Shared Agency and Motor Representation

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Abstract

Shared agency is paradigmatically involved when two or more people paint a house together, tidy the toys away together, or lift a two-handled basket together. To characterise shared agency, some philosophers have appealed to a special kind of intention or structure of intention, knowledge or commitment often called 'shared intention'. In this paper we argue that there are forms of shared agency characterising which requires appeal to motor representation. Shared agency is not only a matter of what we intend: sometimes it also depends on interlocking structures of motor representation. This may have consequences for some metaphysical, normative and phenomenological questions about shared agency.

1. ***Discussion with Hong Yu

'Once we move beyond the single agent there's an a priori reason to suppose that you have a single kind of agentive structure' (Hong Yu). This is slightly tricky for me because I don't think there's a single kind of agentive structure in individual action either.

Dissimilarity between this paper and the paper on intention and motor representation: whereas it was maybe plausible to conjecture that all intentions bottom out in motor representation, it is not similarly plausible to claim that shared intentions bottom out in social motor representations (there are surely cases of shared agency where the sharing is entirely a matter of intention and does not involve motor representations at all).

Hong Yu suggested that we need to include the argument about format in order to argue that motor representations have a role distinct from that of shared intention.

In discussion: I need to shift this paper from saying:

> There is a form of shared agency and that form cannot be characterised without reference to motor representation.

to saying:

> There are at least two forms of shared agency (at least two agentive structures) and some of these are such that characterising them involves appeal to motor representation.

This shift reveals a new problem: we become more open to the objection that philosophy should concern forms of shared agency involving intention only.

I need to stress the *parity argument*. The argument is this: If

> two or more agents' actions being appropriately related to a shared intention (as Bratman characterises it) is sufficient for shared agency,

then

> two or more agents' actions being appropriately related to a structure of social motor representation is also sufficient for shared agency.

2. Introduction

Shared agency is paradigmatically involved when two (or more) people paint a house together (Bratman 1992), lift a heavy sofa together (Velleman 1997), prepare a hollandaise sauce together (Searle 1990), go to Chicago together (Kutz 2000), and walk together (Gilbert 1990). In developmental psychology paradigm cases of shared agency include two people tidying up the toys together (Behne et al. 2005), cooperatively pulling handles in sequence to make a dog-puppet sing (Brownell et al. 2006), bouncing a ball on a large trampoline together (Tomasello & Carpenter 2007).

A *joint action* is an action or event involving shared agency.

Shared agency raises a tangle of scientific and philosophical questions. Psychologically we want to know which mechanisms make it possible (Vesper et al. 2010). Developmentally we want to know when shared agency emerges, what it presupposes and whether it might somehow facilitate sociocognitive, pragmatic or symbolic development (Moll & Tomasello 2007; Hughes & Leekam 2004; Brownell et al. 2006). Phenomenologically we want to characterise what (if anything) is special about experiences of action and agency when shared agency is involved (Pacherie forthcoming 2010). Metaphysically we want to know what kinds of entities and structures are implied by the existence of shared agency (Gilbert 1992; Searle 1994). And normatively

we want to know what kinds of commitments (if any) are entailed by shared agency and how these commitments arise (Roth 2004).

To support investigation of these questions it may be useful to have an account of shared agency that gives us a principled way of distinguishing shared from individual agency (compare Bratman 2009).

Where could we start in constructing or evaluating an account of shared agency? One possibility is to start with some well-known contrast cases. Contrast cases are pairs of events which are similar in terms of the behaviour and coordination they involve but where one exemplifies shared agency while the other does not. Thus Gilbert (1990) contrasts two people walking together with two people individually walking side by side. The two pairs' movements may be the same and similarly coordinated (to avoid collision), but walking together involves shared agency whereas merely walking side by side does not. Relatedly, Searle (1990) contrasts a case in which several park visitors simultaneously run to a central shelter in order to perform a dance with another case in which the park visitors run to the central shelter in order to escape a storm. The first case involves shared agency, the second does not; but the same movements occur in both.[1] These sorts of contrast case invite the question, How does shared agency differ from individual but parallel agency? Gilbert's example shows that the difference can't just be a matter of coordination, because people who are merely walking alongside each other also need to coordinate their actions in order to avoid colliding. And Searle's example shows that the difference between shared agency and parallel individual agency can't just be that the resulting actions have a common effect because merely parallel actions can have common effects too. So one constraint on any account of shared agency is that it should enable us to make systematic sense of these and other contrast cases.

