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Empathy and the Disunity of Vicarious Experiences

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Abstract What makes one individual's experience vicarious is that it is both similar to, and caused by, another's psychological state. Vicarious responses are mediated by the observation of another's goal-directed or expressive action. While the evidence from cognitive neuroscience suggests the ubiquity of vicarious responses to others' goals, intentions, sensations and emotions, the question is: is the general function of vicarious responses to understand another's mind? In this paper, I argue for a dual view of the function of vicarious responses: while empathetic responses are other-directed, contagious responses are self-centered.

KEYWORDS: Empathy; Vicarious Responses; Action; Self; Otherness.

Riassunto *L'empatia e la disunità delle esperienze vicarie* – Ciò che rende un'esperienza individuale un'esperienza vicaria è al contempo il suo essere simile *a* e causata *da* uno stato psicologico di un'altra persona. Le risposte vicarie sono mediate dall'osservazione dell'azione altrui nel suo essere diretta al raggiungimento di uno scopo oppure nel suo portare a espressione qualcosa. Mentre l'evidenza delle neuroscienze cognitive ci autorizza a pensare come ubiquitarie le risposte vicarie nei confronti di obiettivi, intenzioni, sensazioni ed emozioni altrui, la questione ancora aperta è: la funzione generale delle risposte vicarie è quella di comprendere la mente altrui? In questo lavoro intendo proporre un duplice punto di vista sulla funzione delle risposte vicarie: mentre le risposte empatiche sono rivolte verso gli altri, le risposte determinate da esperienze di contagio sono centrate sul sé.

PAROLE CHIAVE: Empatia; Risposte vicarie; Azione; Sé; Alterità.



THE WORD “EMPATHY” HAS BOTH an Ancient Greek etymology and a rich philosophical pedigree. It was only introduced into English in the early part of the twentieth century as a translation of the German word *Einführung*, often used by philosophers in association with the word *Verstehen*.

In the context of the German hermeneutical tradition (including the Phenomenological tradition), which advocated the methodological duality between the *Geisteswissenschaften* (the sciences of the mind) and the natural sciences, both words were meant to refer to the distinctive kind of (non-scientific)

understanding involved in making sense of human actions and in grasping the contents of human minds and the meaning and significance of human texts and works of art.¹

There are currently two main approaches to empathetic phenomena, which are the focus of much attention in both the philosophy of mind and social cognitive neuroscience: the *direct perception* approach² and the *simulation*-based approach to third-person mindreading.³ While the former construes empathetic experiences on the model of perceptual experiences, the latter construes them as *vicarious* experiences.

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Since I find it unnecessarily contentious to assume that one could *perceive* the content and character of another's affective state, I assume that empathetic experiences are vicarious responses to others' affective states, *not* perceptual experiences of others' affective states.⁴

I further assume that what makes an experience vicarious is that it is both similar to, and caused by, another's psychological state. In other words, to empathize is to *share* to some extent another's affective state. But as I will argue, there are some fundamental distinctions between the affective or emotional experience of one individual and that of another individual who empathizes with the former.⁵

Vicarious experiences are puzzling. A vicarious response resembles the experience that caused it, but the agent whose experience caused it did not *intend* to cause it or to share her experience with some addressee by having him recognize her communicative intention. In a nutshell, a vicarious response is not the output of an intentional communicative action between a communicator and her addressee (in Grice's sense). So the first question is: what is the mechanism causing vicarious experiences?

Among advocates of the simulation approach to vicarious experiences, one recent influential answer is: *mirroring*. One consequence of the discovery of mirror neurons has been the tendency to overestimate the unity of vicarious experiences. But this is a mistake: hence the title of the present paper. While empathetic experiences are vicarious experiences, not all vicarious experiences are empathetic. Contagious responses to others' affective states are not empathetic responses, but they are also vicarious experiences. So the second question arises: what distinguishes empathetic from contagious responses?

In the first section of the paper, I offer an *imagination*-based account of the nature of vicarious experiences and argue that in the case of vicarious experiences of pain, unlike contagious responses, empathetic responses to another's pain must satisfy five distinct conditions: the affectivity condition, the in-

terpersonal similarity condition, the causal condition, the ascription condition and the care condition. In a nutshell, I argue that while contagious pain is *self-centered*, empathetic pain is *other-directed*.

In the rest of the paper, I examine Vittorio Gallese's competing account of empathy, which he calls "embodied simulation". Gallese's embodied simulation approach rests on three fundamental assumptions, the first of which is the thesis of the unity of vicarious experiences, i.e., the assumption that all vicarious experiences are the output of processes of mirroring. The second assumption, which is accepted by most simulation-based approaches to mindreading others' affective states, is that empathy is the default response to one's awareness of another's affective state. The third assumption, which is contentious among simulation-based approaches to mindreading, is that mirroring, which enables one individual to share a psychological state with someone else is sufficient for ascribing it to him or her.

In the second section, I call into question the second and third assumptions of embodied simulation. In the third section, I call into question the thesis of the unity of vicarious experiences and argue that much of the evidence for vicarious motor activities, vicarious tactile experiences and vicarious experiences of disgust is best construed as self-centered contagious responses, not as other-directed empathetic responses.

■ The puzzle of empathetic pain

■ Physical and vicarious pain

A proper account of empathetic pain must be consistent with the fact that an empathetic response to another's pain is different from the pain that caused it. It is also different from contagious pain, from a sympathetic response to another's pain and from a non-empathetic ascription of pain to someone else.

I feel physical pain in my left ankle because I just twisted it. If you empathize with my

pain, then you feel vicarious pain: you share my pain to some extent (but only to *some* extent). Unless you and I shared my left ankle, you cannot experience my pain. My physical pain and your empathetic pain are not two different tokens of one and the same type of painful experience. My physical pain is caused by injury to my left ankle. Your vicarious pain is caused by your awareness of my physical pain. Since you share to some extent my pain in my left ankle, your vicarious experience of pain and my physical pain are similar to some extent. They are also dissimilar since your vicarious experience of pain is *caused* by my physical pain and not vice-versa. I would feel pain in my left ankle whether or not you experienced vicarious pain. But you would not experience vicarious pain unless I felt physical pain.

All empathetic experiences are vicarious experiences, but not all vicarious experiences are empathetic experiences. For example, when one individual catches another's fear as in crowd panic (as one catches the common cold), and thereby comes to share to some extent the latter's fear, the former's vicarious experience of fear need not be empathetic: it is a vicarious experience of fear generated by a process of emotional or affective contagion, i.e., a vicarious experience of contagious fear, not empathetic fear. Similarly, awareness of my pain in my left ankle could cause someone else to catch a vicarious experience of contagious pain, not to experience empathetic pain.

Arguably what distinguishes an empathetic response from a contagious response to another's affective state is that while the former is *other-directed*, the latter is *self-centered*. Empathizing involves ascribing some affective state to another (and thereby understanding another's psychological state). Catching another's affect by a process of contagion causes one to prepare for the typical behavioral consequences of the affect, not to ascribe the affective state to another.

Thus, we need to distinguish not only experiences of physical pain from vicarious experiences of pain, but also between at least

two sorts of vicarious experiences of pain: empathetic pain and contagious pain. As the neuroscientific study of pain shows, physical pain has two neurological components: a *sensorimotor* component (recruiting the primary and secondary somatosensory areas, as well as the posterior insula) and an *affective* component (recruiting the anterior insula, the anterior cingulate cortex, the thalamus, and the brain stem).

The primary somatosensory cortex (SI) underlying the sensorimotor component of pain has a somatotopic organization: different regions of SI are activated according to whether one's pain is located in e.g. one's hand, foot or mouth. While the sensorimotor component underlies the experience of the intensity and the bodily location of pain, the affective component underlies the unpleasantness of painful experiences.

Arguably all painful experiences, whatever their different bodily locations and intensities, share a characteristic feeling of global bodily unpleasantness.⁶ Further neuroscientific evidence shows that when people experience vicarious pain as a result of being aware of another's pain, only one of the two components of standard pain (the sensorimotor or the affective component) is primarily active.

■ Contagious and empathetic pain

Contagious (or sensorimotor vicarious) pain is primarily generated by the activity of the *sensorimotor* component of the pain system. It is best illustrated by evidence reported by Avenanti et al.⁷ showing that the observation of another's right hand deeply penetrated by a needle causes muscle-specific inhibition in the participants' right hand and a generalized increase of corticospinal excitability in their left hand.⁸

In these experiments, participants saw video-clips of another's right hand without being provided with any information about the identity of the owner of the hand. These findings strongly suggest that the experience of contagious pain, caused by the perception

of another's bodily part being subjected to painful stimulation, consists in imagining the sensorimotor consequences of painful stimulation at the very same location on *one's own* body at some future time.⁹ Thus, the perception of another's right hand subjected to painful stimulation seemed to cause participants, not to care about another's pain, but to automatically prepare themselves for future pain at the same location on their own body.

