scholars in the humanities is a way to realize that we are dealing with the same things, but simply using different levels of descriptions, different jargons. We are dealing with different levels, which nevertheless belong to the same manifold. Learning things from a different level of description can help, as I get a lot of help studying what the human being is, starting from the personal level of description, provided by writers and artists, or literary scholars, or philosophers or anthropologists. It helps me to figure out what kind of questions I can ask to those sub-

personal entities—the neurons—that contribute to making me into the human being that I am.

HCW. The idea of different perspectives on art will not come as a surprise to literary theorists and others in the humanities. But the idea that neuroscience can shed light on what we do is likely to excite a great deal of interest. It already has.

VG. I think we all should do a lot more homework!

HCW. I like that. By the way, I'm very happy that you're willing to talk to humanists about what you do, and also about what we do.

VG. I think it's a very good benchmark, because, you see, what we neuroscientists are up to in the end is to provide a biological description of what a human being is, although we don't deal in principle with the person. I mean, we are dealing with the sub-components of the person, the neural cells that we all have in our heads, in our brain; nevertheless we use this approach, presumptuously perhaps, but we have the feeling that by asking those questions about those sub-personal entities, we get answers that provide the tools to have a better and clearer picture even at the personal level. When we get to the personal level, the personal level cannot be entirely reduced to the sub-personal level.

If I want to understand who a person is, it's not enough to describe those sub-personal entities, which, by the way, don't know anything about intentionality, passion, love, disgust, emotion. What they are dealing with is a bunch of ions—potassium, sodium, calcium, and that's it. That's all they "know" of the outer world.

We (not the ions in our brain) know about passion. So that's why I do not understand sentences like "I am my synapses." At best, it's a truism. "I am my liver, I am my kidneys"—what does that mean? "I am my blood." If you remove any of these sub-components, you won't have a living human being anymore, you won't have a functioning human being any more. But merely making such a statement doesn't tell you anything about who you are. The trick is to understand how come I am who I am partly *also* because of those synapses wired in this proper way.

So, for example, by addressing this topic—these huge topics—by means of a methodological reductionism (which is not ontological, by the way, though for some colleagues it can be both), you can come up with counter-intuitive findings like those that we have just now been discussing here. We don't see with our visual system only; we also see with our motor system, with our tactile system. To the extent that I do resonate when I see you doing something—a very basic ingredient of this particular relationship—you are acting, and I am passively witnessing your action—my motor system comes into play, which is completely counter-intuitive. It is completely counter-intuitive to speak of "motor cognition," because cognition is modeled on all the metaphors that come from vision, starting from the word "idea," *eidōs*—it's visual.

Most of the metaphors we employ to describe our cognitive apparatus come from vision, because vision is so pervasive in our experience of the world. But it's not the only way. It's probably the most important gate we have to the world, but we shouldn't forget other senses like touch, for example. Because, again, when I see your cheek being caressed, my somatosensory cortex also resonates along with your tactile sensation. I put into play part of the brain machinery as if, as Damasio would put it, I were experiencing the sensation I'm only passively witnessing. So this passive is not so passive. It's an active participation in terms of the partial sharing of the brain's structures that are employed. In a standard account, when you are touched, what really matters in making *you* feel the touch, your experience, is your tactile brain. When *I* witness your tactile sensation, what really matters is my visual brain. *False*. What really matters is my visual brain, which is the gate through which I am processing your own tactile sensation. But equally important, if not most important, is my tactile simulation, which provides the experiential content that enables me to understand how it feels to be slapped or caressed.

HCW. Vicarious experience, in other words.

VG. Cognitively I can certainly get to a *similar* conclusion by using inference by analogy. But the quality of my understanding is completely different. My colleagues did an experiment in which they put people in the scanner, and they had them watch in two different sessions videos portraying a human being, a monkey and dog chewing food.