3. Shared intention

On the leading, best developed accounts of shared agency in philosophy and psychology, shared agency is explained in terms of a special kind of intention or structure of intention, knowledge and commitment often called a shared intention. On this widely held view, the difference between our walking together and two strangers merely walking side-by-side is that one event is appropriately related to a shared intention whereas the other is not.

Of course, explaining shared agency in terms of shared intention pushes us back to the question, What is shared intention? The term 'shared intention' is a term of art. On many accounts, shared intentions are neither shared nor intentions. Minimally, a shared intention stands to a joint action

[1] Compare Pears on individual action, using contrast cases to argue that whether something is an action depends on its antecedents ***

in roughly the way that an ordinary, individual intention stands to an ordinary, individual action. Now an ordinary, individual intention represents an outcome, coordinates an agent's actions, and coordinates the agent's actions in such a way that, normally, this coordination would facilitate the occurrence of the represented outcome. Similarly, a shared intention involves one or more representations of an outcome, coordinates the several agents' actions, and coordinates them in such a way that, normally, the coordination would facilitate the occurrence of the represented outcome.

Beyond this parallel there is much divergence on what shared intention is. Some hold that it differs from ordinary intention with respect to the attitude involved (Searle 1990). Others have explored the notion that it differs from ordinary intention with respect to its subject, which is plural (Gilbert 1992; Helm 2008), or that it differs from ordinary intention in the way it arises, namely through team reasoning (Gold & Sugden 2007), or that it involves distinctive obligations or commitments to others (Gilbert 1992; Roth 2004). Opposing all such views, Bratman (1992, 2009) argues that shared intention can be realised by multiple ordinary individual intentions and other attitudes whose contents interlock in a distinctive way.

We can distinguish strong and weak claims linking shared agency to shared intention. The weak claim is that shared intention will enable us to understand *some forms* of shared agency. This claim is neutral on whether there might be joint actions without shared intention, and on whether ingredients other than shared intention might be needed in giving a full account of shared agency. The strong claim is that an account of shared intention gives us the whole story about shared agency, so that no other ingredients are needed. Given this claim, for an event to be a joint action is for it to be appropriately related to a shared intention.

Some philosophers and psychologists have endorses the strong claim. For instance:

> 'I take a collective action to involve a collective intention.' (Gilbert 2006, p. 5)
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> ****This quote is not clearly endorsing the strong claim (and we don't want to deny that all shared agency will involve shared intention (cf not arguing that there are individual actions which involve intention in paper-1).)*

Further examples could be given (Carpenter 2009, p. 381; Call 2009, p. 369; Kutz 2000; Rakoczy 2006, p. 117; Tollefsen 2005). In what follows we remain neutral on the weak claim but argue against the strong claim. We argue against the strong claim on the grounds that shared agency is sometimes not only a matter of shared intention but may also involves structures of interlocking motor representations. This may have consequences for some of

the metaphysical, normative and phenomenological questions about shared agency mentioned above.

4. The parallel with ordinary intentions

Why might anyone endorse the strong claim that for an event to be a joint action is for it to be appropriately related to a shared intention? Those who endorse it rarely or never provide arguments. However, two considerations might appear favour this view.

First, if someone thought that it is possible to distinguish systematically between the contrast cases by appeal to shared intention (and perhaps only by appeal to shared intention), this could motivate holding that for an event to be a joint action is for it to be appropriately related to a shared intention. We shall argue, however, that distinguishing systematically between the contrast cases cannot be done entirely in terms of shared intention. [*HY: this argument is missing from this draft.]

A second consideration in favour of this view is a possible parallel between joint action and ordinary, individual action. If you think that events are actions in virtue of being appropriately related to intentions, and if you think that shared intention stands to joint action as plain vanilla intention stands to ordinary, individual action, then it seems reasonable to suppose that for an event to be a joint action is for it to be appropriately related to a shared intention (Pacherie 2012 offers this argument).