Empathetic pain is primarily generated by the activity of the *affective* component of the pain system. Relevant experimental evidence, based on functional brain imaging (fMRI), shows that the affective component of pain can be selectively activated when people are made aware of others' painful experiences. For instance, Singer et al.¹⁰ showed participants an arrow indicating that their beloved partner was being inflicted a painful stimulus. They report activation only in the affective component of pain (the anterior cingulate cortex and the bilateral anterior insula), not in the sensorimotor component.¹¹

Unlike the sensorimotor component (especially the primary somatosensory cortex), the affective component of pain lacks a somatotopic organization. Further experiments based on brain-imaging in which participants saw either the facial expression of pain¹² or even videos of detailed painful situations, such as a finger or a foot crushed by a door¹³, were also reported to cause the selective activation of the affective component of pain without any somatotopic effect.

Thus, unlike the activity of the sensorimotor component of pain, the selective activity of the affective component of pain does not reflect the bodily location of pain. Furthermore, while Avenanti et al. stressed the automaticity of the 'somatomotor contagion' underlying the corticospinal inhibition,¹⁴ other findings also show that the selective activity of the affective component of pain in participants aware of others' pain is subject to top down modulation by a wide range of contextual parameters.¹⁵

For example, Singer et al.¹⁶ report reduced

activity in the affective component of pain in male (not female) participants when they are made aware of the pain of someone who was previously unfair to them. Cheng et al.¹⁷ report reduced activity in the affective component of pain in medical practitioners aware of the pain of others. Lamm et al.¹⁸ report reduced activity of the affective component of pain in participants who believe that another's pain results from a useful treatment or that the injured bodily part has been anesthetized. Caring seems necessary for empathizing with another's pain. But caring might require overriding empathizing with another's pain if her pain is perceived as a necessary step for her recovery.

The next step is to try and offer a plausible psychological model of the brain processes underlying both kinds of vicarious experience of pain: empathetic pain and contagious pain. One plausible candidate is the kind of *non-propositional imagination* that Goldman¹⁹ calls enactive imagination (or E-imagination) that has been surmised to underlie the experience of visual imagery (and motor imagery). In visual imagery, one visualizes something or imagines seeing something. When taken on-line, one's visual system takes retinal stimulation as inputs and produces visual percepts.

According to an influential proposal, visual imagery results from taking one's visual system *off-line* and giving it inputs from memory instead of retinal inputs. Similarly, one can E-imagine being in pain by taking one's own pain system off-line and giving it inputs from memory: experiencing vicarious pain is the output of a process of E-imagining being in pain by running off-line one's own pain system.

Furthermore, as the evidence reviewed above shows, there are two distinct ways one can run one's own pain system off-line: one can E-imagine being in pain by running off-line primarily either the sensorimotor or the affective component of one's pain system. The output of E-imagining being in pain by running off-line the sensorimotor compo-

ment of one's pain system is the experience of vicarious sensorimotor pain, i.e., contagious pain. The output of E-imagining being in pain by running off-line the affective component of one's pain system is the experience of vicarious affective pain, i.e., empathetic pain.

Unlike contagious pain, empathetic pain involves understanding another's pain by ascribing pain to him or her. The fact that empathetic pain involves pain-ascription is deeply puzzling. Both empathetic pain and contagious pain are vicarious experiences of pain. To experience vicarious pain of either kind is to share to some extent another's pain. Sharing another's pain is to feel pain of some sort.

There are two joint puzzles. The first one is: how could *feeling* pain result in *ascribing* pain to another? How does feeling (vicarious) pain give rise to believing that another feels pain? The second one is: experiencing pain is costly. If understanding another's painful experience can be achieved by executing a standard task of mindreading without experiencing pain, why should a mindreader assume the additional burden of experiencing pain? What is the function of the experience of pain in a task of pain ascription?

In line with a couple of previous papers, I offer the following tentative answer to the first puzzle.²⁰ In feeling either physical pain or even contagious pain, the sensorimotor component of one's pain system is activated and pain is assigned some definite bodily location either now or in the near future. But what underlies empathetic pain is primarily the activity of the affective component of one's pain system. The experience of unpleasantness in turn generates sensorimotor expectations, which in the case of empathetic pain, remain unfulfilled. (Activity of the affective component of the pain system is correlated with a global bodily feeling of unpleasantness, but pain is assigned no definite bodily location).

As a way towards resolving the mismatch between the sensorimotor expectations of pain and the lack of sensorimotor activity, one takes another's physical pain as the *cause*

of one's own psychological disarray and is thereby led to ascribe pain to another. Unlike contagious pain, empathetic pain requires the cognitive resources of mindreading (or ascribing pain to another). In response to the second puzzle, one may just ascribe pain to someone in pain if one does not care about her pain; but one empathetically ascribes pain to someone else when one cares for her pain. To sum up, empathetic pain satisfies five necessary conditions:

- (1) Like all vicarious experiences, it satisfies the *interpersonal similarity* condition: your empathetic pain resembles to some extent (but only to some extent) my physical pain in my left ankle.
- (2) It satisfies the *causal* condition: one respect in which your vicarious experience of pain differs from my physical pain is that the latter causes the former (and not vice-versa).²¹
- (3) It satisfies the *affectivity* condition: what makes your vicarious experience of pain empathetic is that it enables you to share the unpleasantness (i.e., the *affective* quality) of my physical pain. Sharing some of my psychological states devoid of any affective quality (e.g. one of my goals or beliefs) would not make your vicarious experience empathetic.
- (4) It satisfies the *ascription* condition: my physical pain may cause you to imagine pain at a definite location on your own body in the future. But if so, then you would experience contagious pain, not empathetic pain, and you would thereby fail to ascribe pain to me. As it turns out, there is a significant difference between empathetically and non empathetically ascribing pain to someone else. But unless an individual can mindreading another's pain, he or she could not empathize with another's pain.
- (5) It satisfies the *care* condition: the evi-

dence suggests that unlike contagious pain, empathetic pain is subject to modulation by top down factors. Empathy is not the default response to one's awareness of another's affective state: caring about another's psychological life is necessary for empathizing.²²

■ Replies to Joel Smith

In an interesting unpublished paper, Joel Smith has offered a critique of both the causal and the care conditions.²³ The *causal* condition is meant to discriminate empathetic pain (which is a special case of vicarious pain) from physical pain, including cases in which two individuals may simultaneously and coincidentally feel physical pain as a result of some common cause.²⁴

Joel Smith imagines two individuals A and B in the following scenario: while A is in the waiting room of the pain-lab, B has been led off into the occluded and sound-proofed room to be delivered electric shocks. Suppose A simulates B's pain. Joel Smith argues that in this case, we should be inclined to say that A empathizes with B. But since B is in an occluded and sound-proofed room, A's vicarious experience cannot be caused by B's pain. For three reasons it is difficult to know whether Joel Smith provides a genuine counterexample to the causal condition.

First, if A imagines the sensorimotor consequences of painful stimulation at a specific location on his own body in the future by running off-line the sensorimotor component of his pain system, then A feels contagious pain, not empathetic pain. In this case, it is unlikely that A would ascribe pain to B.

Secondly, A can only empathize with B's pain if B does feel physical pain. If B fails to feel pain either because, contrary to A's expectation, B is not being delivered electric shocks or because unknown to A, B has been anesthetized, then A would mis-empathize with B.

Finally, A may correctly or incorrectly ascribe pain to B on the basis of A's know-

ledge of the situation, independently of whether or not A's awareness of B's condition causes A to feel vicarious pain.

The *care* condition is meant to reflect the fact that, unlike sensorimotor vicarious (or contagious) pain, which is automatically triggered by the perception of a bodily part submitted to painful stimulation, affective vicarious (or empathetic) pain is subject to several top-down modulating factors and is therefore not the default response to one's awareness of another's affective state.

Empathetic responses (i.e. activity of the affective component of the pain matrix) are reduced in medical practitioners, in people who believe that another's pain is part of a treatment, and in human males, not human females, when they are aware of the pain of unfair players.

Arguably these findings do not rule out the possibility that empathy is the default response to one's awareness of another's pain that needs to be inhibited in special circumstances. However, Lamm et al. used fMRI to assess how healthy participants would respond to the pain of atypical neurological patients who they were told feel pain when they are softly touched, but not when they are submitted to surgical operations.²⁵

Lamm et al. report that participants displayed activity in the affective component of pain when they saw a patient's hand being touched with a cotton swab but not when they saw it submitted to a needle injection.²⁶ Participants would automatically experience physical pain if one of their own hands were penetrated by a needle, not softly touched. The evidence further shows that they would also automatically feel contagious pain upon seeing another's hand penetrated by a needle, not softly touched.²⁷

The fact that participants displayed empathy in response to perceiving a neurological patient's hand softly touched, not penetrated by a needle, is hard to reconcile with the view that empathetic pain is the default response to one's awareness of another's pain and that it just mirrors contagious pain.

