Joint Action without Mindreading

1. A Challenge and a Conjecture

'participation in cooperative ... interactions ... leads children to construct uniquely powerful forms of cognitive representation.' (Moll & Tomasello 2007)

'perception, action, and cognition are grounded in social interaction' (Knoblich & Sebanz 2006, p. 103)

'human cognitive abilities ... [are] built upon social interaction' (Sinigaglia & Sparaci 2008)

2. Joint Action vs Parallel but Merely Individual Action

Question What distinguishes joint actions from parallel but individual actions?

Simple Account (Intentional) joint action occurs when there is an act-type, φ, such that each of several agents intends that they, these agents, φ.

3. Bratman on Shared Intention

'each agent does not just intend that the group perform the [...] joint action. Rather, each agent intends as well that the group perform this joint action in accordance with subplans (of the intentions in favor of the joint action) that mesh' (Bratman 1992, p. 332).

Our plans are *interconnected* just if facts about your plans feature in mine and conversely.

'shared intentional [i.e. collective] agency consists, at bottom, in interconnected planning agency of the participants' (Bratman 2011).

Bratman's claim. For you and I to have a collective/shared intention that we J it is sufficient that:

(1) '(a) I intend that we J and (b) you intend that we J;

(2) 'I intend that we J in accordance with and because of la, lb, and meshing subplans of la and lb; you intend that we J in accordance with and because of la, lb, and meshing subplans of la and lb;

(3) '1 and 2 are common knowledge between us' (Bratman 1993, View 4)

4. Counterexample to Bratman

We have an *unshared intention* that we <J_1, J_2> where $J_1 \neq J_2$ just if:

(1′) (a) I intend that we J_1 and (b) you intend that we J_2

(2′) I intend that we J_1 in accordance with and because of la, lb, and meshing subplans of la and lb; you intend that we J_2 ...

(3′) 1 and 2 are common knowledge between us.

Our individual subplans concerning our <J_1, J_2>-ing *mesh* just in case there is some way I could J_1 and you could J_2 that would not violate either of our subplans but would, rather, involve the successful execution of those subplans.

5. A Minimal Approach

Events D_1, ... D_n *ground* E, if: D_1, ... D_n and E occur; D_1, ... D_n are each (perhaps improper) parts of E; and every event that is a proper part of E but does not overlap D_1, ... D_n is caused by some or all of D_1, ... D_n.

For an individual to be *among the agents of an event* is for there to be actions a_1, ... a_n which ground this event where the individual is an agent of some (one or more) of these actions.

A joint action is an event with two or more agents (Ludwig 2007).

A *goal* is an outcome to which actions are, or might be, directed. (Contrast a *goal-state*, an intention or other state of an agent linking an action to a goal to which it is directed.)

An outcome is a *distributive goal* of two or more actions just if (a) each action is individually directed to this outcome; and (b) it is possible that: all actions succeed relative to this outcome.

An outcome is a *collective goal* of two or more actions just if (a) this outcome is a distributive goal of the actions; (b) the actions are coordinated; and (c) coordination of this type would

normally facilitate occurrences of outcomes of this type.

6. Motor Representation in Joint Action

Motor representations concern not only bodily configurations and movements but also more distal outcomes such as the grasping of a mug or the pressing of a switch (Butterfill & Sinigaglia 2014; Hamilton & Grafton 2008; Cattaneo et al. 2009).

Some motor processes are planning-like in that they involve deriving means by which the outcomes could be brought about and in that they involve coordinating subplans (Jeannerod 2006; Zhang & Rosenbaum 2007).

Motor processes concerning actions others will perform occur in observing others act (Gangitano et al. 2001)—and even in observing several others act jointly (Manera et al. 2013)—and enables us to anticipate their actions (Ambrosini et al. 2011; Aglioti et al. 2008).

In joint action, motor processes concerning actions another will perform can occur (Kourtis et al. 2013; Meyer et al. 2011), and can inform planning for one's own actions (Vesper et al. 2013; Novembre et al. 2013; Loehr & Palmer 2011).

In some joint actions, the agents have a single representation of the whole action (not only separate representations of each agent's part) (Tsai et al. 2011; Loehr et al. 2013; Ménoret et al. 2013), and may each make a plan for both their actions (Meyer et al. 2013).

An interagential structure of motor representation:

1. there is an outcome to which a joint action could be collectively directed and in each agent there is a motor representation of this outcome;
2. these motor representations trigger planning-like processes in each agent which result in plan-like hierarchies of motor representations;
3. the plan-like hierarchy in each agent involves motor representations concerning another's actions as well as her own;
4. the plan-like hierarchies of motor representations in the agents nonaccidentally match.