Concerning this second consideration, we take for granted that the parallel obtains but we do not accept the view about ordinary, individual action. Not everyone accepts that for an event to be an action is for it to be appropriately related to an intention. Some philosophers allow that there could be agents whose actions are purposive—and, in some cases, even intentional—although the agents have no intentions at all. For instance, Michael Bratman describes a creature who 'acts on the basis of its beliefs and considered desires' only (not intentions) as doing things 'intentionally' Bratman (2000, p. 251). Others reject the standard view without asserting there can be action without intention. Instead they claim that ingredients other than intention are needed to say which events are actions. In particular, some claim that motor representation and intention are both needed in explaining which events are ordinary, individual actions (Pacherie 2000; Butterfill & Sinigaglia 2012). If any such view is correct, it is impossible to fully explain what it is for an event to be an action by appeal to intention alone. So depending on your views about ordinary, individual intention, the second consideration—the idea that the relation of shared intention to joint action is in some ways parallel to the relation between ordinary, individual intention and plain vanilla action—might actually support the view we aim to estab-

lish, namely that fully explaining shared agency requires appeal to structures of motor representation and not only to shared intention.

5. Motor representation

Since we aim to argue that a fully adequate account of shared agency must appeal to motor representation, it may be helpful first to provide some background about motor representation.

A *motor* representation is the sort of representation that enables us to reach for, grasp and transfer objects in a coordinated and fluid way. We follow several psychologists and philosophers in supposing that motor representations feature in planning and monitoring action (e.g. Wolpert et al. 1995; Miall & Wolpert 1996).

Motor representations are in some ways similar to intentions, as some have recently argued (Pacherie 2008, pp. 189-90; Butterfill & Sinigaglia 2012). First, like intentions, some motor representations represent outcomes and not merely kinematic features of action. Like intentions, some motor representations play a role in coordinating multiple component activities by virtue of their role as elements in hierarchically structured plans. And, like intentions, some motor representations coordinate these activities in a way that would normally facilitate the outcome's occurrence.

One major dissimilarity between intentions and motor representations is that motor representations lead a kind of double life. For motor representations are involved not only in producing actions but also in observing actions. Indeed there seem to be some striking similarities between the sorts of processes and representations usually involved in performing a particular action and those which typically occur when observing someone else perform that action (Rizzolatti & Sinigaglia 2010, 2008).[2]

[*HY: I'm still thinking about how best to introduce motor representation: any pointers?]

So much for the bare notion of motor representation. Why suppose that motor representation might be needed to explain shared agency?

6. Interpersonal coordination and motor representation

These bits of evidence are relevant (***):

[2] If motor representations occur in action observation, then observing actions might sometimes facilitate performing compatible actions and interfere with performing incompatible actions. Both effects do indeed occur, as several studies have shown (Brass et al. 2000; Craighero et al. 2002; Kilner et al. 2003; Costantini et al. 2012).

1. Kourtis et al. (2012) shows that motor planning can occur for others' actions when we are engaged in joint action with them.

2. Vesper's ESPP paper (on jumping together and imagining jumping together — jumping is published (?), imagining jumping is about to be submitted (as of August 2012). This shows that individuals are capable of running motor simulations of multiple roughly simultaneous actions. (The important point for me is that one can simulate roughly simultaneous actions, not that the simulations are simultaneous.)

3. The GROOP effect shows that there are representations which specify each agent's task in relation to the other (so they are not simple representing the outcomes to which each of their actions are directed; they are representing an outcome to which their actions taken together are directed.)

4. Vesper says forthcoming EEG paper using piano playing paradigm on agent-neutral identification of error: one brain wave signals whether there is an error, and a different brain wave signals whose error it is (also tells you whether the overall harmonics are affected)

7. Social motor representation

We start from an empirical premise which is about enabling conditions for shared agency only: some joint actions are facilitated by reciprocal, agent-neutral motor representations of outcomes whose obtaining would normally involve action on the part of each agent.