■ Why simulation is not sufficient for ascription

So far I have argued that both empathetic and contagious responses to another's affective state are vicarious experiences, both of which meet the interpersonal similarity condition. But only the former, not the latter, are other-directed and contribute to understanding another's psychological state. By catching contagious pain, one anticipates the sensorimotor consequences of one's own future pain on one's own body. By feeling contagious disgust, one learns about potentially dangerous food and substances for one's own sake. By feeling contagious touch, one prepares oneself for the tactile consequences of one's own future manipulation of the target of a goal-directed action.

■ A mirroring account of empathy

One major competing approach to empathy is the embodied simulation approach advocated by Gallese, according to which empathy is the output of mirroring processes.²⁸ The notion of a mirroring process is a generalization of mirror neuron activity. Gallese was one of the co-discoverers of mirror neurons whose activity was first recorded in the ventral premotor cortex and subsequently in the inferior parietal lobule of macaque monkeys. Mirror neurons fire both when an animal performs a transitive goal-directed action and when it observes another execute the same kind of action.²⁹ Thus, action-mirroring (i.e. mirror neuron activity in an observer's brain) is a covert vicarious motor response to another's overt goal-directed action.³⁰

By mirroring an agent's goal-directed action, an observer is taken to share the agent's goal (or intention) by means of the following two steps: first, the perception of an agent's goal-directed action causes the observer to covertly replicate (without executing) the agent's bodily movements. Secondly, by covertly replicating the agent's bodily movements, the observer comes to share (or simula-

te) the agent's goal or intention.

Clearly, the two-step model of action-mirroring meets the interpersonal similarity condition on empathy. But sharing an agent's *goal* or *intention* fails to satisfy the *affectivity* condition necessary for empathy (cf. section 1). What makes, however, the mirroring approach to empathy attractive is its parsimony: it is parsimonious in two fundamental respects.

First of all, mirroring processes are parsimonious in the sense that the very same processes at work in the execution of action seem sufficient to account for the perception and understanding of actions executed by others. Secondly, the two-step model easily applies to an observer's response to an agent's *expressive* action: first, the perception of an agent's expressive action causes the observer to covertly replicate (without executing) the agent's facial and/or bodily movements. Secondly, by covertly replicating the agent's facial and/or bodily movements, the observer comes to share the agent's *emotion* or *affective state*. Thus, by enabling one individual to share (or simulate) another's affective state, mirroring processes seem to have the resources for generating vicarious experiences that meet the affectivity condition.

As Gallese and Goldman quickly recognized, mirroring processes are naturally construed as instances of simulation processes. They further argued that the function of action-mirroring is to mindread another's intention (and that action-mirroring is therefore other-directed and not self-centered) when they entertained the cautious hypothesis that the mirror mechanism might be «a primitive version, or possibly a precursor in phylogeny, of a simulation heuristic that might underlie mindreading».³¹

Although Gallese and Goldman's hypothesis was restricted to mindreading the intentions of agents' of goal-directed actions, it easily extends to mindreading the emotions or affective states of agents' of expressive actions. Thus, they suggested that the output of mirroring could fit both the affectivity condi-

tion and the interpersonal similarity condition. Whether it could further meet the ascription condition is the basic question of the next sub-section.

In accordance with the interpersonal similarity condition on empathy, all simulation approaches to mindreading others' affective states tend to assume that empathizing is the default response to one's awareness of another's affective state. For example, Goldman, who holds that «the term “empathize” [is] roughly equivalent to “simulate” (in an inter-subjective fashion)», also holds that «empathy is a key to mindreading [...] the most common form of mindreading».³²

There is room for disagreement with Goldman on both scores here. On the one hand, as I argued in section 1, the evidence that supports the *care* condition on empathy also shows that empathetic pain is *not* the default response to another's pain: one does not always empathize with the pains of others, whoever they are and in every context. On the other hand, one can form the belief that an individual is in pain on the basis of cues afforded by his or her expressive behavior and thereby ascribe pain to him or her without sharing his or her pain, i.e. without meeting the *interpersonal similarity* condition on empathy.

■ Mirroring and the ascription condition on empathy

As I argued in section 1, one outstanding puzzle raised by a proper account of the distinction between contagious and empathetic responses to another's pain is that only the latter satisfies the *ascription* condition. While all simulation-based approaches stand in contrast to theory-theory approaches, they also depart from one another in at least three respects.

While Goldman grants priority to first-person mindreading over third-person mindreading, Gordon and Hurley do not.³³ Goldman further advocates a two-tiered simulation approach to mindreading, based on the distinction between two kinds of mental

simulation processes: enactment imagination (or E-imagination) and mirroring.³⁴ He argues that while the former underlies high-level mindreading tasks, the latter underlies low-level mindreading tasks.³⁵ Finally, while Goldman construes mental simulation as only one step in the process of mindreading, Gallese's embodied simulation account is committed to the thesis that mirroring is both necessary and sufficient for mindreading others' intentions and affective states. I now focus on the third disagreement between Goldman and Gallese.³⁶

According to Goldman's two-tiered simulation-based approach to mindreading, it is necessary but not sufficient for process \underline{P} to simulate process \underline{P}^* that the former duplicates or resembles the latter, because unlike duplication (or resemblance), simulation is not symmetrical.³⁷ \underline{P} can only simulate \underline{P}^* if it is one of \underline{P} 's *functions* to duplicate or resemble \underline{P}^* . In the context of tasks of mindreading, mental process \underline{P} simulates mental process \underline{P}^* only if \underline{P} produces an output (i.e., a mental state) whose function is to duplicate (or resemble) the mental state generated by \underline{P}^* and furthermore \underline{P} 's output is *ascribed* by the mindreader to her target.

Thus, for two related reasons, Goldman's approach to third-person mindreading is *not* a pure simulation account.³⁸ First, as Goldman's paradigm example of a simulation process (i.e., the simulation of another's decision) illustrates, when I use my own decision mechanism in order to simulate your decision, I must select a pretend belief-desire pair that will serve as input to my decision mechanism.

While the simulation stage consists in running one's decision mechanism off-line (whose output is a pretend decision), the process whereby the pretend belief-desire pair is selected cannot be a simulation process. Secondly, the simulation stage is followed by a distinct *projection* stage whereby the mindreader ascribes to the target the result of the simulation stage.

Gallese and Goldman can agree that the two-step model of mirroring another's action

applies to both goal-directed and expressive actions: they agree that mirroring can enable an observer to share either the agent's intention or the agent's affective state. But they disagree over whether mirroring is *sufficient* for mindreading another's intention or affective state, i.e. for ascribing either an intention or an affective state to someone else.

While Goldman has argued that a mirroring event can *cause*, but *not* constitute, a mindreading event, Gallese and Sinigaglia explicitly argue for the stronger claim that embodied simulation alone suffices for mindreading another's intention, sensation (e.g., touch) or emotion (e.g., disgust).³⁹ Their conception of embodied simulation combines Hurley's *re-use* conception of simulation and Goldman and de Vignemont's approach to embodied cognition further elaborated by Goldman.⁴⁰ In what follows, I will ignore the second embodied component of their view.⁴¹

Gallese and Sinigaglia endorse Hurley's claim that "re-use", not similarity (or resemblance), is «the core generic sense of process-driven simulation».⁴² In her critique of Goldman's similarity-based notion of simulation, Hurley usefully draws attention to the fact that similarity can apply to either mental processes or their outcomes (i.e., mental states) and that the relevant dimension of similarity between either mental processes or mental states can be either interpersonal or intrapersonal.⁴³ The first question for embodied simulation is: to what extent is re-use the core notion of simulation in the context of mindreading?

In Hurley's terms, each brain must be able to re-use mirror neuron activity in both the execution and the perception of action. She further saddles the simulation approach to mindreading with the assumption that «mindreading aims at simulation of, and hence, matching the target's mental states».⁴⁴ But she thereby inverts the respective functions of simulation and mindreading.

While matching or duplicating the target's mental state is the function of mental simulation, it is not the function of mindrea-

ding. The function of mindreading is to ascribe a mental state to the target. Nor could mental simulation be said to generate «information about a process» by «re-using that very process, as opposed to by theorizing about the process»:⁴⁵ in the context of using mental simulation for tasks of third-person mindreading, the relevant information to be captured is information about another's mental state, not about the simulation process itself.⁴⁶ The simulation process is a means for the goal of ascribing a mental state to another individual.

