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Joint Motor Action and Cross-Creature Embodiment

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Abstract The question of what is shared in joint action has been discussed mainly with reference to the notion of collective intentionality. The problem of how to account for intentional states that are shared between two or more jointly engaged creatures is particularly relevant for actions that involve distal intentions. Yet there is another important kind of joint action, which so far has received less interest, at least by philosophers. This kind of action can be described in terms of a shared motor engagement of two or more creatures with their surroundings. In this paper, I address the question of what is shared in such motor engagements. I suggest that joint motor actions come off through sharing particular kinds of feelings. In order to flesh out what it means to share feelings, I introduce the notion of 'cross-creature embodiment'—the idea that a certain type of embodied mental event is constitutively tied to the body state of another, perceptually present creature in broadly the same way in which it is tied to the experiencing creature's own. I end by suggesting that this notion makes available a new, albeit tentative, interpretation of recent neuroscientific evidence.

1 Introduction

The past two decades have seen a vigorous debate of the idea that actions can be performed jointly. Examples of such actions often found in the literature include going for a walk together (Gilbert 1996), making a sauce hollandaise (Searle 1990), and painting a house with someone else (Bratman 1992). The debate about joint action, and in particular its philosophical dimension, has mainly been conducted in terms of the notion of collective intentionality. One reason for this is that causal theories of action, according to which actions are to be thought of in terms of intentions that stand in a causal relation to the deed itself, are the default position in the philosophy of mind. Along those lines, a convincing account of collective

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intentionality is a necessary prerequisite for a viable theory of collective action. The debate has thus focused mainly on actions whose collectivity resides in the sharing of an intentional state, typically an intention. How one is to conceive of the sharing of an intention remains a controversial issue that is relevant particularly for questions about collective action explanation and collective responsibility (see Tollefsen 2004 for a good summary). Call this the normative aspect of the debate.

There is, however, another quite different interest in joint action, which arises for psychologists and social neuroscientists as well as for philosophers of mind. This dimension of the debate is concerned with the embodied aspect of joint events—the question of what secures the co-ordination of bodily movement (what one might call 'motor intentionality') in such undertakings. To engage with this question really is to engage with an epistemic issue that forms part of the problem of other minds (Avramides 2001); that is, the question of how the perception and joint integration of motor action is possible. The examples of joint actions best suited for the discussion of these epistemic concerns are quite distinct from those on which collective action theorists have traditionally focused. They will highlight the embodied, motor aspect of joint actions rather than their purely psychological, intentional component. Examples of such actions include partner dancing, or kicking along a football with someone while going for a walk, or even a phenomenon as basic as jointly attending to an object with another person. While there is some overlap between these two kinds of joint events (you can be partner dancing in the pursuit of your collective intention to win a competition), they do not always co-incide. There may be joint actions in which long-term intentions are shared but that do not involve physical co-operation; and there may be joint actions that do involve such co-operation but whose participants do not share any long-term intentions.

In this paper, I am going to focus on the question of what is shared in joint motor actions, and will hence be concerned with events of the second kind. A qualified discussion of this question is unlikely to be possible on purely conceptual grounds; empirical research by developmental psychologists and social neuroscientists will play a crucial role. I am going to begin by introducing the idea that the intentional component of motor actions can be elucidated by reference to particular kinds of perceptually presented feelings. In a second step, I will elaborate on a claim defended by a number of developmental psychologists, according to which shared feelings play a crucial role in explaining the possibility of joint attention, and will extend this claim to motor action more generally. I am then going to ask what it means to share feelings, and am going to make a conceptual argument for the idea that some feelings can be embodied across creatures. In the final step, I will argue that this view makes available a particular, albeit tentative, interpretation of recent neuroscientific evidence.

2 Part One: Motor Activity

2.1 Motor Embodiment

Motor actions, in the sense in which I will be employing the term, are kinds of intentional events whose psychological component is directly integrated into the

bodily movement. Reaching for a cup or rowing a boat are examples of this kind of action. Motor actions thus are necessarily what one may call 'embodied'. It is notoriously difficult to spell out what exactly this embodiment consists in (Gallagher 2005). You might start by saying that motor actions comprise both psychological and bodily properties. But this isn't quite sufficient for present purposes, as you can think of events which meet that description yet aren't embodied in the relevant sense—think of a deliberate action in which you decide, literally, to raise your arm, and this causes your arm to go up. In order for an event to qualify as a motor action, the bodily and mental components of the event are intertwined in a way that makes this kind of causal analysis impossible. If you are rowing a boat, you don't carry out a mental act (such as forming an intention) that causes a bodily movement. The mental and physical aspects are irreducibly interlinked. You couldn't adequately describe the activity of rowing in terms of a series of particular bodily movements that are somehow causally linked to intentional states. The intentionality of the event is really *in* the rowing (James 1890). That is why mastery of the practice of rowing requires you to be able to do more than just to know, in theory, how to move your body in the pursuit of the intention of getting the boat to the other shore. To become familiar with the practice of rowing, you have to integrate its psychological and bodily dimensions. And a key component of this practice is the ability to cope with the environmental challenges that arise in its course (Dreyfus 1985). If you are a skilled rower, your body will quite automatically adjust to the currents of the water and the impact of the waves against the boat. Motor activities in my sense thus are not to be thought of in isolation; in order to appropriately describe such an activity, you have to frame it in its environmental context. This context is temporally extended.

So there are three requirements that have to be met in order for an event to qualify as a motor action (or activity) in my sense. These include, first, the embodied nature of the event, where this means that a reductive (causal) analysis of the event's bodily and psychological components is impossible; secondly, its environmental situatedness, which means that an appropriate description of the event will have to take its context into consideration; and thirdly, its temporally extended character, which will often make the term 'activity' more suitable than 'action'.

Motor actions or activities are different from mere bodily reflexes in that they comprise a psychological element which qualifies, in some sense, as intentional. But some clarification is in order here also. The intentional component of motor actions isn't best described as an intention with the same structure as a distal intention geared towards reaching a long-term goal (Anscombe 1969; Pacherie 2006). To that extent the notion of an 'intention-in-action' is rather misleading. Intentions, along the lines of John Searle's (1983) classic analysis, have a 'world-to-mind' fit. That is, they mentally represent a non-existent state of affairs, and the intention's success condition is met if, by means of the action whose execution is caused by that intention, the world is manipulated so as to correspond to that representation. Motor intentions may not be best described along the lines of this model, however. For such a description commits you immediately to a representational view of motor intentionality, against which a number of important arguments can be raised. One consideration that is of particular importance with regard to the above characterization of motor activities is their environmental situatedness. I said that you could not

appropriately describe such an event without situating it in its environment. You could not make sense of the notion of 'coping', in particular—the particular spontaneous responsiveness to environmental challenges—if you did not take this feature of motor activities into account. In order to better understand why motor intentions ought not to be conceived in representational and causal terms, it will be necessary to consider the metaphysical commitments this position is based on. I am going to outline these commitments in the next section.