This needs unpacking. As already mentioned, a *motor* representation is the sort of representation that enables us to reach for, grasp and transfer objects in a coordinated and fluid way. To repeat, motor representations are not concerned with merely kinematic or dynamic features of actions only. Rather, some motor representations represent outcomes, such as the movement of a target object from one place to another.

A representation (motor or not) is *agent-neutral* if its content does not specify any particular agent or agents.[3] To illustrate, agent neutral representations are sometimes found at the early stages of planning. Imagine that you and some friends are tasked with preparing a holiday. You might first write down a plan of action without specifying who will act; the plan simply describes what is to be done. The plan will eventually be implemented by you and your friends but this is not written in plan itself and so it is agent-neutral. Of course the fact that this plan is your collective plan may be represented

[3] Our use of the term 'agent-netural' to describe motor representations bears no relation to the use of the same term to describe reasons (on the latter, see Parfit 1984).

elsewhere; this fact may also be implicit in the plan's being stapled to the door of your communal kitchen. The agent-neutrality of a representation does not require that the agents are nowhere specified, only that they are not specified in the content of the representation.[4]

Two or more agents have *reciprocal* motor representations just if there is a single outcome and each agent has a motor representation of that outcome. It is hardly controversial that reciprocal motor representations exist, for their existence is suggested by by a large body of research on motor cognition in action observation. [***Rest of this paragraph belongs in the evidence section? Should be clearer about transition: (a) I am observing and we reciprocally represent an outcome of your action (mirroring). (b) We are interacting and reciprocally represent an outcome of your action (mirroring in joint action). (c) We are interacting and reciprocally represent an outcome to which our actions are distributively directed.] It is more controversial that reciprocal motor representation occurs in joint action, but there is some evidence for this claim too.[5]

We want to go a tiny step further and suggest that in joint action there are sometimes reciprocal, agent-neutral representations of outcomes whose obtaining would normally involve action on the part of each of the agents. So when we act together, some of my motor representations may concern outcomes that are partly but not entirely to be realised by my actions (and likewise for you). For example, suppose our task is to move an object from A to B, where you pick it up and pass it to me so that I can then place it. In this case I may represent the movement of the object from A to B and not only the component movements. I represent a collective outcome of our actions and not just outcomes to which each of our actions are individually directed.

We shall use the term *social* motor representation as an abbreviation for the reciprocal, agent-neutral motor representation of outcomes whose obtaining would normally require action on the part of each reciprocating agent. (This is probably a bad term to pick; we are still trying to come up with a better one. Certainly we cannot assume in advance of argument that such reciprocal, agent-neutral motor representations are social in any interesting sense; for now we are using the term 'social' in a non-standard way

[4] Strictly the following argument does not hinge on the agent-neutrality of representations. It is sufficient for our purposes that there are reciprocal motor representations of outcomes whose obtaining would normally involve action on the part of each of the reciprocating agents. In principle such representations could have contents which specify other agents or multiple agents. We focus on agent-neutral representations to show that our view is consistent with the possibility that reciprocal motor representations are agent-neutral.

[5] See Kourtis et al. (2012): 'the partner's expected action is simulated at the motor level, which probably facilitates effective performance of the joint action.' Kourtis et al. (2010) show that reciprocal motor representation is more likely to occur in joint action than is mere observation. See also Knoblich & Jordan (2003).

as an abbreviation, one that reflects our aim.)

What follows is speculative philosophy: we take for granted that social motor representation sometimes facilitates joint action and ask whether this conjecture bears on our question about shared agency. As a first step, we shall ask how social motor representation might facilitate joint action. Note that answering this question does not directly commit us to any view about shared agency. After all, social motor representation might be an enabling condition for some instances of shared agency but completely unnecessary for explaining what shared agency is.

[*HY: I'm planning a short section on evidence for social motor representation. But as I'm going beyond the evidence anyway, I don't plan to include it in presenting this paper to philosophers.]

8. How could social motor representation coordinate actions?

Suppose that social motor representation is sometimes present when two or more agents act together. It doesn't follow, of course, that social motor representation will play any role in coordinating the agents' actions. But let us consider just the possibility that it might. How could this happen? How could social motor representation play a role in coordinating action when two or more agents act together?