As Goldman has observed, within simulation-based approaches to mindreading, there is no room for an interpersonal notion of re-use.⁴⁷ Presumably re-using a mental state would require using twice the same mental state token. (Using or re-using a mental state type does not seem to make sense). But since the mental state that is the output of a process of mental simulation is token-distinct from the target's state that it duplicates or matches, in generating the former, the mindreader cannot re-use the latter. Thus, Hurley's notion of re-use naturally applies not to mental states themselves, but to mental or cognitive mechanisms (or capacities). While re-use of a single cognitive mechanism (or intrapersonal similarity at different times) may be a necessary condition, it cannot be a sufficient condition, of interpersonal similarity of mental states, which is a necessary step for any defensible version of the simulation approach to third-person mindreading: one and the same cognitive mechanism (e.g. the visual system, the human language faculty, or the mindreading system) can obviously be used on several occasions to generate distinct mental states.⁴⁸

The challenge for Gallese and Sinigaglia is to show that the process of embodied simulation that underlies a mirroring event can also *constitute*, and not merely *cause*, a mindreading event.⁴⁹ Whether embodied simulation is construed in terms of re-use (or intrapersonal similarity) or in terms of interpersonal similarity, mirroring can at best enable an observer of an action performed by another to share

either the agent's intention or the agent's affective state. So the challenge for Gallese and Sinigaglia is to fill the gap between sharing another's intention, sensation or emotion and attributing an intention, sensation or emotion to someone. To share another's intention, sensation or emotion is to have an intention, sensation or emotion. But to ascribe an intention, sensation or emotion to another is to believe (or judge) that another has an intention, sensation or emotion.

To meet this challenge, Gallese and Sinigaglia argue that attribution can be understood in two ways: either representationally or functionally. As I understand it, a representational attribution of an intention to an agent is a meta-representation of the agent's intention, i.e., a belief about the agent's intention. As I understand it, to perform a functional attribution of an intention to an agent is just to form the same intention as the agent, which enables the attributor «to deal with the agent by virtue of its being appropriately related to that agent's [...] intention», where «this appropriateness is higher the more the attributor and the target share the same kind of neural structures and cognitive resources».⁵⁰

I think this distinction faces two problems. First of all, to functionally attribute an intention to another suspiciously looks like sharing another's intention. If so, then the claim that embodied simulation constitutes a functional attribution of an intention, sensation or emotion to another seems to concede that it is not a genuine attribution. Secondly, sharing a joint goal in the sense of "functional attribution" seems to «enable one to deal with an agent by virtue of being appropriately related to that agent's goal».⁵¹

Now the ability to share a joint goal and to engage in joint action with another has been highlighted by Tomasello, Carpenter, Call, Behne, and Moll as a uniquely human cognitive and motivational capacity, not shared by non-human primates.⁵² If so, then mirror neuron activity would not seem sufficient to support sharing a joint goal and engaging in joint action. In fact, it seems to me

that establishing a joint goal and fulfilling it by successfully executing a joint action require for each agent not only to track and mindread the other's motivational and epistemic states and to construe them as putative reasons for her action, but also to engage in communicative action.

If this is correct, then far from being achieved by mirror neuron activity, functional attribution (exemplified by sharing a joint goal) seems to rely on, and require, representational attributions of mental states to others.

■ Self-centered vicarious responses

In section 2, I challenged the claim that embodied simulation can meet the ascription condition on empathy. In the present section, I am going to challenge directly the assumption of the unity of vicarious experiences. As the example of vicarious pain from section 1 shows, there are at least two kinds of vicarious responses to another's physical pain: empathetic and contagious responses.

Empathetic pain is a vicarious affective response to another's pain and it is other-directed. Contagious pain is a vicarious sensorimotor response to another's pain and it is self-centered. In this section, I will argue that much evidence for vicarious experiences is best construed as evidence for self-centered, not other-directed vicarious experiences. I will start with some evidence about action-mirroring.

■ Vicarious motor activities

With respect to the evidence for vicarious motor activities, two major questions arise, the first of which is that it is sometimes difficult to disentangle genuine instances of vicarious motor activities from instances of non-vicarious motor activities. The second problem is whether the function of vicarious motor activities in an observer's brain is other-directed or self-centered. I turn to the first problem first.

One possible instance of a confusion between non-vicarious and vicarious motor activities is the recent claim that there exist mirror neurons that fire both when a monkey looks in a direction favored by these neurons and also when the animal sees another monkey looking in the same direction. Sheperd et al. have recently recorded the activity of neurons in the lateral intraparietal area (LIP) of rhesus macaques during a task in which the recorded animal performed a saccadic eye-movement to a peripheral target either to its left or to its right, after seeing a picture of a monkey face whose gaze was averted to one of the two locations.⁵³

Thus, monkeys performed saccadic eye-movements to a target whose location could be either congruent or incongruent with the direction of gaze of another monkey displayed in the picture. Sheperd et al. report that congruent gaze shifts were significantly faster than incongruent ones and that the firing rate of some LIP neurons increased following presentation of the monkey face gazing toward the neurons' own receptive fields (RF, i.e., the direction of gaze preferred by the neurons). Sheperd et al. present their results as evidence for mirror neurons for shared attention:

neurons mirrored observed attention by firing both when the subject looked in the preferred direction of the neuron, and when observed monkeys looked in the preferred direction of the neuron, despite the irrelevance of the monkey images to the task.⁵⁴

But what the results seem to show instead is that the speed and firing rate of LIP neurons during the *execution* of a gaze-shift towards their preferred RF are being *modulated* by the observation of another's averted gaze towards the same or the opposite location. Evidence that neural activity during the execution of a saccade is modulated by the detection of the direction of another's eye-gaze is not evidence for mirroring of another's ga-

ze shift (or for vicarious motor response to another's gaze shift). This interpretation of the findings by Sheperd et al. is consistent with other findings based on fMRI by Newman-Norlund et al., showing activation of the human mirror system for *complementary* (not replicative) actions.⁵⁵

I now turn to the second issue. Gallese and Goldman argued that the function of action-mirroring is to mindread another's intention.⁵⁶ They linked the mirror mechanism to the simulation approach to mindreading, thereby stressing the *synchronous interpersonal neural similarity* between the agent's and the observer's brains as a step in the process whereby the observer ascribes an intention to the agent.

While it is clear that action-mirroring is a vicarious motor activity and that vicarious motor activity can prepare the observer for future actions, it is controversial whether it is other-directed and promotes social understanding.⁵⁷ First, is at best unclear whether macaque monkeys ascribe intentions to others. Secondly, covert motor activities caused by another's overt action might be evidence that the observer is preparing some complementary action, not duplicating the agent's overt action.⁵⁸ In which case, these covert motor activities would not meet the definition of either action-mirroring or vicarious motor activities.⁵⁹

Because they advocated the mindreading function of action-mirroring, Gallese and Goldman emphasized the role of interpersonal similarity, in accordance with the simulation approach to mindreading. However, Rizzolatti et al. do not define mirror neuron activity directly in terms of a synchronous interpersonal neural similarity across two distinct brains, but rather in terms of a *non-synchronous intrapersonal neural similarity* within single brains, at different times, in different tasks, i.e., the execution and the perception of action.⁶⁰

In fact, synchronous interpersonal neural similarity between the agent's and the observer's brains could hardly be achieved unless

there were a mechanism active in single brains, at different times, in different tasks (i.e., the execution and the perception of action). Two distinct brains could not stand in some appropriate similarity relation at a single time unless both brains were independently endowed with a mechanism (the mirror mechanism) active in two different tasks at different times.

In other words, synchronous interpersonal neural similarity across two distinct brains at a single time presupposes asynchronous intrapersonal neural similarity at different times in two different tasks. Presumably, natural selection operates on individuals' brains, not on pairs of individuals' brains. Only individual members of a species whose brains contained a mechanism active at different times in the execution and the perception of action could have been selected by evolution – not sets of pairs of individual members of a species, whose brains stood in some suitable similarity relation when one executed a grasping action and the other watched the former.

Granted, the priority of asynchronous intrapersonal neural similarity over synchronous interpersonal neural similarity must make room for the fact that the perception of another's action involves synchronous interpersonal similarity (between the agent's brain and the observer's). But the point holds that synchronous interpersonal neural similarity across two individuals asymmetrically depends on the selection of a mechanism active in single brains in two different tasks (an executive task and an observational task) at different times.⁶¹

Thus, non-synchronous intrapersonal neural similarity is a more basic property of the mirror mechanism than synchronous interpersonal neural similarity. But now a neural mechanism (the mirror mechanism) that is active in both the execution and the perception of instances of grasping is a mechanism whose function seems to be to abstract away from the many differences between executing and observing an act of grasping. For example,

only an agent executing a task of grasping a target, not an observer perceiving the action, will both have efference copy information about his motor instruction and also haptic information about the target. Only the agent, not an observer, will be in a position to predict the sensory consequences of her action before executing it.