2.2 The Relational View of Perceptual Experience

The relational view takes it that experience is a relation between perceiving organism and perceived object. This position runs counter to the customary view of experience as a mental phenomenon that is caused by events in the brain, directed at the world from which one receives information via one's sensory organs, and represents aspects of that world. On the relational view, experience can't be a purely mental phenomenon, in the sense that mental content (however you want to spell out that notion) determines the character of the experience. I follow Campbell (2002) in thinking that the object of a perceptual experience features directly in the experience. There hence is a difference in kind between an experience of a tomato in your visual field, and (say) a hallucination of a tomato, and the difference is precisely that in the actual experience, but not in the hallucination, the experience is to be thought of as a relation between you and the thing. This is why a relational account denies, on the level of experience at least, the viability of a representational approach to perception. Such an approach is committed to the idea that there is no difference in kind between an experience of an actual object and an experience that is based on a hallucination. But once you accept this idea, it becomes very hard to say how reference to the actual object is possible. While the relational account is certainly not unproblematic (see Hill (2009) for a recent critical evaluation), I think this consideration decisive: no representational theory will be able to explain, ultimately, what connects us, in experience, thought, and reference, to the world that surrounds us.

You may think that an externalist conception of reference can solve this problem while still remaining committed to a representational theory of mind. Social Externalism, as defended perhaps most famously by Hilary Putnam (1973), is the idea that reference is ultimately determined by facts about the world and not facts about the speaker. On Twin Earth, the term 'water' refers to XYZ even if the transplanted earthling has H2O in mind. Meanings, in Putnam's famous slogan, 'just ain't in the head'. Reality, and not mental content, fixes reference. You may think that this move secures our connection with the external world. And you may also think it compatible with a representational account of mind if you take it that the contents of experience are determined by what is 'in the head'. The price the social externalist pays for this reconciliation of the content-determining role of the external world with a representational account of mind is that mental content and reference can come apart. You can think of water as H2O while really, when visiting Twin Earth, referring to XYZ.

The defender of the relational will reject this proposal because it cannot accommodate the idea that perceptual experience plays a key role in determining reference. You cannot, on a relational view, afford to pay the externalist price

because you could then not maintain that what acquaints us with the world, and what allows us to correctly use referential terms, is perceptual experience. The question that arises for the relational view is how we are to think of the object of experience —aspects of the world that, in experience, we are directly acquainted with. The relational view embraces a kind of 'naïve realism', which you may characterise as the idea that reality, to use John Searle's (1995) terminology, is 'ontologically independent'. The world must be so independent, on the relational view, because bits of it could not otherwise directly feature in a creature's perceptual experience. But it can't be that experience, and hence reference, are simply determined by what there is independently. For if this were the case, experience could not be thought of as a two-place *relation* between experiencing creature and perceptual object. If experience is to be conceived in those terms, it has to be the case that the character of the experience is determined jointly by facts about the perceiver and facts about the perceptual environment: change relevant such facts and the qualitative character of the experience changes. So the defender of the relational view, or at least of my version of it, has to explain how it can be that reference to aspects of an ontologically independent reality is fixed by perceptual experience, while that experience is jointly determined by facts about the experiencing creature and facts about the object of experience.

I think that answering this question requires deep revisions of Western philosophy's standard view of the nature of perceptual experience. On the standard view, perceptual experience is directed at an outer world: that is the core idea of the notion of intentionality which goes back to Brentano and which is pervasive in both analytic and phenomenological accounts of mind. The intentionalist thesis entails a commitment to a metaphysical divide between the 'inner' mental life of the experiencing creature and the 'outer' world at which this experience is directed. The social externalist thesis falls squarely within this paradigm: to say that the content of experience is determined by the external world is to accept the metaphysical divide between inner mental life and outer world. But if you take seriously the idea that experience is a relation between creature and world, you are forced to reject this divide between inner and outer. Only thus is it possible to say that world and creature jointly determine experience. The question is how, on this account, experience is to be conceived: if experience is a relation between mind and world, if it acquaints us with what there is, and if this acquaintance makes reference possible—then what is it we are acquainted with?

To make progress here, it will be helpful to consider again the conception of motor intentionality I outlined in the previous section. I said that the capacity of conscious creatures to cope with challenges imposed on them in their everyday dealings with their environment ought to be thought of in embodied, situated, and dynamic terms. On this account, a creature's behaviour, when engaged in motor acts, is not best causally explained, however fine grained. It isn't that the creature enjoys a mental state (perhaps an intention of some kind) that is causally related to its doings. Rather, the purposive character of the creature's activities is shaped by, and in turn shapes, its relation to the environment. And this dynamic relation between creature and environment starts as soon as there is perceptual experience, even if you aren't doing anything in the traditional sense (according to which bodily movement is required for you to be engaged in an activity). Consider a very ordinary scenario:

you see the table in front of you, a stack of papers on its left, an open book on its right, a few pens in a jar. You hear the sash window rattling in the wind. You smell the coffee that is brewing in the kitchen, and your hands touch the well-worn wooden surface of your chair's armrest. You just sit there: you are not moving about, you are tranquilly perceiving the scene. Nevertheless, you are actively engaging with your environment. You attend to some bits of the perceived scene and not to others; you look at the stack of papers or the open book and not at the bit of empty table surface in between. You listen to the rattle of the window and not the faint murmur of voices from the terrace next door. You focus, you zoom in and out, you *select*: and by doing so, you change and modify the experience. It has long been thought that there is a foundational connection between attention and agency (e.g. Allport 1980); more recently, Jesse Prinz (2011) has argued that attention is necessary and sufficient for consciousness. If you take seriously both thoughts (and ignore, for present purposes, the crucial question of what is required to make them compatible), you may suppose that perceptual experience, as a particular kind of conscious state, is contingent on the capacity to interact with your perceptual surroundings. Perception *is* a kind of activity (see also Noe (2005) and Gallagher (2008) for different versions of this view). On such a view, there can be no consciousness without attention; and thus there can be no perceptual experience without activity of some kind.