To answer this question let us step back from motor representation to illustrate a general principle about planning. Suppose that Aravinda runs the trains and Gerhard runs the busses. Twice a year, on the equinoxes, Aravinda updates the train timetables and sends Gerhard the changes. For his part Gerhard also updates the bus timetables twice a year, on the solstices, and sends Aravinda the changes. Each wants their services to be optimally coordinated with the other's services in the sense of minimising passengers' journey times (perhaps only in order to maximise profits). So how successful Gerhard's plans are depends on Aravinda's plans, and conversely. This is why each is responsive to the other's plans; indeed, each may even try to predict changes in the other's plans. But from each individual's point of view, the other's plans are merely a constraint. This approach to planning suffers from two defects. First, it is unlikely to be optimal in the sense of resulting, eventually, in a combination of plans such that no other combination of plans would have been better for at least one service and no worse for either service. Second, it is unlikely to be efficient in the sense of allowing Gerhard and Aravinda to arrive at an optimal combination of plans for the two services, trains and buses, with the fewest iterations. How could they do better? One possibility may be to have a single plan covering busses and trains—perhaps for example Aravinda could buy Gerhard's franchise. But

suppose that this is not possible, and that there are limits on how much information Aravinda and Gerhard can share. Now there is a single goal to which Aravinda and Gerhard's activities are both directed.

To answer this question let us take a step back and consider an individual action. Suppose an agent moves a mug from one place to another, passing it from her left hand to her right hand half way. It is a familiar idea that motor planning, like planning generally, involves starting with relatively abstract representations of outcomes and gradually filling in details. We can capture this by supposing that motor representations for planning and monitoring action involve a hierarchical structure of representations. At the top we might find a relatively abstract representation of an outcome, in this case of the movement of the object from one location to another. Action-relevant details are progressively filled in by representations at lower stages of the hierarchy. Now in the action we are considering there is a need, even for the single agent, to coordinate the exchange between her two hands. How is this achieved? We suppose that part of the answer involves the fact that planning for the movements of each hand is not done entirely independently. Rather there is a plan for the whole action and plans for the movements of each hand are components of this larger plan. It is in part because they are parts of a larger plan that the plan for one hand constrains and is constrained by the plan for the other hand.

How is this relevant to the case of joint action? In joint action the agents have the same goal, to move the object from one place to another. They also face a similar coordination problem, requiring a precisely timed swap from one hand to another. Now suppose, that the same planning is involved in the individual case (where one agent performs the whole action) and in the joint action case (where the action is distributed between two agents). The planning is the same almost up to the actual muscle contractions.

How could this be helpful? Suppose the agents' planning processes are similar enough that, for a given context and problem, they will produce approximately the same plans. Then having each agent plan the whole joint action means that (i) each agent plans the other agent's action, (ii) each agent's plan for the other agent's action is approximately the same as that agent's plan for her own action, and (iii) each agent's plans for their own action are constrained by the plans for the other agent's action.

[***TODO: (a) contrast this case with a team of experts, each with different motor expertise (e.g. musicians playing together). They can't plan each others' actions. (b) Discuss in how much detail each others' actions should be planned so as to enable coordination.]

So what enables the two agents' plans to mesh is not that they represent each other's plans but more simply that they plan each other's actions as well as their own actions as if they were each about to do the whole thing themselves.

Each agent is planning (and monitoring) both their actions almost as if a single agent were going to execute the whole action. And of course this is exactly what we want for small-scale joint action—we want two or more agents to act as one. This may be why the performance of dyads in joint actions often resembles the performance of individuals tasked with performing the whole action alone (Knoblich & Jordan 2003).

So what is the difference between the individual and the joint case? From the point of view of motor representation, the primary difference may be that in joint action there is a need to prevent execution of the parts of the action which are not one's own.

9. Grounding the purposiveness of joint action

So far we have only been considering a possible role for social motor representation in enabling joint action. How does any of this bear on our main question about shared agency? The details of how social motor representation enables joint action already give us grounds for holding that motor representation has a role to play in explaining shared agency.

Here are two basic question about joint action are. What singles out the outcome or outcomes to which a purposive joint action is directed? And what binds together the various activities (of several agents) that make up the joint action?