Furthermore, among several studies, Kohler et al. and Keysers et al. have reported that single neurons in the monkey ventral premotor cortex selectively fire when the animal both executes and also sees, hears and both hears and sees such actions as peanut breaking, ring grasping or paper ripping.⁶² So not only does the mirror mechanism seem able to discard the many differences between executing and perceiving an action, but in perceptual tasks, it also seems able to abstract away from the further differences between vision and audition.

In a nutshell, the evidence shows that the mirror mechanism is active when an animal executes and perceives one and the same action (e.g., grasping). It also shows that it is able to achieve cross-modal integration in perceptual tasks. Now it seems as if the function of a mechanism able to deliver a representation of an action whose content brackets the differences between the motor, visual and auditory representations of one and the same action is to deliver a representation of this action with *conceptual* content. The view that the function of the mirror mechanism is to provide conceptual representations of actions makes sense of the variations in the statistical congruency between the motor and the perceptual properties of mirror neurons noted by Csibra.⁶³

This conceptualist interpretation of the mirror mechanism is in agreement with the view that mirror neuron activity underlies action recognition. It is also in agreement with the view expressed by Rizzolatti et al. and Craighero et al. according to which area F5 of the monkey ventral premotor cortex (where mirror neurons were first discovered) is «a store of motor schemas or a *vocabulary*

of actions», i.e. a *motor vocabulary*:

Neurons forming these vocabularies store both knowledge about an action and the description [...] of how this knowledge should be used.⁶⁴

Thus, the motor vocabulary stored in F5 consists of mental schemas or symbols whose semantic role is to denote actions and such that the meanings of complex symbols depend systematically on the meanings of their constituents. If so, then mirror neuron activity does not directly underlie the attribution of a psychological state (e.g. an intention) to an agent. But it may contribute the abstract (cross-modal or amodal) content of the concept of the action (e.g. grasping) to determining the content of the agent's intention (to e.g. grasp a target).⁶⁵

Thus, vicarious motor activity in an observer's brain caused by an agent's overt execution of a grasping action may turn out to be a by-product of the fact that mirror neuron activity for grasping actions in executive tasks and in cross-modal perceptual tasks underlies the mastery of the concept GRASPING.⁶⁶ If this is the case, then vicarious motor activity exemplified by action-mirroring is not other-directed: it does not subserve social understanding or mindreading another's intention.

■ Vicarious disgust

Much further evidence in humans has been reported for mirroring others' sensations and emotions. It has been interpreted as evidence that the observation of cues that others are experiencing sensations and emotions vicariously triggers neural representations underlying one's own corresponding sensations and emotions. Vicarious responses to others' sensations and/or emotions have further been interpreted as empathetic responses to others' sensations and/or emotions, as well as the basis for mindreading others' sensations and/or emotions.⁶⁷ In particular, vicarious activities for disgust and touch have been investigated.

In an fMRI study by Wicker et al., healthy participants were scanned during the experience of disgust and during the observation of disgust-expressive faces.⁶⁸ First, participants viewed video-clips of individuals' faces smelling the content of a glass (disgusting, pleasant, or neutral). Then the same participants inhaled disgusting or pleasant odorants through a mask.

Wicker et al. report that the left anterior insula and the right anterior cingulate cortex were preferentially activated both during the olfactory experience of disgusting odorants and during the visual observation of disgust-expressive faces.⁶⁹ Thus, Wicker's study provides evidence of overlap of brain areas active during the experience of disgust and the perception of cues of others' experience of disgust. The perception of others' facial expressions of disgust caused in participants the vicarious activity of the left anterior insula and the right cingulated cortex. Arguably these brain responses underlie participants' vicarious experience of disgust.

But the question is whether this vicarious experience of disgust is empathetic and other-directed or contagious and self-centered. It might be self-centered and not other-directed if, for example, detecting cues of another's disgust provided information about the danger of consuming some food or substance that caused another's disgust. Furthermore, possessing a concept with the content DISGUST might depend on having brain areas active in two basic situations: when an individual has the olfactory experience of a disgusting smell and when the same individual visually processes disgust-expressive faces.

If so, then the overlap of brain areas during the olfactory experience of disgust and the visual perception of disgust-expressive faces might underlie the mastery of the concept DISGUST and the vicarious experience of disgust caused by perceiving the facial expression of disgust might be a by-product of the possession of the concept DISGUST. If the vicarious experience of disgust is other-directed, then it makes the content of the concept DISGUST available for an attribution of

disgust to someone else. But if the vicarious experience of disgust is self-centered, then it may prepare the individual who experiences vicarious disgust to act accordingly.

Thus, the vicarious experience of disgust caused by the perception of another's behavioral display of disgust need not in all cases be an empathetic step towards mindreading another's psychological experience and ascribing disgust to him or her. Instead, the vicarious experience of disgust would prepare oneself for action towards some potential food or drink.

Neuropsychological data are consistent with the view that the brain areas involved in the olfactory experience of disgust and the visual perception of disgust-expressive faces are necessary conditions for possessing the concept DISGUST. Following damage to the insula and basal ganglia, patient NK investigated by Calder et al. displayed selective impairment in both the olfactory experience of disgust and the recognition of disgust in others.⁷⁰ Damage to the insula and basal ganglia selectively impaired the neural basis of the patient's mastery of the concept DISGUST necessary for attributing disgust to others. But the fact that mastery of the concept DISGUST is necessary for attributing disgust to others does not mean that it is sufficient. In a nutshell, the intentionality of the concept DISGUST is not intrinsically other-directed: it can apply either to others or to self.

■ Vicarious touch

In another fMRI study, Keysers et al. compared participants' brain activities in response to having their own leg being touched and seeing a movie depicting another's leg being touched.⁷¹ Keysers et al. found activations of both the primary somatosensory cortex (SI) and the secondary somatosensory cortex (SII) when participants' legs were being touched. They found activations in SII, not SI, when participants viewed a movie depicting another's leg being touched by an object. Furthermore, activity in SII turned out to be

significantly stronger when participants viewed a movie depicting another's leg being touched than when they viewed an object approaching another's leg without touching it.⁷²

Arguably the brain response of participants to the perception of another's leg being touched underlies their vicarious experience of feeling their own leg touched. But first the question arises whether a vicarious experience of touch satisfies the affectivity condition of section 1. Secondly the further questions arise whether these vicarious tactile experiences are empathetic and other-directed or contagious and self-centered and whether the vicarious tactile experience might reflect the possession of the concept TOUCH, whether the concept applies to self or others.

Ebisch et al. conducted a relevant fMRI experiment in which they compared participants' brain responses when confronted with the following four stimuli. In the intentional-animate condition, they saw either a male hand touch the back of a female hand or a female hand touch the back of a male hand.⁷³ In the intentional-inanimate condition, they saw a male or a female hand touch the arm of a wooden garden chair. In the accidental-animate condition, the back of either a male or female hand was touched by one of two different wind-moved palm tree branches. In the accidental-inanimate condition, the arm of a wooden garden chair was touched by one of two different wind-moved palm tree branches.

They found activation of the secondary somatosensory cortex (SII) for all four conditions, independent of the intentionality of the touching agent and the animacy of the touched object. Thus, whether tactile experiences have some affective quality or not, vicarious touch in these experiments has little (if anything) to do with empathy.

As Ebisch et al. rightly note, unlike emotions, instances of touching events extend far beyond human social cognition to e.g. tree branches touching each other. As they conclude,

our findings show that activation of a vi-

suotactile mirroring mechanism in the secondary somatosensory cortex (SII) during touch observation applies to the sight of any touch, thus likely contributing to our capacity of entertaining an abstract notion of touch.⁷⁴

The findings about disgust and touch just reviewed suggest that vicarious disgust and vicarious touch are self-centered, not other-directed. Vicarious disgust provides useful information about dangerous food and substances for oneself. As Keyser et al. note, vicarious touch is also triggered by the perception of goal-directed hand actions in which objects are manipulated (as opposed to actions of pointing or mimicked grasping).

As they argue, vicarious activities of the somatosensory cortices might be

involved in vicariously representing the haptic combination of tactile and proprioceptive signals that would arise if the participant manipulated the object in the observed way.⁷⁵

If so, then vicarious touch may supply tactile information relevant to action-mirroring and be part of vicarious motor activity. While Susskind et al. have argued that the antagonistic facial expressions of fear (opening the eyes and nasal aperture) and disgust (narrowing eye-opening and nasal aperture) might have adaptive consequences for the individual who feels fear and disgust by either increasing or decreasing the individual's sensory exposure, this point might extend to the adaptiveness of the vicarious responses caused by the perception of a fearful or disgusted face.⁷⁶

Furthermore, vicarious disgust and vicarious touch may elicit the concepts DISGUST and TOUCH, but the application of these concepts may be either other-directed or self-centered.