It is but a short step from this dynamic, interactive conception of perceptual experience to the notion of motor action. I said that motor actions were best conceived as a kind of coping with environmental challenges; as a relation to an ever-changing environment that requires you to constantly adapt to, and shape, your surroundings (see Erik Rietveld (2008) for an elaboration of this idea). On this picture, there isn't a categorical distinction between the kinds of engagement that characterize perceptual experience and motor activity. In fact, you may think of attention, of focusing on particular aspects of your perceptual surroundings, of your selection of some bits of information over others, as the simplest kind of motor activity. Even when you are sitting perfectly still, just taking in the perceptual environment, you are nevertheless, on the view I am advocating, doing things. As a conscious creature, you couldn't do otherwise. But most perceptual experience isn't like that; typically you physically interact with your surroundings; you squint, you move closer, you reach, you point, you touch. You are doing so in order to shape your perceptual experience to your advantage; and that is to say, you are adjusting to your environment so as to cope with the challenges it imposes on you. Perceptual experience, as attention to aspects of your surroundings, and motor engagement are really inextricably intertwined.

On this approach, a creature's engagement with its surroundings, in perception and action, ought not to be thought of in the disembodied terms of an 'intention-in-action'. If you subscribe to the idea that such intentions can be conceived as distinct psychological states that stand in a causal relation to the creature's doings, you are committed to the idea that the intention and the deed can be individuated separately. That is to say, the intention cannot feature in the individuating description of the deed, and vice versa. But this suggestion is not sustainable on a view which thinks of perceptual attention as the most basic kind of activity. If there is no perceptual experience without attention, and if attention is an activity, then there can't be an ontological distinction between experience and attentional activity. And

the reason is that you cannot individuate the experience without invoking the creature's doings: zooming in, selecting, highlighting. To deliver a definite description of perceptual experience will require you to say something about not only what objects in your visual field you are highlighting, or what bit of sound in your surroundings you are focusing on; you will also have to say something about what you are doing. For your experience is shaped not just by the objects in your perceptual field but also the stance you take towards them. It would be a mistake to think of the experience as the result of having taken such a stance; your stance, your doings are part of the experience itself. It follows that you cannot, on the account promoted here, conceive of motor intentionality as causally related to your doings. Your mental life really is in the activity, and the correct conception of your perceptual surroundings is of a world *of which you are part.*

This consideration makes available an answer to the question of how it can be that experience determines reference while being itself determined by facts both about the experiencing creature and its perceptual environment. Perceptual experience, on the present account, is of an independent reality—so much is entailed by the idea that the object features directly in the experience. But the experience isn't *about* objects in a classic intentionalist sense. When you see the scene that surrounds you—the ripples in the water, the increasingly distant shore, the wet planks of the boat, the bright sun above—you enjoy an experience, if it is perceptual and not hallucinatory, that is informed by what there is. But it is also informed by you. It is shaped by, and constantly changes in accordance with, your interactions with your surroundings. This is a consequence of the thought that your experience is determined jointly by facts about you and facts about your perceptual surroundings. And it follows that how you individuate aspects of your experience, in perception and thought about the experience, is subject to biological and cultural facts about you as much as it is subject to facts about the world. That you see ripples and planks and sunshine, and that you are able to refer to these things as such, is due to your being an occupant of a particular position in time and space, member of a specific biological species and cultural and linguistic community. That there is something which can be individuated in those terms is due to the world, but how you carve it up is up to you. So reference is secured both by facts about the world and by facts about you. For it is both kinds of facts that jointly generate experience, and it is experience that determines reference.

2.3 Perceptual Experience and Simple Feelings

Along this line of thought, there is a subjective element to all perceptual experience. 'Subjective' here means, somewhat unusually, that the experience is informed by facts about the subject of experience. There is no perceptual experience which would not be subjective in this sense. Since experience consists in a particular relation between object and perceiver, both play a foundational role in the constitution of the experience. Change relevant facts about one of them and the relation changes. This consideration has immediate consequences for thinking about perceptual experience. To adequately characterise the qualitative character of experience, it won't suffice to think about those aspects of the experience that are determined by, say, the object's size, shape, and spatial position vis-à-vis the perceiver. An adequate characterization

of the experience will also have to include relevant facts about the creature. Some such facts, such as the creature's sense organs, are biological; some have to do with its linguistic and cultural environment (where applicable); some, such as the creature's past experiences and mental disposition, are psychological. Such facts play a role, on the relational account, in determining perceptual experience. This role is not unified. A fly's eyes present the world differently than a human's to the perceiver, and seeing a spider on the ceiling will be a different experience for a sufferer from arachnophobia than for an entomologist. Both of these differences are subjective in my sense; but only the latter is what one may call affective. It is these affective aspects of perceptual experience that I have in mind. Elsewhere I have called them 'simple feelings' (Seemann 2008, 2010). These feelings are part and parcel of perceptual experience; they are constitutive elements of it. You could not, on my account, enjoy a perceptual experience without them, just as you couldn't enjoy a visual experience that didn't feature colours (or at least shades) of any kind.

What more can one say about these simple feelings? In earlier papers, I mentioned 'tastiness' or 'disgust' or 'pain' as examples. Perhaps this was not an altogether fortuitous move, since it suggests a conception of perceptual experience as a composite of object-dependent characteristics and their subject-dependent counterparts. Yet perceptual experience is not correctly thought of as such a composite. You cannot, on my account, reductively analyse experience in this way. Simple feelings may thus be better described, as a reviewer of the present paper suggested, as a 'general affective dimension' of perceptual experience.

If my account is correct and perceptual experience is interactive, in the sense that it requires the perceiving creature to engage in various kinds of (motor) activities, then there has to be some aspect of the experience that explains the way in which the creature interacts with its surroundings. That you see ripples in the water and stacks of paper on your desk is due to both facts about the environment and facts about you, and so is your focus on the papers and your balancing of the boat in response to the waves. The idea is that simple feelings both form an irreducible aspect of perceptual experience and can be invoked to explain the creature's perceptual motor behaviour. You may think that the reason why you focus on the towering stack of papers is your interest in whether it will topple over, or that the reason why you freeze when seeing a spider is your mortal fear of the animal; and when you explain your doings in this way, you rely on simple feelings. Since these feelings are part of the experience, you individuate a particular aspect of it for explanatory purposes. It is, however, crucial that this individuation be not understood as a reduction of the experience to basic building blocks; the relational account denies that perceptual experience can be analysed in this way. The simple feelings you invoke are, if your explanation is correct, based on the experience, and they are apt as an answer to the question before you. But you might have adequately explained your doings in a number of other ways, such as, perhaps, your worry that the order of your papers will be upset, or the remembrance of an early experience of being bitten by a spider. Depending on the question you are trying to answer, you might also have described your doings in different terms altogether (for an elaboration of this thought, see Seemann 2009). It's not a matter of anything goes, of course; some individuating descriptions of your doings are correct while others are not, and not all explanations

of them are adequate. But since there is a variety of satisfactory such descriptions and explanations, one ought to resist the temptation to think of simple feelings as readily individuated needs, interests, or other basic feelings such as pain or pleasure. They are just an affective dimension of experience which can be invoked in order to explain why you interact with your surroundings in particular ways, and which lends itself to a number of suitable descriptions.