If we appeal to a notion of shared intention, we can answer these questions about joint action. A shared intention is what relates purposive joint actions to the outcomes to which they are directed. For the shared intention involves a representation, on the part of each agent, of an outcome, coordinates the several agents' activities and coordinates the several agents' activities in such a way that would normally facilitate the occurrence of the represented outcome. This is how a shared intention can bind together the activities comprising a joint action and link them to an outcome.

Our earlier discussion of how social motor representation might enable joint action already shows that social motor representation resembles shared intention in this respect. Return to the example of two agents moving an object in a way that involves passing it between them. Suppose that their passing involves a social motor representation of the outcome, which is the movement of the object. Then there are motor representations, one for each agent, of an outcome to which the joint action is directed. And these representations coordinate the several agents' activities, and do so in ways that would normally facilitate the occurrence of the outcome represented.[6] So social motor representation can bind together the activities comprising a joint

[6] This implies that social motor representation and the associated processes underwrite what Butterfill (submitted) calls *collective goals*.

action and link them to an outcome in much the way that shared intention can.

What we are suggesting is very simple. Given the correctness of a standard view about shared intention in joint action, and given that in ordinary, individual action, motor representations bind together activities and link them to outcomes, it is plausible that in joint action, several agents' activities can be bound together and linked to an outcome by social motor representation. That is, the purposiveness of a joint action can be grounded not only in shared intention, but also in social motor representation. This is why we suppose that an account of shared agency must appeal not only to shared intention but also to social motor representation.

10. How social motor representation resembles shared intention

It may be helpful to compare and contrast the notion of social motor representation with a notion of shared intention. We shall use Bratman's account of shared intention as it is the best developed. Here are Bratman's collectively sufficient[7] conditions for you and I to have a shared intention that we J:

> '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, p. View 4)

Let us take each of these three conditions in turn.

To see a parallel with the first condition, (1), recall two (empirical) claims on which the notion of social motor representation is based. First, some motor representations represent outcomes. Second, some motor representations represent the outcomes of actions not all of whose components will be executed by the agent whose motor representation it is. Given these claims, there is a direct parallel with Bratman's first condition, (1). Where some agents have either a shared intention or a social motor representation, there is an outcome to which their actions are directed and each agent represents this outcome. Of course there is also a difference: In the case of social motor

[7] In Bratman (1992), the following were offered as jointly sufficient *and individually necessary* conditions; the retreat to sufficient conditions occurs in Bratman (1997, pp. 143-4) where he notes that 'for all that I have said, shared intention might be multiply realizable.'

representation, the outcome is represented motorically and need not feature in the content of any intention.[8]

Concerning the second condition, (2), there is clearly no direct parallel. Whereas one intention can be about another intention, we assume that one motor representation cannot be about another motor representation. But there is a parallel of sorts. A function of the second condition, (2), is to ensure meshing of subplans. Each agent's having a motor representation of the outcome to which all their actions are together directed does ensure meshing of subplans. What ensures this meshing is not the fact that each agent represents the other's plans as the other's plans. Rather what ensures meshing of subplans is this: Each agent plans all of the agents' actions, and the agents rely on planning strategies that are sufficiently similar to ensure meshing subplans.

The third condition, (3), concerns common knowledge. Why is this condition needed? Bratman himself says little.[9] One possible justification for supposing that shared intention involves common knowledge concerns a normative link between intention and reasons. In acting on an intention, there should be reasons for which the agent acts. And, arguably, a consideration can only be among the reasons for which an agent acts if she knows that consideration (or at least is in a position to know it). So the need for common knowledge may arise from the need to explain how reasons for which an agent acts could include facts about others' intentions. This need does not arise in the case of social motor representation (at least not in the same way). For, arguably, where actions involve motor representations, it is not true that there should be reasons for which the agent acts. (Of course there are reasons which explain why motor actions happen; but these need not be reasons for which agents act.) So motor joint action does not require that one agent's motor representations provide reasons for which another agent acts. Instead, what is required is this. There should be a good chance—good relative to the potential costs and benefits of attempting this particular joint action now—that social motor representation will provide the necessary coordination. Of course this could be guaranteed by common knowledge. But common knowledge is not required. Alternatively it can be ensured by common planning processes and a common background of dispositions, habits and expectations.[10]

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[8] Here and below were are assuming that no motor representations are intentions. If this assumption is wrong (as Pacherie 2008 suggests), social motor representation may be even more closely related to shared intention that we suggest here.

