



## The tuning-fork model of human social cognition: A critique <sup>☆</sup>

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### ARTICLE INFO

#### Article history:

Received 20 December 2007

Available online 25 June 2008

#### Keywords:

Mirror neurons

Mindreading

Direct mapping

Action-understanding

Motor mirroring

Action-mirroring

Emotion-mirroring

Simulation

Imagination

Concept possession

### ABSTRACT

The *tuning-fork model* of human social cognition, based on the discovery of mirror neurons (MNs) in the ventral premotor cortex of monkeys, involves the four following assumptions: (1) mirroring processes are processes of resonance or simulation. (2) They can be motor or non-motor. (3) Processes of motor mirroring (or action-mirroring), exemplified by the activity of MNs, constitute instances of third-person mindreading, whereby an observer represents the agent's intention. (4) Non-motor mirroring processes enable humans to represent others' emotions. After questioning all four assumptions, I point out that MNs in an observer's brain could not synchronically resonate with MNs in an agent's brain unless they discharged in a single brain in two distinct tasks at different times. Finally, I sketch a conceptualist alternative to the resonance model according to which a brain mechanism active in both the execution and the perception of e.g., the act of grasping is the neural basis of the concept of e.g., *grasping*.

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### 1. Introduction

So-called “mirroring” processes are best exemplified by mirror neurons (MNs), i.e., sensorimotor neurons that fire both when an animal executes a transitive hand or mouth action (directed towards a target) and when the animal perceives the same kind of action being performed by a conspecific or by a human experimenter. MNs were first discovered (in the early 1990's) by single-cell recording in area F5 of the ventral premotor cortex (PMv) and later also in area PF of the inferior parietal lobule of monkeys. Subsequently, TMS and brain imaging experiments<sup>1</sup> have been reported in support of the exist-

<sup>\*</sup> For comments on an earlier version of this paper, I am grateful to Patrick Cavanagh. For conversations on the topics of this paper, I am grateful to Jérôme Dokic, Gunther Knoblich, Hugo Mercier, Thomas Metzinger, Elisabeth Pacherie, Philippe Rochat, Natalie Sebanz, Mark Ashton Smith, Daniela Tagliafico, Iris Trinklér and Frédérique de Vignemont. A version of this paper was delivered at a Conference on “Self and other in social neuroscience and philosophy of mind” organized by Julian Kilverstein, Barry C. Smith and Tim Crane at the Institute of Philosophy, School of Advanced Study, at the University of London (in November 2007) at the APIC seminar at the Institut Jean Nicod (in December 2007) organized by Jérôme Dokic and Joëlle Proust and at a workshop at the university of Bilkent in Ankara (in April 2008) on “Taking the measure of mirror neurons” organized by Radu Bogdan. I am grateful to the organizers of these meetings and the audiences for their comments. I am also grateful to Alvin Goldman for email exchanges about the topic of this paper and for having sent me a copy of two recent papers of his on this topic. Finally, I am grateful to two anonymous referees for this journal and to the editor for their detailed critical comments.

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<sup>1</sup> But, see Turella, Pierno, Tubaldi (2008) for a recent critical assessment of the brain-imaging evidence in favor of the existence of a mirror (neuron) system in humans.

tence of a so-called mirror (neuron) system (MNS) or mirror circuit that responds to the execution and the perception of a wider range of actions, including both transitive and intransitive actions (not directed towards a target).<sup>2</sup>

MNs were so-called because their activity in an observer's brain is supposed to *mirror* (or *resonate* with) their activity in the agent's brain. Clearly, when MNs endogenously discharge in an agent's brain, their firing does not count as a *mirroring* process. Only the *exogenously* caused MN activity in an observer's brain, not the endogenously caused MN activity in an agent's brain, counts as a mirroring process.