3 Part Two: Joint Activities

3.1 Joint Attention and Joint Motor Action

On the view developed here, it will make sense to begin thinking about joint motor engagement by considering the notion of joint attention. Just as attention is the simplest kind of motor activity, so you may think of joint attention as the simplest kind of motor involvement of two creatures with some aspect of their perceptual surroundings. This consideration immediately puts my approach at odds with the traditional way to approach joint attention. Along the lines of Simon Baron-Cohen's (1995) classic view, to jointly attend to an object with another is to focus on the same object as the other creature and to be mutually aware of this fact. Although I think it is in fact true that something like this kind of awareness has to be in place for joint attention to be possible, it doesn't establish a sufficient condition for joint attention (Peacocke 2005; Seemann 2010). A more promising way of thinking about this phenomenon will not focus on joint perceptual episodes in these static terms. Typical, and relevant, scenarios surely build on an interaction of the involved creatures. Consider the kind of joint motor action at issue in the present paper: passing a football to and fro with another person, for example. In such an activity, the involved parties rarely, if ever, statically focus on one and the same object. They have the same general scene in view, and there are particular objects in that scene that command their particular attention (in the present case, the football). Yet in order to do a competent job they have to be highly alert to changes in the environment; they have to be open to changes in their perceptual fields, which will require them to constantly shift and adapt their focus. The perceptual jointness of the engagement, I have suggested elsewhere (Seemann 2011), is to be found not so much in some kind of mutual awareness but in the sensitivity to the other's movement and direction of gaze. It is this sensitivity, the influence the other's behaviour exerts over one's own, that is at the core of joint motor engagements. The closely related view that joint attention ought to be conceived as a process rather than a state is increasingly prominent (e.g. Hobson and Hobson (2011), Reddy (2011)).

3.2 Intersubjectivity and Sharing Feelings

The question then is how this sensitivity is to be accounted for: how it can be that creatures involved in joint motor activities are particularly attuned to the other's doings while not focusing on this other creature. My answer to this question draws on the key consideration of the first part of this paper: the idea that simple feelings

are at the heart of an organism's motor engagement with its surroundings, and thus that the affective aspect of perceptual experience plays an explanatory role with regard to that organism's behaviour.

One psychological concept that is of key importance for the idea that feelings play an important role in joint engagements is the notion of 'intersubjectivity', as first introduced by Colwyn Trevarthen (1980) and now defended by Vasu Reddy (2005, 2008) and Peter Hobson (2004, 2005). The basic idea is that infants are capable of an attunement with their caregivers' mental lives, and that this attunement is first evident in episodes of mutual attention. Hobson suggests that it is in early episodes of mutual attention that infants learn to share feelings with their caregivers, which (to use his expression) 'puts the 'jointness' into joint attention'. On Hobson's account, this adjustment of gaze is explained by the attunement of the involved persons' subjective lives—their intersubjective engagement with each other. What secures this attunement, so my suggestion—what makes possible the move from primary to secondary intersubjectivity, and on to joint action—is the sharing of feelings that are 'simple' in my sense. Taking together my general account of simple feelings and Hobson's idea that the sharing of feelings makes joint engagement possible, the idea is that joint motor activity is made possible by, and can be partly explained in terms of, the sharing of simple feelings, in the previously explained sense, that occurs in intersubjective perceptual episodes.

It is notoriously difficult to spell out quite what it means to 'share' feelings, or indeed any other state of mind. To suggest that each of the involved creatures enjoys the same type of experience is unconvincing, as nothing needs to be shared for this to be the case (you and I might both be in pain even though an ocean divides us). But to say that these creatures are enjoying one token experience doesn't make sense either, at least not on the account developed here, on which simple feelings are part and parcel of perceptual episodes: obviously the (in the standard case) visual aspect of the perceptual experience isn't the same for each of the involved creatures. To make progress here, it will be useful to consider the particular sensitivity displayed by mutually or jointly engaged creatures to each others' doings. Your smile will have an immediate psychological and bodily impact on me; your adjustment of gaze will make me look in that direction also. There are two ways to describe this kind of sensitivity. You may, on the one hand, describe it in causal terms: you may say that seeing you smile at me causes me to smile back, and seeing you look in a certain direction causes me to look the same way. In order to be able to describe things this way, I have to individuate the two involved events separately: your smile can cause mine only if your smile doesn't figure in the individuating description of mine. And there is, I think, a perfectly good sense in which this account of the event at issue is appropriate. It is appropriate if you start from a detached, third-person perspective: from the viewpoint of someone interested in the causes of a creature's behaviour.

However, there is also another way of describing what is going on. This second way takes seriously the phenomenal dimension of being engaged in an exchange of smiles with another. From this perspective, the presence of the other person plays a crucial role in the characterization of your activity: your smile features in the individuation of mine. I could not fully describe it without reference to yours. On this view, you couldn't really be enjoying the kind of experience at issue if you were by yourself. An episode of smiling with no-one else around (perhaps when you read

a funny passage in a book) would simply be an experience of a different kind. You may thus say that the other's doings play a constitutive role in the individuation of your embodied state of mind: you could not appropriately describe that state without reference to the other's doings.

On this second way of thinking about smiles and related embodied mental events, a smile, of the kind I have in mind, is an aspect of an interaction between two people. It can only really be understood in these terms: a smile is a signal for someone else, and often it is a response to another's such signal. It is embedded in a rich social and cultural context; it may be about some jointly observed event, or a commentary on such an event, or an accompaniment to eye contact, or an invitation to start a conversation. To individuate a smile as an independent embodied mental state, on this view, would deprive it of its meaning. On such a conception of what it is to smile with another,[1] the intersubjective character of this kind of event really becomes apparent: what smiles are, typically and most importantly, are instances of sharing bits of one's mental life with someone else. This conception starts from an engaged, embodied, experiential perspective, whereas the individuation of a smile as a particular kind of facial expression, which may stand in a causal relation to another's similar expression, subscribes to a detached, third person point of view.