[9] See Bratman (1993, p. 117): 'it seems reasonable to suppose that in shared intention the fact that each has the relevant attitudes is itself out in the open, is public.' In other words, common knowledge is needed because it is.

[10] Another possible line of justification the claim that common knowledge is involved in shared intention might start from a generalisation of Davidson's claim that '[a]ction does

If, as we have just argued, social motor representations play a role analogous to the structure of intentions and knowledge which Bratman identifies as sufficient for shared intention, then this is a (non-decisive) reason to think that motor representation is also needed in characterising shared agency.

11. Are social motor representations shared intentions?

We have been arguing that an account of shared agency cannot appeal to shared intention only but must also appeal to social motor representation (and perhaps to other ingredients besides). Our argument rests on the premise that social motor representations are not shared intentions. But since we have just bee pointing to broad similarities between shared intention and social motor representation in that both play a role in coordinating agents' actions by virtue of representing outcomes, it may be tempting to suppose that some social motor representations are shared intentions.

This issue might easily seem narrowly conceptual or terminological. At the end of the day it doesn't much matter if we want to call some motor representations 'shared intentions'. After all, as already noted, on some accounts shared intentions are neither shared nor intentions so we would hardly be doing more violence to the term than is already being done.

However exactly one decides to use the term 'shared intention', at least three substantive issues remain. The first concerns conceptual demands. Whereas having a shared intention arguably demands an ability to represent others' intentions (pp. * Butterfill 2012), social motor representation imposes no such demands. The second concerns planning. Whereas shared intentions are elements in long-term plans and function in part to enable agents to coordinate their plans, social motor representation is incapable of playing this role. A third, and related substantive issue is that social motor representations are structures of representations with a non-propositional format and so cannot be inferentially integrated with ordinary intentions and knowledge (pp. * Butterfill & Sinigaglia 2012), whereas shared intentions can.

While prefer (for narrowly terminological reasons) to state our claim by saying that explaining shared agency requires ingredients other than shared intention, the claim could alternatively be formulated by saying that explaining shared agency requires importantly different (in the ways described) varieties of shared intention.

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require … that what the agent does is known to him under some description' (Davidson 1971, p. 50).

12. Conclusion

We have been considering how to provide an account of shared agency that might contribute to investigating a tangle philosophical and scientific questions.

Whereas some have claimed that shared agency can be fully explained in terms of a notion of shared intention, we have argued that some events are joint actions by virtue of being appropriately related to a structure of motor representations we call social motor representation. We don't mean to suggest that all joint actions involve social motor representation. The view we are aiming to establish is rather this: Some events are joint actions in virtue of being appropriately related to social motor representations which bind their components together and ensure that there is a single outcome to which these components are collectively directed. This is why understanding shared agency requires understanding not only shared intention but also the coordinating role of social motor representation.

None of this is to deny that shared intention is among the ingredients needed to characterise shared agency. Indeed, it may be that the notion of social motor representation has a role to play in explaining what shared intention is. In constructing realisers of shared intention from ordinary individual intention, we need intentions *that we* J. As has been much discussed (e.g. Petersson 2007), the contents of these intentions cannot all refer to actions involving shared intentions. For this reason Michael Bratman suggests that things we intend are cooperatively neutral activities. It is then necessary to add further intentions in order to transform cooperatively neutral activities into joint actions. But it also seems possible that in some cases, what we intend when we intend that we J is not a cooperatively neutral activity but instead a joint action of the sort which involves social motor representation.

So perhaps harmony between shared intention and social motor representation is sometimes achieved in this way: what we intend when we share an intention is the sort of joint action that involves social motor representation.

In conclusion, two things. First, some events are joint actions in virtue of being appropriately related to social motor representations which bind their components together and ensure that there is a single outcome to which these components are collectively directed. Second, and much more tentatively, in some cases social motor representation may be among the ingredients that realise a shared intention.

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