These conditions are sufficient for an event with two or more agents to be a joint action:

1. the actions which are part of this event have a collective goal;
2. the coordination required for the collective goal is provided by an appropriate interagential structure of motor representation.

References

Aglioti, S. M., Cesari, P., Romani, M., & Urgesi, C. (2008). Action anticipation and motor resonance in elite basketball players. *Nat Neurosci*, *11*(9), 1109–1116.

Ambrosini, E., Costantini, M., & Sinigaglia, C. (2011). Grasping with the eyes. *Journal of Neurophysiology*.

Bratman, M. E. (1992). Shared cooperative activity. *The Philosophical Review*, *101*(2), 327–341.

Bratman, M. E. (1993). Shared intention. *Ethics*, *104*, 97–113.

Bratman, M. E. (2011). Acting over time, acting together (draft).

Butterfill, S. A. & Sinigaglia, C. (2014). Intention and motor representation in purposive action. *Philosophy and Phenomenological Research*, *88*(1), 119–145.

Cattaneo, L., Caruana, F., Jezzini, A., & Rizzolatti, G. (2009). Representation of goal and movements without overt motor behavior in the human motor cortex: A transcranial magnetic stimulation study. *The Journal of Neuroscience*, *29*(36), 11134 –11138.

Gangitano, M., Mottaghy, F. M., & Pascual-Leone, A. (2001). Phase-specific modulation of cortical motor output during movement observation. *Neuroreport*, *12*(7), 1489–92.

Hamilton, A. F. d. C. & Grafton, S. T. (2008). Action outcomes are represented in human inferior frontoparietal cortex. *Cerebral Cortex*, *18*(5), 1160–1168.

Jeannerod, M. (2006). *Motor Cognition: What Actions Tell the Self*. Oxford University Press.

Knoblich, G. & Sebanz, N. (2006). The social nature of perception and action. *Current Directions in Psychological Science*, *15*(3), 99–104.

Kourtis, D., Sebanz, N., & Knoblich, G. (2013). Predictive representation of other people's actions in joint action planning: An EEG study. *Social Neuroscience*, *8*(1), 31–42.

Loehr, J. D., Kourtis, D., Vesper, C., Sebanz, N., Knoblich, G., et al. (2013). Monitoring individual and joint action outcomes in duet music performance. *Journal of cognitive neuroscience*, *forthcoming*.

Loehr, J. D. & Palmer, C. (2011). Temporal coordination between performing musicians. *The Quarterly Journal of Experimental Psychology*, *64*(11), 2153–2167.

Ludwig, K. (2007). Collective intentional behavior from the standpoint of semantics. *Nous*, *41*(3), 355–393.

Manera, V., Schouten, B., Verfaillie, K., & Becchio, C. (2013). Time will show: Real time predictions during interpersonal action perception. *PLoS ONE*, *8*(1), e54949.

Ménoret, M., Varnet, L., Fargier, R., Cheylus, A., Curie, A., des Portes, V., Nazir, T., & Y., P. (2013). Neural correlates of non-verbal social interactions: A dual-eeg study. *Neuropsychologia*, *in press*.

Meyer, M., Hunnius, S., Elk, M. v., Ede, F. v., & Bekkering, H. (2011). Joint action modulates motor system involvement during action observation in 3-year-olds. *Experimental Brain Research*, *211*(3-4), 581–592.

Meyer, M., van der Wel, R. P. R. D., & Hunnius, S. (2013). Higher-order action planning for individual and joint object manipulations. *Experimental Brain Research*, *225*(4), 579–588.

Moll, H. & Tomasello, M. (2007). Cooperation and human cognition: the vygotskian intelligence hypothesis. *Philosophical Transactions of the Royal Society B*, *362*(1480), 639–648.

Novembre, G., Ticini, L. F., Schütz-Bosbach, S., & Keller, P. E. (2013). Motor simulation and the coordination of self and other in real-time joint action. *Social Cognitive and Affective Neuroscience*, *forthcoming*. PMID: 23709353.

Sinigaglia, C. & Sparaci, L. (2008). The mirror roots of social cognition. *Acta philosophica*, *17*(2), 307–330.

Tsai, J. C.-C., Sebanz, N., & Knoblich, G. (2011). The GROOP effect: Groups mimic group actions. *Cognition*, *118*(1), 135–140.

Vesper, C., van der Wel, R. P. R. D., Knoblich, G., & Sebanz, N. (2013). Are you ready to jump? predictive mechanisms in interpersonal coordination. *Journal of Experimental Psychology: Human Perception and Performance*, *39*(1), 48–61.

Zhang, W. & Rosenbaum, D. A. (2007). Planning for manual positioning: the end-state comfort effect for manual abduction–adduction. *Experimental Brain Research*, *184*(3), 383–389.