The important thing to note is that these two descriptions of a smile are not, or at least not necessarily, at odds with one another. They are given from different viewpoints to serve different purposes, but they are still descriptions of one and the same event. Discussions of the relative merits of different descriptive perspectives on events that have both mental and bodily aspects often overlook that fact. A smile is a smile, whether I describe it in behavioural third-person or experiential first- or second-person terms. Since the purposes of these descriptions are distinct, they have different advantages and disadvantages, which are well-known from the long-standing discussion of conception of mind. This is perhaps easiest to see when considering a phenomenon that is not intrinsically social and thus does not raise the question of whether it ought to be individuated by reference to another's doings. Consider an episode of pain that is manifest in a person's behaviour. You touch the hot stove and it hurts, so you quickly remove your hand. You can describe this event either in experiential terms (of what it feels like), or in behavioural terms (an account of your bodily reaction). But it still is one event: an episode of bodily manifest pain. And each of these descriptions has its merits. The first allows you to understand the phenomenology of this instance of pain, which may put you in a position to explain certain facts about the subject of the experience (her subsequent doings, perhaps, or aspects of her more general psychological makeup). The downside is, of course, that experiential descriptions make it very hard to individuate the episode with any precision, and that the possibility of misinterpretation is substantial. Behavioural descriptions, on the other hand, allow you to single out an episode of bodily expressed pain relatively unambiguously, but you haven't then said anything about what arguably matters most about an experiential state, namely what it is like to be in that state; and, as is well known from the discussion of philosophical behaviourism, it is doubtful whether a state of mind really can be reliably individuated in terms of behaviour.

My suggestion is that these two kinds of description can be usefully combined. You may say that in an episode of embodied pain, a constitutive tie obtains between

[1] I am obliged to Stephen Butterfill for suggesting this expression.

the experiencing creature's behaviour and its embodied experience. In this description, the bodily element occurs twice over, as it were: as the behavioural expression of an instance of pain, and as the bodily aspect of the embodied event. To say that there is a constitutive tie between behaviour and embodied experience is to say that you could not enjoy the experience without the behaviour: you could not be subject to an episode of the relevant kind of pain if it were not bodily manifest (though the reverse is not true). Note that the tie is constitutive and not causal; the event is not to be thought of as an instance of behaviour that is causally related to a particular experience. Rather, the embodied experience can be characterised as necessarily connected to the behavioural event, which makes it possible to describe an embodied mental event in terms of behavioural display: *whenever* you experience bodily manifest pain, there is a bit of conveniently describable behaviour in terms of which it can be characterised. This kind of description allows you, so the thought, to combine some of the advantages of a behavioural individuation of an embodied mental episode with some of the advantages of an experiential characterization.

These advantages are particularly important when considering phenomena with mental and bodily characteristics that also have a social dimension. Consider, once again, an instance of smiling in interaction with someone else, which can be described in terms of primary intersubjectivity—as a face-to-face interaction in which an important dimension of the involved creatures' mental lives is shared between them. As I said earlier, it isn't at all easy to make sense of this idea of sharing. The hope is that describing the event in terms of a constitutive tie between observable body state and embodied mental life is going to help here. As before, in order to single out an episode of smiling, you can individuate it in behavioural terms. You can say that a person is smiling when she lifts the corners of her mouth and narrows her eyes. You can say, furthermore, that this bit of behaviour is caused by, and has causal consequences for, what others are doing. But if you want to take seriously the thought that smiling is a deeply social phenomenon, you can't just individuate it in terms of the individual's own behaviour, even if causally coupled with someone else's. You really need to anchor it in the behaviour of the other person with whom the subject of the smile is engaged. And so the proposal is to account for the experience of smiling, in an intersubjective context, by describing it in terms of a dual constitutive tie that obtains between the embodied event and, first, the creature's own body state *and, secondly, that of the person she is engaged with*. Wherever there is an experience of smiling, in such a context, you can characterise it by reference to the subject's body state, and that of the other person.

What this amounts to is the suggestion that there are embodied mental events whose terms of embodiment extend beyond the body of the event's subject. To experience a smile, in the relevant sense, is to be constitutively connected to another person's body state in the same way as you are to your own. For lack of a better expression, I will call this notion 'cross-creature embodiment'. The notion is important in the present context because it provides a handle on the question of what it means to share simple feelings. Simple feelings, I said, are subjective and action-bound aspects of a creature's perceptual experience. They are thus part of perceptual episodes in which, for instance, you smile at another person; they are that part of the episode that motivates your smile. So you may, along the above line of thought, say that simple feelings can be characterised in terms of the constitutive tie between your

embodied experience, your body state, and that of the other person with whom you are engaged. And you may, further, describe the experience of the other person in a corresponding way. It isn't, after all, that in an intersubjective context only you are interacting with the other person; the interaction involves both of you. That's what makes it an *inter*action. So you may say that the other person's embodied experience is tied to your body state in the same way as yours is tied to hers. This mutual tie is what is required to make the episode intersubjective. And it thus is what it means to share simple feelings. To share simple feelings, on the present account, is for two (or perhaps more) creatures to undergo perceptual experiences that are constitutively tied not only to their own body state but also to that of the other person. Shared simple feelings are embodied across creatures.

The idea of cross-creature embodiment sheds light on the question of what it means to stand in a perceptual relation to another person with whom you are mutually engaged. The relational account suggests that the other person features directly in the individuation of the experience. What this cannot mean is that the two persons' experiences are identical, since the visual, or otherwise sensory, properties are quite distinct in each case (you see me while I see you after all). What it does mean is that a constitutive mutual dependence relation obtains between the two, a condition of satisfaction that is met only if each person features in the individuation of the other's perceptual experience.

3.3 Joint Attention and Action

This account can be expanded so as to make available an answer to the question of what it is for a three-place epistemic relation to obtain between jointly engaged subjects and their object of experience. I follow Campbell (2005, 2011) in thinking that on the relational view, this relation must be thought of as basic; it cannot be reduced to a set of two-place relations that interlock in a particular way (Seemann 2010). To get started, it will be helpful to briefly rehearse the developmental considerations driving the present account: the thought, promoted by Vasu Reddy, that a thorough understanding of the developmentally earlier interactions between infant and caregiver are at the heart of a promising approach to joint attention; and Hobson's related idea that the sharing of simple feelings, which occurs in such interactions, really is what makes three-place perceptual episodes joint. Infants' capacity for joint attention grows out of their earlier mutual engagements with their caregivers; the adult directs the gaze of the infant focusing onto a third object, perhaps through pointing or diversion of her own focus onto that object. And even in adult life, joint attention is often preceded by mutual focus: we may sit opposite one another in a restaurant, attending to each other during our conversation. Someone walks past our table, you look at that person, my gaze follows yours: now we are jointly attending to her. So the suggestion is that the kind of cross-creature embodiment that characterizes primary intersubjectivity carries over into secondarily intersubjective three-place perceptual relations, and that it is what makes these relations irreducibly basic.