Here's what they found. When you see a dog eating his food, your motor system resonates practically in the same way as when you see a human being eating. You recognize chewing as chewing. That is not only processed by your visual system, and cognitively you understand the dog is biting. You're really understanding experientially—from the inside, so to speak—because your motor system resonates along.

However, if the same three different species perform something different—not a consummatory act, like eating, but a communicative act, like silent speech, a monkey lip-smacking, which is an affiliative gesture, or a barking dog, you see that during the silent lip-reading [of a human], your motor system still resonates a lot. When you watch the monkey lip-smacking, the activation of the motor system is dramatically reduced, but it is still resonating. When you see the barking dog, your motor system is silent. You process that stimulus visually, then you elaborate the outcome of that visual analysis cognitively.

So that tells you two things. In order to understand what's going on with the external world, you do not necessarily need to resonate with what happens in the world. In other words, it's not only through mirroring that you have a chance to know what's going on. You can reason on what your senses are telling you, and understand there is a barking dog over there. This of course does not mean that we do not empathize with animals. Actually, we do it a lot. It only says that you can resonate with your own motor system only to the extent that you share with the animal the same motor program. Since we clearly lack a motor program enabling us to bark, when we see a barking dog our motor system is silent, it doesn't resonate.

But the second point is even more important. What these and other results seem to suggest is that there are different ways of understanding. The understanding enabled by

the MNM relies on our experiential background. It employs what Edith Stein calls “filling.” Without the experiential filling provided by the activation of embodied simulation we are left with “empty representations,” as again Stein put it (1964). Just because in both cases we employ the same word “understanding,” it doesn’t follow that there is a unique way of understanding others. The type of understanding I am referring to in relation to embodied simulation is very close to the German notion of *verstehen*.

HCW. You make a beautiful point here.

VG. You know there’s a verse in Dante’s *Paradiso*, which sounds like a perfect description of embodied simulation: “S’io m’antuassi, come tu t’inmii.” Dante makes a verb out of “tu” (you) and “mi” (me). It’s like if you had a verb “to you”: “if I could inyou myself as you inme yourself.” I think it could be a nice opening for one of my talks.

‘Dio vede tutto, e tuo veder s’inluia,
diss’io, ‘beato spirto, sì che nulla
voglia di sé a te puot’esser fuia.
Dunque la voce tua, che ’l Ciel trastulla
sempre col canto di quei fuochi pii
che di sei ali facen la coculla,
perché non satisface a’ miei disii?
Già non attendere’ io tua dimanda,
s’io m’antuassi, come tu t’inmii.’
(*Paradiso IX, 73-81*)²

‘God sees all things and your sight so in himself,’ I said, ‘O blessed spirit,
that no desire can flee from you.
Therefore your voice, that delights Heaven always, with the singing of
those devout fires that make of their six wings their robes,
why does it not fulfill my desires? Surely I would not wait for your asking,
if I could inyou myself as you inme yourself.’

HCW. What a great example. So here’s a final question for you: was Dante a neuroscientist? Or better still, what does the past teach us about the present, neurologically speaking?

VG. No, of course I don’t think Dante was a neuroscientist!

² Both Italian original and English translation taken from Alighieri (2011).

HCW. I meant that tropologically.

VG. This is a nice example of how much art can anticipate science. In those verses Dante provides a wonderfully concise but at the same time incredibly efficient poetic description of a basic form of interpersonal relation, which in its utmost expression is a prerogative of God. I am tempted to say that this exemplifies the superiority of art with respect to science. Even when this intuition about human nature (what I tentatively define as embodied simulation) will eventually be proven to be scientifically false (as it happened to most of Dante's scientific background), still we will be left with Dante's immense poetry. Both art and science are among the most distinctive expressions of human creativity. Both enable us to make visible the invisible. Art, however, does it in a much less prosaic way. This is also why it is perhaps more appealing than science. This example also clearly shows that almost always someone else in the past got it right before us. As scientists we should learn a little more humility....

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