Conclusions

In this paper, I have argued that empathetic

responses are vicarious responses to others' affective states and I have advocated an imagination-based account of empathetic responses. I have further stressed the gap between two kinds of vicarious responses to others' affective states: empathetic and contagious responses: empathizing with another's pain, not contagious pain, involves ascribing pain.

Empathetically ascribing pain is different from non-empathetically ascribing pain. But if one could not ascribe pain at all, then one could not empathize with another's pain. I have also examined and criticized the arguments offered by advocates of embodied simulation for the view that the function of vicarious responses to others' actions, sensations and emotions is to mindread others' intentions, sensations and emotions.

I have further argued that the evidence showing vicarious motor activities, vicarious experiences of disgust and vicarious experiences of touch in response to perceiving others' goal-directed actions, others' disgust-expressive actions and others' being submitted to tactile stimulations is best construed as evidence for self-centered contagious responses, not for other-directed empathetic responses.

Notes

¹ Cf. K. STUEBER, *Empathy*, in: E.N. ZALTA (ed.), *Stanford Encyclopedia of Philosophy*, Stanford University, Stanford (CA) 2008 <<http://plato.stanford.edu/entries/empathy>>.

² S. GALLAGHER, *In Defense of Phenomenological Approaches to Social Cognition: Interacting with the Critics*, in: «Review of Philosophy and Psychology», vol. III, n. 2, 2012, pp. 187-212; D. ZAHAVI, *Empathy and Direct Social Perception: A Phenomenological Proposal*, in: «Review of Philosophy and Psychology», vol. II, n. 3, 2011, pp. 541-558.

³ V. GALLESE, *The "Shared Manifold" Hypothesis: From Mirror Neurons to Empathy*, in: «Journal of Consciousness Studies», vol. VIII; n. 5-7, 2001, pp. 33-50; A.I. GOLDMAN, *Simulating Minds: The Philosophy, Psychology, and Neuroscience of Mindreading*, Oxford University Press, Oxford 2006.

⁴ For criticisms of the direct-perception approach to empathy, cf. P. JACOB, *The Direct-perception*

Model of Empathy: A Critique, in: «Review of Philosophy and Psychology», vol. II, n. 3, 2011, pp. 519-540. For some responses, cf. D. ZAHAVI, *Empathy and Direct Social Perception*, cit.; S. GALLAGHER, *In Defense of Phenomenological Approaches to Social Cognition*, cit.

⁵ Cf. F. DE VIGNEMONT, P. JACOB, *What Is It like to Feel Another's Pain?*, in: «Philosophy of Science», vol. LXXIX, n. 2, 2012, pp. 295-316.

⁶ Cf. K.D. DAVIS, *The Neural Circuitry of Pain as Explored with Functional MRI*, in: «Neurological Research», vol. XXII, n. 3, 2000, pp. 313-317.

⁷ A. AVENANTI, D. BUETI, G. GALATI, S. AGLIOTI, *Transcranial Magnetic Stimulation Highlights the Sensorimotor Side of Empathy for Pain*, in: «Nature Neuroscience», vol. VIII, n. 7, 2005, pp. 955-960; A. AVENANTI, I. MINIO-PALUELLO, A. SFORZA, S. AGLIOTI, *Freezing or Escaping? Opposite Modulations of Empathic Reactivity to the Pain of Others*, in: «Cortex», vol. XLV, n. 9, 2009, pp. 1072-1077.

⁸ By contrast, no such inhibition was reported when participants were either shown a cotton swab gently moving over the same area of the hand or a needle penetrating a tomato.

⁹ As Avenanti and colleagues put it, «it is entirely possible that the somatomotor contagion that may underlie the corticospinal inhibition reported in our study implies pain anticipation in oneself [...] and that the anticipatory quality of the sensorimotor mapping may be automatic» (see A. AVENANTI, I. MINIO-PALUELLO, A. SFORZA, S. AGLIOTI, *Freezing or escaping?*, cit., p. 958).

¹⁰ T. SINGER, B. SEYMOUR, J. O'DOHERTY, H. KAUBE, R. DOLAN, C. FRITH, *Empathy for Pain Involves the Affective but not Sensory Components of Pain*, in: «Science», vol. CCCIII, n. 5661, 2004, pp. 1157-1162.

¹¹ «Bilateral anterior insula (AI), rostral anterior cingulate cortex (ACC), brainstem, and cerebellum were activated when subjects received pain and also by a signal that a loved one experienced pain. AI and ACC activation correlated with individual empathy scores. Activity in the posterior insula/secondary somatosensory cortex, the sensorimotor cortex (SI/MI), and the caudal ACC was specific to receiving pain. Thus, a neural response in AI and rostral ACC, activated in common for “self” and “other” conditions, suggests that the neural substrate for empathic experience does not involve the entire “pain matrix”. We conclude that only that part of the pain network associated with its affective qualities, but

not its sensory qualities, mediates empathy» (see T. SINGER, B. SEYMOUR, J. O'DOHERTY, H. KAUBE, R. DOLAN, C. FRITH, *Empathy for Pain Involves the Affective but not Sensory Components of Pain*, cit.).

¹² M. BOTVINICK, A.P. JHAB, L.M. BYLSMAA, F.A. FABIAN, P.E. SOLOMON, K.M. PRKACHIN, *Viewing Facial Expressions of Pain Engages Cortical Areas Involved in the Direct Experience of Pain*, in: «Neuroimage», vol. XXV, n.1, 2005, pp. 312-319.

¹³ P.L. JACKSON, A.N. MELTZOFF, J. DECETY, *How do we Perceive the Pain of Others? A Window into the Neural Processes Involved in Empathy*, in: «Neuroimage», vol. XXIV, n. 5, 2005, pp. 771-779.

¹⁴ A. AVENANTI, D. BUETI, G. GALATI, S. AGLIOTI, *Transcranial Magnetic Stimulation Highlights the Sensorimotor Side of Empathy for Pain*, cit.; A. AVENANTI, I. MINIO-PALUELLO, A. SFORZA, S. AGLIOTI, *Freezing or Escaping?*, cit.; A. AVENANTI, I. MINIO-PALUELLO, I. BUFALARI, S. AGLIOTI, *Stimulus-driven Modulation of Motor-evoked Potentials During Observation of Others' Pain*, in: «Neuroimage», vol. XXXII, n. 1, 2006, pp. 316-324.

¹⁵ Cf. T. SINGER, C. LAMM, *The Social Neuroscience of Empathy*, in: «Annals of the New York Academy of Sciences», vol. MCLVI, n. 1, 2009, pp. 81-96.

¹⁶ T. SINGER, B. SEYMOUR, J. O'DOHERTY, K. STEPHAN, R. DOLAN, C. FRITH, *Empathic Neural Responses are Modulated by the Perceived Fairness of Others*, in: «Nature», vol. CDXXXIX, n. 7075, 2006, pp. 466-469.

¹⁷ Y. CHENG, C.P. LIN, H.L. LIU, Y.H. HSU, K.E. LIM, D. HUNG, J. DECETY, *Expertise Modulates the Perception of Pain in Others*, in: «Current Biology», vol. XVII, n. 19, 2007, pp. 1708-1713.

¹⁸ C. LAMM, H.C. NUSBAUM, A.N. MELTZOFF, J. DECETY, *What are you Feeling? Using Functional Magnetic Resonance Imaging to Assess the Modulation of Sensory and Affective Responses During Empathy for Pain*, in: «PLOS ONE», vol. II, n. 12, 2007, e1292.

¹⁹ A.I. GOLDMAN, *Simulating Minds: The Philosophy, Psychology, and Neuroscience of Mindreading*, cit.

²⁰ P. JACOB, *The Direct-perception Model of Empathy*, cit. and F. DE VIGNEMONT, P. JACOB, *What Is It like to Feel Another's Pain?*, cit.

²¹ Furthermore, while physical pain involves the joint activity of the sensorimotor and the affective component of pain, vicarious pain involves the selective activity of either component.

²² These five conditions are spelled out in detail in

F. DE VIGNEMONT, P. JACOB, *What Is It like to Feel Another's Pain?*, cit.

²³ J. Smith's paper *What is empathy for?* was presented at a symposium on empathy, Collective Intentionality VIII, University of Manchester, on August 31, 2012.

²⁴ It is an empirical question whether when A and B feel pain as a result of some common cause and A is aware of B's pain, A can both feel physical pain and empathize with B's pain.

²⁵ C. LAMM, A.N. MELTZOFF, J. DECETY, *How do we Empathize with Someone who is not Like us? A Functional Magnetic Resonance Imaging Study*, in: «Journal of Cognitive Neuroscience», vol. XXII, n. 2, 2010, pp. 362-376.