After much discussion, no consensus has yet been reached about the exact nature of both the mechanism and the function of MN activity. Nonetheless, in 2004, Gallese, Keysers and Rizzolatti published a provocative paper entitled "A unifying view of the basis of social cognition", in which they offered a "unifying neural hypothesis on how individuals understand the actions and emotions of others". Their main claim was that "the fundamental mechanism at the basis of the experiential understanding of others' actions is the activation of the mirror neuron system. A similar mechanism, but involving visceromotor centers, underlies the experiential understanding of the emotions of others".<sup>3</sup> On their view, "the fundamental mechanism that allows us a direct experiential grasp of the mind of others is not conceptual reasoning but direct simulation of the observed events through the mirror mechanism. The novelty of our approach consists in providing for the first time a neurophysiological account of the experiential dimension of both action and emotion understanding".<sup>4</sup>

On the basis of Gallese et al.'s (2004) use of the indefinite description "a direct experiential grasp of the mind of others", and borrowing a term from Saxe's (2005) reply to Goldman and Sebanz's (2005) reply to her original (2005a) critique of simulation theory, I will call Gallese et al.'s (2004) unifying view of social cognition the *tuning-fork* model of human social cognition. The tuning-fork model of human social cognition is a theory of human *mindreading*. Like most philosophers and psychologists, I assume that mindreading is the human cognitive ability to represent the psychological states (perceptions, emotions, intentions, desires, beliefs, etc.) of either self or others.<sup>5</sup> Whereas a task of third-person mindreading consists in forming a belief about another's psychological state, a task of first-person mindreading consists in forming a belief about a psychological state of one's own.

What I call the *tuning-fork* model of human social cognition is a particular version of *simulation*-based approaches to human third-person mindreading. Like other versions of simulation-based approaches to third-person mindreading, it emphasizes the contribution of psychological and neural *similarity* to tasks of third-person mindreading. As Goldman (2006: 35–36), a philosophical advocate of the simulation-based approach to mindreading, has emphasized, the English word "simulation" derives from the Latin verb *simulare*, which means "to duplicate" (or "to replicate"), and from the Latin adjective *similis*, which means "similar". What is distinctive of the tuning-fork model of human social cognition is that it is jointly committed to the four following assumptions.

(1) The first assumption is that mirroring processes, which underlie the so-called "experiential understanding" of another's action, are instances of mental simulation by virtue of being instances of *motor* simulation. (2) The second assumption is that mirroring processes can be motor or non-motor. (3) The third assumption is that processes of motor mirroring (action-mirroring), exemplified by the activity of MNs, constitute instances of third-person mindreading by virtue of which an observer can represent an agent's intention. (4) The fourth assumption is that non-motor mirroring processes enable humans to represent others' *emotions*. Assumption (2) presupposes that mirroring processes form a generic kind that can be divided into at least two species, the first of which underlies an observer's automatic response to another's action, and the second of which underlies an observer's automatic response to another's emotion. In light of assumption (2) of the tuning-fork model, in order not to beg the question against the possibility of emotion-mirroring, I will call "action-mirroring" or "motor mirroring" the first species of mirroring process, which is exemplified by MN activity in both the monkey's PMv and PF and by the human MNS.

This paper, which is a critical examination of the tuning-fork model of social cognition, is divided into three sections. In the first two sections, I restrict myself to *action-mirroring*. In the first section, I ask whether, in accordance with assumption (1), action-mirroring really qualifies as a species of motor simulation (or motor resonance). In Section 3, I examine the question of the link between action-mirroring and third-person mindreading. I first argue that, contrary to assumption (3), instances of action-mirroring could not *constitute* (in a strong sense) instances of third-person mindreading. I then examine possible causal links between tasks of mindreading and action-mirroring. In Section 4, I argue that the enriched definition of a mirroring process required by the extension of action-mirroring into *emotion-mirroring*, in accordance with assumptions (2) and (4), faces insuperable difficulties. There, I offer an alternative conceptualist interpretation of some of the relevant evidence which serves as an empirical basis for the tuning-fork model of mindreading. The conclusion of my overall argument is that mirroring might turn out to be a by-product of third-person mindreading.

<sup>2</sup> I will use the abbreviation "MNs" to refer to mirror neurons and the abbreviated definite description "the MNS" to refer to the human mirror neuron system (or circuit).

<sup>3</sup> Cf. Gallese, Keysers, and Rizzolatti (2004: 396).

<sup>4</sup> *Ibid.*

<sup>5</sup> On the view that an individual's psychological states (perceptions, emotions, etc.) are mental representations, a mindreader's belief about an individual's psychological states is a metarepresentation.

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