As in social embodied mental events which are instances of mutual attention, there are two ways of describing the relation obtaining between the involved creatures. You can either single out each creature's embodied state of mind

individually, in terms of a behavioural description, and then think of the relation between the creatures' behavioural episodes in causal terms. You may say, for instance, that what causes me to adjust my gaze is your focus away from me and onto the third person walking past our table. But you may also think, as Hobson and Reddy do, that my adjustment of gaze really is due to a mental attunement, a kind of sharing. As before, the need arises in this case to say more about what is meant by the notions of 'attunement' and 'sharing' here. And as before, the suggestion is to account for what it means to be jointly engaged by drawing on the idea that the simple feelings which form part of the perceptual episode are embodied across creatures. Thus, you describe the event in terms of a constitutive tie, for each involved creature, between the creature's embodied mental state and, first, its own body state and, secondly, that of the other creature. This is what explains your particular sensitivity to the doings of your co-attender. If she diverts her gaze, or if she sneezes, or collapses, this will have a particular impact on you. And to properly explain this particular sensitivity, to account for why her presence is a dominant behavioural factor for you, you have to say what gives her this special status. The suggestion is that thinking of your experience in cross-creature embodied terms provides such an explanation. Since your perceptual experience is available only if your embodied mental state is tied to my body state in the same way as it is tied to yours, changes to your body state will modify my experience just as they do yours. That is what it means to say that each involved creature directly features in the other's experience, and hence that the three-place relation between the two subjects of experience and their shared object of attention is primitive: you could not reductively account for it in terms of a set of more basic two-place relations. It isn't just that I am looking at the third person, and am aware of you doing so also, and vice versa. It is, rather, that my perceptual experience is appropriately described in terms which make reference to both your and my body state. When we are jointly attending to an object, you feature in the individuation of my experience, and vice versa. My embodied mental state—my perceptual experience, which on the present account includes simple feelings—is such that it is constitutively tied to your presence. And that presence, though it is mentioned, in the individuating description of my perceptual experience, as a bodily presence, amounts to more than that: it amounts to the presence of a creature whose own perceptual experience is tied to your own perceptual presence in the same way.

This view relaxes what one might think of as a classic criterion of joint attention: the idea that for creatures to be jointly engaged, they have to be attending to one and the same object. On my view, this requirement is too strong. Rather, a necessary condition that has to be met in order to secure the continuity of the attunement through the shift from primary to secondary intersubjectivity is, for each involved creature, the constant potential perceptual presence of the other. It is a potential presence because you can think of activities that are joint in a relevant sense but in which there are moments when the involved creatures are not in their respective visual fields, such as a game of football. What seems important is that the other can be made visually present, if need be, by a shift of focus that may involve bodily movement (turning one's head, for instance).

It is this presence that makes the cross-creature embodiment of joint perceptual experience possible. And it can explain how sustained joint involvement is possible

in cases in which we aren't, or aren't constantly, focusing on the same object. If you and I are passing a football to each other, we won't be both attending to the ball at all times (as long as we are any good at football, that is). I might look ahead to find out where the other team's goalie has positioned himself; you might look towards the left in order to focus on the other team's midfielder. But what is crucial for us to succeed in our pass, and what secures our joint involvement, is that we remain in our potential respective visual fields. So much is necessary if we are to enjoy the kind of sensitivity to the other's focus and action that makes successful team play possible.

3.4 Cross-Creature Embodiment and Neural Systems

I want to finish this paper with a reflection on the consequences of the present account of joint engagement, in attention and motor activity, for thinking about the neural systems involved in it, whatever exactly these may turn out to be. I need to stress immediately that the idea here is not that of a 'neural correlate' of joint experience—the idea that for every joint mental event there is a brain event, and that the occurrence of this brain event constitutes a sufficient condition for the occurrence of the joint mental event. On a relational account of perceptual experience, such an idea would have to be rejected. While it seems uncontroversial that, at least for creatures found in the kinds of biological environments we are familiar with, the occurrence of brain events is a necessary condition for mental life, the insistence that a perceptual experience be conceived as a relation between subject and perceived object is at odds with the idea that brain events are sufficient such conditions, particularly if one considers, as I have in this paper, embodied mental episodes. The idea is, rather, that brain events are one factor in a relation that also involves other body parts of the perceiver, as well as the object of attention in its perceptual environment. So much seems necessary if you want to maintain that the object of experience, and not a representation of it, features directly in the experience, and if you are also committed to the idea that the perceiver is *in* the experience (in the sense outlined in this paper), even though the experience is not *about* her. There can't be, on a relational account, 'brains in vats'. What secures experience is not the stimulation of a brain, but a system involving a brain in a body in a perceptual environment. An experience generated by such stimuli (if available at all) would, on the relational account, be of a different kind. It simply couldn't be an experience of an object.

Since the focus of this paper is joint motor action, I will draw out the consequences of the present approach for the question of how to think about the role of neural events in joint experience. If you take the notion of cross-creature embodiment seriously, you will reject the idea that such experience can be individuated by reference to events in the brain of one perceiving creature. You will reject this idea because joint perceptual events consist, on the present approach, in a particular relation between the involved creatures. In order to do justice to the idea that joint experiences are embodied across creatures, you will, when considering the role of brain events in such experiences, need to invoke events occurring in the other creature's body. I already said that it will be uncontroversial to think of brain events as necessary conditions of perceptual experience, but that, on a relational view, you ought not to think of them as sufficient such conditions. In this

respect, their role really is akin to the role of behaviour: just as there can't be embodied mental life without behaviour, so there can't be perceptual experience without neural events. The suggestion is to think of particular neural events as constitutively involved in experience while denying that experience is identical to, caused by, or reductively explicable in terms of such events. And where joint experience is concerned, the constitutive relation between brain event and mental life needs to make reference to events occurring in the brains of both involved creatures: that's what it takes to account, on the level of brain activity, for the joint character of the experience. Since, on the relational view, the experience is not 'in the head' (or brain) of any one creature but rather consists in a relation between the involved creatures and the object of experience, events in the brains of *both* involved creatures are constitutively involved in the experience. If they are not so involved, if only one brain is involved in generating the experience, it does not qualify as joint in the relevant sense. This thought runs counter to Searle's (1995) idea that collective intentional states can be entertained by one single individual.

