Toward a second-person neuroscience

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Introduction & Conceptual framework

Debates about how we understand others have been dominated by Theory-Theory and Simulation Theory. According to the former, we treat other people like any scientist treats their object of study, i.e. we approach them from a detached, observational, and third-person perspective (3PP). According to the latter, we use our own first-person experience (1PP) to create pretend states and project them onto the other. Such views ignore the fundamental difference between online and offline cognition: Arguably, our understanding of others differs depending on whether we are directly engaged with them in social interaction or merely observing them.

This difference, we suggest, can be captured by a second-person approach (2PP), emphasizing direct engage-ment and the reciprocity resulting from the dynamic feedback essential to online social cognition. Such a 2PP approach can be developed by extending the enactive approach to cognition to the social domain.

ENACTIVE COGNITION

Cognition arises from the successful **coupling** of embodied agent and environment, and from the exercise of **skillful know-how** in the active exploration of the environment. Herein, the **body** functions as an egocentric principle of experience and as an experiencing organ. Perception is enabled by bodily actions (Thompson 2007, Noe 2004).

Online cognition is characterized by producing "fluid and flexible real-time adaptive responses to incoming sensory stimuli" (Wheeler 2005). The relevant knowledge is **implicit** rather than explicit.

By contrast, **offline** cognition is manifest when one is, say, pondering on a mathematical problem or deliberating about what to eat.

In online cognition, objects are presented as **affording** the agent with various possibilities for action, e.g. a cup is presented as graspable etc.

ENACTIVE SOCIAL COGNITION

Basic social cognition is enabled by successful coupling between two agents and the exercise of skillful embodied know-how about people, acquired in **direct interaction**. Embodied practices, e.g. facial expressions and gestures are essential here (Gallagher 2001, Ratcliffe 2007).

Online social cognition is characterized by **feedback loops** and **reciprocal interaction** (Frith 2007), not by observation. E.g., Moll et al. (2007) showed that one-year olds can attribute know-ledge/ignorance to others, depending on **joint engagement** between infant and adult (see also Reddy 2008).

In online social cognition, we can perceptually pick up **social affordances** (Costall 1995), arising from coupling and appropriate feedback (cf. infants' sense for reciprocity/musicality of interaction in still-face procedure & video-delay studies, Murray & Trevarthen 1985).

Enactive social understanding is systematically, phylogenetically and ontogenetically prior to and more basic than mindreading (Sinigaglia 2008, Schlicht 2008). The relevant knowledge is **implicit** rather than explicit. For example, **autistic** patients may pass false-belief tasks when prompted to do so and thus do not lack but rather need an explicit theory of mind. Yet, as Senju et al. (2009) showed, even then they remain impaired in the "automatic online computation of others' mental states" - as predicted by the enactive approach to social cognition.

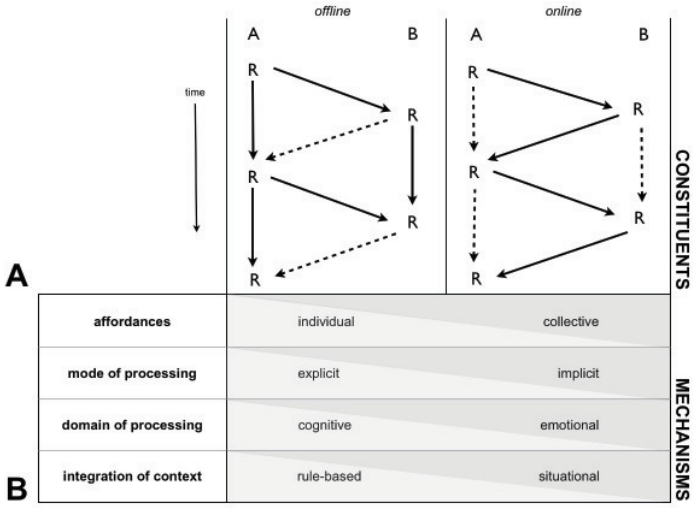

Figure 1. A) Schematic depiction of interaction contingencies constitutive of 'offline' and 'online' social cognition. A: person A, B: person B, R: (re-) action. Dotted lines indicate the absence or relatively decreased influence of actions on oneself or the other. *Adapted from: Gerard & Jones (1967).* **B)** Differential recruitment of underlying mechanisms.