²⁶ C. LAMM, A.N. MELTZOFF, J. DECETY, *How do we Empathize with Someone who is not Like us?*, cit.

²⁷ Cf. A. AVENANTI, D. BUETI, G. GALATI, S. AGLIOTI, *Transcranial magnetic stimulation highlights the sensorimotor side of empathy for pain*, cit.

²⁸ V. GALLESE, *The "Shared Manifold" Hypothesis: From Mirror Neurons to Empathy*, cit.; V. GALLESE, *Embodied Simulation: From Neurons to Phenomenal Experience*, in: «Phenomenology and Cognitive Science», vol. IV, n. 1, 2005, pp. 23-48; V. GALLESE, *Embodied Simulation and Its Role in Intersubjectivity*, in: T. FUCHS, H.C. SATTEL, P. HENNINGSEN (eds.), *The Embodied Self: Dimensions, Coherence and Disorders*, Schattauer, Stuttgart 2010, pp. 78-92.

²⁹ G. RIZZOLATTI, L. FADIGA, V. GALLESE, L. FOGASSI, *Premotor Cortex and the Recognition of Motor Actions*, in: «Cognitive Brain Research», vol. III, n. 2, 1996, pp. 131-141; G. RIZZOLATTI, L. FOGASSI, V. GALLESE, *Cortical Mechanisms Subserving Object Grasping and Action Recognition: A New View of the Cortical Motor Functions*, in: M. GAZZANIGA (ed.), *The New Cognitive Neuroscience*, The MIT Press, Cambridge (MA), 2000, pp. 539-552; G. RIZZOLATTI, L. FOGASSI, V. GALLESE, *Neurophysiological Mechanisms Underlying the Understanding and Imitation of Action*, in: «Nature Reviews Neuroscience», vol. II, n. 9, 2001, pp. 661-670.

³⁰ C. KEYSERS, V. GAZZOLA, *Expanding the Mirror: Vicarious Activity for Actions, Emotions, and Sensations*, in: «Current Opinion in Neurobiology», vol. XIX, n. 6, 2009, pp. 666-671; C. KEYSERS, V. GAZZOLA, *The Vicarious Brain*, in press.

³¹ V. GALLESE, A.I. GOLDMAN, *Mirror Neurons and the Simulation Theory of Mind-reading*, in: «Trends in Cognitive Sciences», vol. II, n. 12, 1998, p. 493-501.

³² A.I. GOLDMAN, *Two Routes to Empathy: Insights from Cognitive Neuroscience*, in: A. COPLAN, P. GOLDIE (eds.), *Empathy: Philosophical and Psychological Perspectives*. Oxford University Press, Oxford 2011, pp. 31-44. It is one thing to take the interpersonal similarity condition on empathetic pain (as I did in section 1). It is another thing to take it as a necessary condition for ascribing pain to another (which I do not).

³³ A.I. GOLDMAN, *Simulating Minds: The Philosophy, Psychology, and Neuroscience of Mindreading*, cit.; R.M. GORDON, *Folk Psychology as Simulation*, in: «Mind and Language», vol. I, n. 2, 1986, pp. 158-171; R.M. GORDON, *Simulation Without Introspection or Inference from Me to You*, in: M. DAVIES, T. STONE (eds.), *Mental Simulation: Evaluations and Applications*, Blackwell, Oxford 1995, pp. 53-67; R.M. GORDON, "Radical" Simulationism, in: P. CARRUTHERS, P.K. SMITH (eds), *Theories of Theories of Mind*, Cambridge University Press, Cambridge 1996, pp. 11-21; S. HURLEY, *Understanding Simulation*, in: «Philosophy and Phenomenological Research», vol. LXXVII, n. 3, 2008, pp. 755-774.

³⁴ A.I. GOLDMAN, *Simulating Minds: The Philosophy, Psychology, and Neuroscience of Mindreading*, cit.; A.I. GOLDMAN, *Hurley on Simulation*, in: «Philosophy and Phenomenological Research», vol. LXXVII, n. 3, 2008, pp. 775-788.

³⁵ On the account presented in section 1, empathetic pain involves elements of high-level mental simulation. For a detailed discussion of Goldman's distinction, cf. F. DE VIGNEMONT, *Drawing the Boundary Between Low-level and High-level Mindreading*, in: «Philosophical Studies», vol. CXLIV, n. 3, 2009, pp. 457-466. The reason that even contagious (or sensorimotor vicarious) pain seems to fit an E-imagination based account better than a mirroring account is that in the experiments by Avenanti et al. participants see a needle penetrate an anonymous hand, but they do not see any pain expressing action performed by the hand-owner (A. AVENANTI, D. BUETI, G. GALATI, S. AGLIOTI, *Transcranial Magnetic Stimulation Highlights the Sensorimotor Side of Empathy for Pain*, cit.; A. AVENANTI, I. MINIO-PALUELLO, A. SFORZA, S. AGLIOTI, *Freezing or Escaping?*, cit.).

³⁶ A.I. GOLDMAN, *Simulating Minds: The Philosophy, Psychology, and Neuroscience of Mindreading*, cit.; A.I. GOLDMAN, *Mirroring, Mindreading, and Simulation*, in: J.A. PINEDA (ed.), *Mirror Neuron Systems: The Role of Mirroring Processes in Social*

Cognition, Humana Press, New York 2009, pp. 311-330; A.I. GOLDMAN, *Mirroring, Simulating, and Mindreading*, in: «Mind and Language», vol. XXIV, n. 2, 2009, pp. 235-252; V. GALLESE, *The "Shared Manifold" Hypothesis: From Mirror Neurons to Empathy*, cit.; V. GALLESE, *Embodied Simulation: From Neurons to Phenomenal Experience*, cit; V. GALLESE, *Before Hurley and Below "Theory of Mind": Embodied Simulation and the Neural Correlates of Social Cognition*, in: «Philosophical Transactions of the Royal Society, B», vol. CCCLXII, n. 1480, 2007, pp. 659-669; V. GALLESE, *Embodied Simulation and Its Role in Intersubjectivity*, cit.

³⁷ A.I. GOLDMAN, *Simulating Minds: The Philosophy, Psychology, and Neuroscience of Mindreading*, cit., ch. 2.

³⁸ A.I. GOLDMAN, *Simulating Minds: The Philosophy, Psychology, and Neuroscience of Mindreading*, cit.

³⁹ A.I. GOLDMAN, *Mirroring, Mindreading, and Simulation*, cit.; A.I. GOLDMAN, *Mirroring, Simulating, and Mindreading*, cit; V. GALLESE, C. SINIGAGLIA, *What is so Special about Embodied Simulation?*, in: «Trends in Cognitive Sciences», vol. XV, n. 11, 2011, pp. 512-519.

⁴⁰ A.I. GOLDMAN, F. DE VIGNEMONT, *Is Social Cognition Embodied?*, in: «Trends in Cognitive Sciences», vol. XIII, n. 4, 2009, pp. 154-159; A.I. GOLDMAN, *A Moderate Approach to Embodied Cognitive Science*, in: «Review of Philosophy and Psychology», vol. III, n. 1, 2012, pp. 71-88.

⁴¹ For further discussion of the embodied component of embodied simulation, cf. P. JACOB, *How from Action-mirroring to Intention-ascription*, in: «Consciousness and Cognition», vol. XXII, n. 3, 2013, pp. 1132-1141.

⁴² V. GALLESE, C. SINIGAGLIA, *What is so Special about Embodied Simulation?*, cit., p. 513. See also S. HURLEY, *Understanding Simulation*, cit., p. 760. Anderson has recently argued that "re-use" of neural circuits is a fundamental organizational principle of the brain (see M.L. ANDERSON, *Neural Reuse: A Fundamental Organizational Principle of the Brain*, in: «Behavioral and Brain Sciences», vol. XXXIII, n. 4, 2010, pp. 245-266).

⁴³ A.I. GOLDMAN, *Simulating Minds: The Philosophy, Psychology, and Neuroscience of Mindreading*, cit.; S. HURLEY, *Understanding Simulation*, cit.

⁴⁴ *Ivi*, p. 757.

⁴⁵ *Ivi*, p. 759.

⁴⁶ Cf. A.I. GOLDMAN, *Hurley on Simulation*, cit., here p. 778.

⁴⁷ *Ivi*, pp. 778-779.

⁴⁸ Cf. *ivi*, p. 778.

⁴⁹ V. GALLESE, C. SINIGAGLIA, *What is so Special about Embodied Simulation?*, cit., p. 517.

⁵⁰ *Ibidem*.

⁵¹ *Ibidem*.

⁵² M. TOMASELLO, M. CARPENTER, J. CALL, T. BEHNE, H. MOLL, *Understanding and Sharing Intentions: The Origins of Cultural Cognition*, in: «Behavioral and Brain Sciences», vol. XXVIII, n. 5, 2005, pp. 675-691.