These considerations are not merely of theoretical import. They can be exploited, I think, in order to develop a view on the relevance of what is perhaps the most important (and certainly the best publicised) discovery in social neuroscience of the past two decades: the finding that neurons in the frontoparietal action networks are active both when a particular motor action (such as 'reaching for a cup') is perceived and when the same kind of action is executed by the perceiver (Rizzolatti et al. (1996), reviewed Rizzolatti and Craighero 2004). While these early findings reported on events that very clearly have an intentional component, mirror neuron activity has more recently been detected in song imitation in birds (Prather et al. 2008) and in gaze following (Shepherd et al. 2009; 2010). One finding that made headlines last year was the first direct recording of mirror neurons in humans (Mukamel et al. 2010). So it seems fair to say that mirror neuron research is flourishing; but there have been a number of critical voices also. These have been concerned with the question of whether mirror neurons really form a distinct class of cells (Hickok 2009), and with the highly speculative nature of the conclusions drawn from the available evidence (Dinstein et al. 2008); but the main critical thrust has been the worry that mirror neurons, supposing they exist, can show very little about social cognition (Borg 2007; Jacob 2008; Allen 2010). Such worries certainly ought to be taken seriously: after all, we are talking about findings that concern very small numbers of single neurons. In Shepherd et al.'s (2009) study, for instance, the number of recorded neurons in the lateral intraparietal area of rhesus macaques was 106, activity in not quite a third of which was modulated by social gaze cues. And it is fair to say that nobody has a clue about the function of these mirroring events in the much larger cognitive system that is likely to give rise to consciousness. One doesn't have to be a radical sceptic to think that ascribing complex representational capacities (such as the capacity to represent motor intentions) to discharges of what are, after all, nothing but electrically excitable cells is a rather wild shot in the dark.

On the other hand, the current fascination with mirror neurons didn't come out of the blue. It really is a potentially relevant discovery that there are single cells which are stimulated both by the execution and the observation of a particular motor activity. It is a relevant discovery because it extends to the neural level (though it does not, as far as I can see, obviously solve) what used to be one aspect of the

problem of other minds: the question of how it can be that some creatures are capable of making sense of another's perceived doings, and of accomplishing this so quickly and effortlessly that it really seems as if the understanding of the other's state of mind were achieved by means of a perceptual act and not an inferential process.

In order to make a qualified judgement about the role of mirror neurons in social cognition, it will be necessary to pay attention to recent research developments that are not, as yet, adequately reflected in the literature. Most important here is the already mentioned discovery of mirror neuronal activation in events whose cognitive dimension, if it is to be thought of as cognitive at all, is quite different from that of action perception. A bird's response to another's song or a monkey's adjustment of gaze upon the perception of a photographed conspecific does not necessarily require, as the understanding of a motor action arguably does, access to aspects of the other's mental life. You could in principle conceive of gaze following in purely reflexive-imitative terms (the perceived creature's direction of gaze may have the same causal effect as a particularly salient feature of the environment, such as an arrow); see Deaner and Platt (2003) for a reflexive account of gaze following. And you may think, along similar lines, that a bird's response to another's song really is just a causal effect of a particular auditory stimulus. So these recent results shed a dubious light on general claims about the cognitive import of mirror neurons. Whatever thought you want to defend with regard to the role of mirror neurons in social cognition, it will need to reflect the consideration that this role is not unified.

In order to make progress here, it will be useful to distinguish between types of social perceptual events that have been shown to involve neuronal mirroring processes in terms of their cognitive properties. As far as I can see, there are three such types. The first can be characterised, roughly, in reflexive-behavioural terms. Instances of gaze following are events of this type. No understanding of the observed creature's state of mind is necessary for this adjustment of gaze to be possible; in the simplest case, it may really be just particular visual properties of the observed scene that affect the observer's focus of attention. This view is supported by the fact that creatures which one does not necessarily credit with mindreading abilities are capable of gaze following behaviour. Of course, things will in actual fact be more complicated: whether or not an episode of gaze following presupposes mindreading skills will depend, to a large extent, on the context in which the episode occurs (see Shepherd and Cappuccio (2011) on the relation of gaze following and joint attention), as well as on what kinds of creatures are involved. Still, the general point holds: simple gaze following behaviour is explicable in principle without presupposing the capacity for mindreading.

The second kind of event is perceptual action understanding. This kind of event clearly does rely on the perceiver's cognitive capacities. You could not understand a perceived event as an action, and thus as an event that involves an intentional element (see Gallese (2005); Rizzolatti and Sinigaglia (2008), and Pacherie (2006), for different accounts of motor intentionality), if you did not possess some understanding of the perceived creature's state of mind. This is so even where motor actions or activities are concerned. However you want to characterise the intentional element of such activities, the foundational distinction between a motor activity, such as reaching for a cup, and a purely non-intentional event, such as a

twitch in your arm, is precisely that the former but not the latter has an intentional component; it hence follows that understanding a perceived motor act depends on some grasp of the observed creature's mental life.

Action understanding is not the same thing as intersubjective engagement, however. You can, on occasion, perceptually understand simple motor actions even though the observed creature is not jointly engaged with you, or perhaps not even aware that you are observing its doings. As I suggested earlier, joint engagements are based on a particular attunement of the involved creatures' mental lives, which I tried to capture in terms of the notion of cross-creature embodiment. In joint engagements, each involved creature displays a particular sensitivity to the other's doings. This sensitivity, I said, is not of a merely causal kind, and thus not akin to episodes of gaze following. It is a kind of sensitivity that is constitutive of joint motor actions.

My hypothesis is that this distinction between three types of social perceptual events -non-cognitive or minimally cognitive phenomena such as gaze following, phenomena that build on only one creature's social cognitive capacities such as action perception, and phenomena that require all involved creatures to exercise these kinds of capacities, such as joint attention and action—corresponds to the relations that can obtain, logically, between the perceptually involved creatures' mirror neuronal systems. I am putting forward a logical and not an empirical claim here: to my knowledge, no-one has yet studied the relations, causal or constitutive, between mirror neuronal activation in two or more creatures in the various types of social perceptual events under consideration. The thought is that different kinds of such events integrate these neurons in different ways. What these differences consist in, so the suggestion, can be illuminated by relating the classification of social perceptual events I introduced above to the proposal that some such events are embodied across creatures.