Evidence from functional neuroimaging

Being Addressed as You:

The neural correlates of self-directed, socially relevant facial expressions

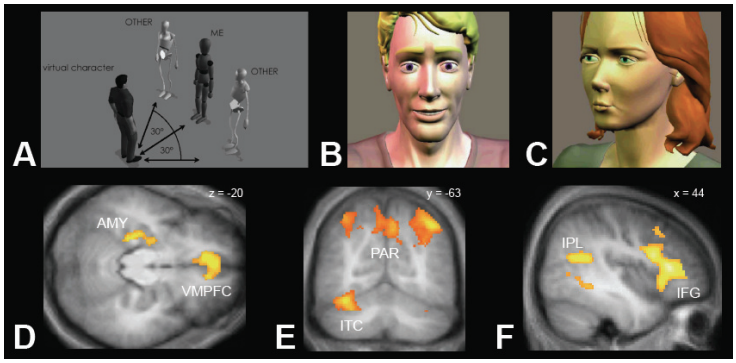

Figure 2. A) Virtual scenario as shown in the instructions. B) Self-directed, socially relevant facial expression. C) Other-directed, arbitrary facial movement. D) Neural correlates of the perception of self-directed facial expressions. E) Neural correlates of the perception of other-directed facial expressions. F) Neural correlates of the perception of arbitrary facial movements AMY: amydala, VMPFC: ventro-medial prefrontal cortex, ITC: inferior temporal cortex, PAR: parietal cortex, IPL: inferior parietal lobe, IFG: inferior frontal gyrus. *Activation overlays based on re-analysis of data taken from:* Schilbach et al. (2006).

Minds Made For Sharing:

Initiating joint attention in ‚online' interaction recruits reward-related neurocircuitry

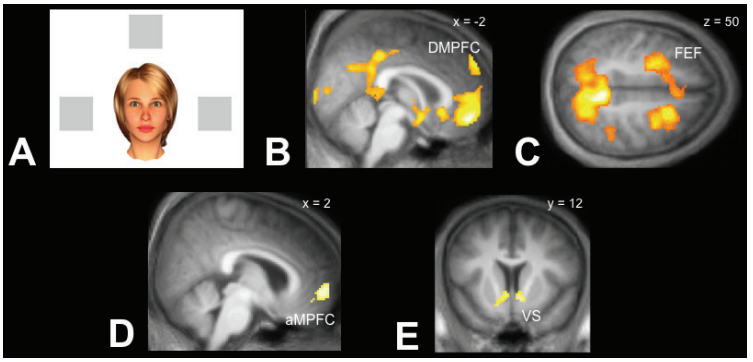

Figure 3. A) Screenshot depicting an anthropomorphic virtual character and three objects (grey squares). B) Neural correlates of looking at a grey object ‚together with' the virtual character (joint attention, regardless of whether or not it was self- or other-initiated). C) Neural correlates of looking at an object different from the one the virtual character is looking at (no joint attention, regardless of whether or not it was self- or other-initiated joint attention of other-initiated) D) Neural correlates of other-initiated joint attention. E) Neural correlates of self-initiated joint attention. aMPFC: anterior medial prefrontal cortex, DMPFC: dorsal medial prefrontal cortex, FEF: frontal eye field, VS: ventral striatum. *Activation overlays based on re-analysis of data taken from:* Schilbach et al. (2009).

Discussion & Outlook

Here, we argue for a second-person approach (2PP) to other minds suggesting that interpersonal understanding is primarily a matter of direct interaction with others during which the affective and sensorimotor contingencies that result from being personally addressed prompt responses which feed into the reciprocal to and fro constitutive of 'online' social interaction. We suggest that this account — well-grounded in current philosophical considerations and supported by developmental evidence — provides a radically different route to the investigation of intersubjectivity by emphasising aspects of social cognition specifically related to the procedural nature of social interactions.

Furthermore, we argue for the application of this approach to the neurobiological investigation of social cognition based on our analysis that 'dark matter' in social neuroscience remains due to difficulties of investigating real-time social interactions. While preliminary neuroscientific evidence suggests that social cognition, indeed, is fundamentally different when we are engaged in 'online' interaction, many questions remain open. Studies are needed to directly compare 'online' and 'offline' social cognition with respect to the recruitment of underlying mechanisms. A second-person neuroscience will, therefore, make use of innovative experimental setups to investigate social interaction in an ecologically valid way (e.g. Wilms et al. 2010). Such developments will not only help neuroscience to really 'go social', but may also be relevant for our understanding of psychiatric disorders construed as disorders of social cognition.

References & Acknowledgements

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