⁵³ S.V. SHEPERD, J.T. KLEIN, R.O. DEANER, M.L. PLATT, *Mirroring of Attention by Neurons in Macaque Parietal Cortex*, in: «Proceedings of National Academy of Sciences – U.S.A.», vol. CVI, n. 23, 2009, pp. 9489-9494.

⁵⁴ *Ivi*, p. 9489. This interpretation is endorsed by G. RIZZOLATTI, C. SINIGAGLIA, *The Functional Role of the Parieto-frontal Mirror Circuit: Interpretations and Misinterpretations*, in: «Nature Reviews Neuroscience», vol. XI, n. 4, 2010, pp. 264-274; V. GALLESE, C. SINIGAGLIA, *What is so Special about Embodied Simulation?*, cit.; A.I. GOLDMAN, *A Moderate Approach to Embodied Cognitive Science*, cit.

⁵⁵ R.D. NEWMAN-NORLUND, H.T. VAN SCHIE, A.M. VAN ZUIJLEN, H. BEKKERING, *The Mirror Neuron System is More Active During Complementary Compared with Imitative Action*, in: «Nature Neuroscience», vol. X, n. 7, 2007, pp. 817-818.

⁵⁶ V. GALLESE, A.I. GOLDMAN, *Mirror Neurons and the Simulation Theory of Mind-reading*, cit., p. 948.

⁵⁷ Oosterhof and colleagues report stronger fMRI activity for first-person than third-person representations of actions in human premotor cortex (N.N. OOSTERHOF, S.P. TIPPER, P.E. DOWNING, *Crossmodal and Action-specific: Neuroimaging the Human Mirror Neuron System*, in: «Trends in Cognitive Sciences», vol. XVII, n. 7, 2013, pp. 311-318).

⁵⁸ Cf. R. D. NEWMAN-NORLUND, H.T. VAN SCHIE, A.M. VAN ZUIJLEN, H. BEKKERING, *The Mirror Neuron System is More Active During Complementary Compared with Imitative Action*, cit.

⁵⁹ Cf. P. JACOB, *What do Mirror Neuron Contribute to Social Cognition?*, in: «Mind and Language», vol. XXIII, n. 2, 2008, pp. 190-223 for challenges to the mindreading interpretation of action-mirroring.

⁶⁰ G. RIZZOLATTI, L. FOGASSI, V. GALLESE, *Cortical Mechanisms Subserving Object Grasping, Action Understanding, and Imitation*, in: M. GAZZANIGA (ed.), *The Cognitive Neurosciences III*, The MIT Press, Cambridge (MA) 2004, pp. 427-440.

⁶¹ As my discussion of the disagreement between

Hurley and Goldman in section 2 shows, a simulation approach to mindreading is committed to the condition of synchronous interpersonal similarity. Furthermore, empathy requires this condition. But I am not committed to the simulation approach to mindreading. Nor do I think that empathy is the default response to one's awareness of another's affective state.

⁶² E. KOHLER, C. KEYSERS, M.A. UMITA, L. FOGASSI, V. GALLESE, G. RIZZOLATTI, *Hearing Sounds, Understanding Actions: Action Representation in Mirror Neurons*, in: «Science», vol. CCXCVII, n. 5582, 2002, pp. 846-848; C. KEYSERS, B. WICKER, V. GAZZOLA, J.-L. ANTON, L. FOGASSI, V. GALLESE, *A Touching Sight: SII/PV Activation During the Observation and Experience of Touch*, in: «Neuron», vol. XLII, n. 2, 2004, pp. 335-346.

⁶³ G. CSIBRA, *Action Mirroring and Action Understanding: An Alternative Account*, in: P. HAGGARD, Y. ROSSETTI, M. KAWATO (eds.), *Sensorimotor Foundations of Higher Cognition, Attention and Performance*, Oxford University Press, New York, 2007, pp. 435-480.

⁶⁴ G. RIZZOLATTI, L. FOGASSI, V. GALLESE, *Cortical Mechanisms Subserving Object Grasping and Action Recognition: A New View of the Cortical Motor Functions*, cit, p. 542; L. CRAIGHERO, G. METTA, G. SANDINI, L. FADIGA, *The Mirror-neurons System: Data and Models*, in: «Progress in Brain Research», vol. CLXIV, 2007, pp. 39-59.

⁶⁵ I have argued for such an interpretation of mirror neuron activity in P. JACOB, *The Tuning-fork Model of Social Cognition: A Critique*, in: «Consciousness and Cognition», vol. XVIII, n. 1, 2009, pp. 229-43. Meini and Paternoster also argue for a similar interpretation, but they hold a different view of concept-possession (see C. MEINI, A. PATERNOSTER, *Mirror neurons as a conceptual mechanism?*, in: «Mind & Society», vol. XI, n. 2, 2012, pp. 183-201). Interestingly, this line of thinking has been explicitly endorsed by Gallese: «The results briefly reviewed above concerning “audiovisual mirror neurons” are important in that they seem to suggest that it is possible to have sameness of informational content at a quite “abstract” level, the level of conceptual content, without being endowed with the cognitive faculty of language» (see V. GALLESE, *A Neuroscientific Grasp of Concepts: From Control to Representation*, in: «Philosophical Transactions of the Royal Society of London, B», vol. CCCLVIII, n. 1435, 2003, pp. 1231-1240, here p. 1238).

⁶⁶ I follow the standard practice of using words in capital letters to denote concepts.

⁶⁷ Wood and colleagues in their paper refer to “empathy for touch” and “for somatosensory sensation” (see R. WOOD, V. GALLESE, L. CATTANEO, *Visuotactile Empathy within the Primary Somatosensory Cortex Revealed by Short-latency Afferent Inhibition*, in: «Neuroscience Letters», vol. CDLXXIII, n. 1, 2010, pp. 28-31).

⁶⁸ B. WICKER, C. KEYSERS, J. PLAILLY, J.-P. ROYET, V. GALLESE, G. RIZZOLATTI, *Both of us Disgusted in my Insula: The Common Neural Basis of Seeing and Feeling Disgust*, in: «Neuron», vol. XL, n. 3, 2003, pp. 655-664.

⁶⁹ Cf. V. GALLESE, C. KEYSERS, G. RIZZOLATTI, *A Unifying View of the Basis of Social Cognition*, in: «Trends in Cognitive Sciences», vol. VIII, n. 9, 2004, pp. 396-403

⁷⁰ A.J. CALDER, J. KEANE, F. MANES, N. ANTOUN, A.W. YOUNG, *Impaired Recognition and Experience of Disgust Following Brain Injury*, in: «Nature Reviews Neuroscience», vol. III, n. 11, 2000, pp. 1077-1078.

⁷¹ C. KEYSERS, B. WICKER, V. GAZZOLA, J.-L. ANTON, L. FOGASSI, V. GALLESE, *A Touching Sight: SII/PV Activation During the Observation and Experience of Touch*, cit.

⁷² Blakemore and colleagues report that seeing another person's being touched directly causes individuals with so-called «mirror-touch synesthesia» to feel tactile experiences in the very same body part as that of the person who is being touched (see S.-J. BLAKEMORE, B. BRISTOW, G. BIRD, C. FRITH, J. WARD, *Somatosensory Activations During the Observation of Touch and a Case of Vision-touch Synaesthesia*, in: «Brain», vol. CXXVIII, n. 7, 2005, pp. 1571-1583). Furthermore, fMRI experiments showed stronger activity in somatosensory cortices for the individual with synesthesia than for non-synesthetic controls; cf. M.J. BANISSY, J. WARD, *Mirror-touch Synaesthesia is Linked with Empathy*, in: «Nature Neuroscience», vol. X, n. 7, 2007, pp. 815-816.

⁷³ S.J.H. EBISCH, M.G. PERRUCCI, A. FERRETTI, C. DEL GRATTA, G.L. ROMANI, V. GALLESE, *The Sense of Touch: Embodied Simulation in a Visuotactile Mirroring Mechanism for Observed Animate or Inanimate Touch*, in: «Journal of Cognitive Neuroscience», vol. XX, n. 9, 2008, pp. 1611-1623.

⁷⁴ *Ivi*, p. 1612.

⁷⁵ C. KEYSERS, J.K. HAAS, V. GAZZOLA, *Somatosensation in Social Perception*, in: «Nature Reviews

Neuroscience», vol. XI, n. 6, 2010, pp. 417-428, here p. 423.

⁷⁶J.M. SUSSKIND, D.H. LEE, A. CUSI, R. FEIMAN,

W. GRABSKI, A.K. ANDERSON, *Expressing Fear Enhances Sensory Acquisition*, in: «Nature Neuroscience», vol. XI, n. 7, 2008, pp. 843-850.