In events with no or minimal cognitive import, such as instances of gaze following, it is plain that mirror neuronal activation in the brain of the perceiving subject does not have to be complemented by corresponding activity in the brain of the observed creature. In Shepherd et al.'s experiment, mirroring activity occurs in the lateral intraparietal area of the subject both when it perceives a conspecific (or, in this case, a photo of one) focusing on a particular object, and when it adjusts its gaze so as to focus on that object itself. But the same will not be true of the perceived monkey, even if it is an actual animal and not a photograph: if mirror neurons have anything to do with social stimuli, then just focusing on some inanimate object or spatial region (in the experiment, it is an illuminated square) will not activate mirror neurons. So there seem to be instances of social perception involving mirror neuronal activity in the perceiving but not in the perceived creature.

Compare this with an episode of motor action perception. The key insight of the now well-known classic experiments by Rizzolatti et al. (2004) is that mirror neuronal activation occurs both in a monkey's execution of an action and in its perception of the same type of action by another. It follows that mirror neuron stimulation in the brain of the perceiver of a particular type of motor action ought to be matched by the same kind of neuronal activation in the brain of this other creature. Hence, mirror neuron activity in the premotor cortex of both monkeys ought to be observable when one of them sees the other execute a particular motor

act. This is so even in the absence of mutual awareness; it simply follows from the 'mirroring' properties of the neurons in question. Parallel mirror neuron activation, in action perception, does thus not depend on joint engagement—nothing is shared between perceiving and perceived creature, and there is no co-ordination of looks or deeds. While the perceiving animal will be sensitive to the doings of the perceived creature, the reverse is not true; motor action perception is possible where the perceived agent is unaware of being observed. Along the lines of the present account, this means that the correct individuation of the perceiving creature's experience will make reference to the perceived creature's body or brain state; but the acting (and perceived) creature's state of mind can be described without such reference, even though mirror neuronal discharges are involved in generating its experience. Nothing about the perceived creature's own experience hinges on the doings of the perceiving monkey; it is not part of the perceptual relation between perceived animal and its object of attention. By contrast, the complete individuation of the perceiving monkey's experience will, where questions about neural events are at stake, make reference to mirroring activity in the relevant brain areas of the perceived creature.

Things are different in cases of joint engagement—episodes of joint attention or joint motor activity. In such cases, I suggested, the perceptual experience of each involved creature is to be individuated by reference to the body state of the other creature. Correspondingly you may say, if the focus is on brain- rather than behavioural events, that the neural systems of jointly engaged creatures ought to be intertwined in a particular way. In an episode of joint engagement, so the idea, the individuation of each creature's perceptual experience must involve a reference to mirror neuron activity in the other creature's relevant brain areas. For each involved creature, the other's brain state is constitutively tied to its own motor action experience. And since the key feature of mirror neurons is their sensitivity to both motor action perception and execution, the cross-creature relation of the involved subjects' social cognitive systems plays an explanatory role with regard to the particular sensitivity of each creature to the other's doings in intersubjective episodes.

One question that arises for this train of thought is how it accounts for the *mirroring* capacities of the relevant neurons, or neuronal systems, in joint episodes. After all, you could object, it isn't a very revealing insight that two members of the same species focusing and acting jointly on an object will display neural activity of the same kind, and that their respective brain states will somehow reflect the fact that they are aware of each other's doings. No special mirroring capacity seems required in order for this to be possible. What, then, is the particular role, in joint engagements, of some of the involved neurons' sensitivity to both action execution and -perception?

Classic mirror neuron theory answers this question in terms of a simulationist account of mindreading: what mirror neurons explain, according to e.g. Gallese (2005), is the embodied understanding of another's doings by simulating, in the perceptual act, the deed off-line. He conceives of embodied simulation as a modelling process that is concerned with the expected motor consequences of an action, and that makes possible the prediction of both one's own and another's action. He takes it that the modelling process which is at the heart of the

simulationist activity is, in a sense, agent neutral: the simulative processes that make both action and action understanding possible are not initially mapped onto the agent herself and subsequently projected onto another observed creature. Rather, the simulative process can be mapped either to oneself or an observed creature. So you may understand joint attention as a motor activity, whose consequences (what you or the other creature are going to look at, what you are going to point at, and so on) can be explained by reference to an embodied modelling process in which perspectives are taken—in which, to use Gallese's words, 'the world of the other (is penetrated) by means of a direct, automatic, and unconscious process of motor simulation' (35). And it is this simulative process which explains both your grasp of the other's embodied mental life and your sensitivity to her behaviour.

The question arises how, on such an account, the perspective-taking part of this modelling process is to be understood. It is particular pressing if you suppose, as Gallese does, that mirror neurons are significantly involved in it. Since motor action perception proceeds through an off-line simulation of the same processes that are involved in action execution, there needs to be some distinguishing fact about the neural systems active in action execution and -perception, respectively, that allow the perceiving creature to understand the perceived act as pertaining to another creature. And this thought triggers the further question of how the awareness of the distinction between self and other, as perceiver and perceived, is encoded in the neural systems of creatures involved in joint undertakings. In such cases, each involved creature is perceiving and executing motor actions of the same type; when we are carrying a sofa up the stairs together, I am both seeing you lift up the thing and lifting it myself. If it is the same mirroring activity that represents both the perception and the execution of the deed, then some other mechanism is needed in order to account for the distinction between perception of another's act, and the execution of the same type of act by oneself. And some further explanation is required of what it means to suggest that the initially agent-neutral awareness of such an act, in perception or execution, can be mapped *either* onto the agent *or* a perceived creature.

The relational view rejects the notions of simulation and representation and thus avoids the above questions. It operates with the idea that in joint engagements, instances of action perception and -execution are embodied across the involved creatures, and that this embodiment results in a particular attunement of these creatures' neural systems. This attunement relies on the mirroring properties of some of the involved neurons. The key consideration is that the relevant neurons are sensitive to both executed and perceived motor actions. In action perception, mirror neurons in the perceiving creature's relevant brain areas are sensitive to stimuli from the perceived creature, but not vice versa. The neural system that is involved in the perceiver's experience is embodied across creatures; the agent's is not. In joint engagements, by contrast, both creatures neural systems are sensitive to stimuli from the other; they are both sensitive to stimuli from their own bodies (in action execution) and from the other's body (in action perception). And what explains this dual sensitivity is that there are neurons forming part of these systems which have mirroring properties—that is, whose discharge is triggered by both perceptual and executive stimuli.

Of course, this very brief sketch raises a number of pressing questions. One such question, which I cannot address in this paper, is how the relational view

accommodates the widely shared idea that motor actions are the result of the capacity to predict motor goals and to match actual movements to such goals (Pacherie 2006, 2011; Vesper et al. 2010). Another question is how to conceive of what I have called the 'attunement' that results from the cross-creature embodiment of cognitive systems. As far as bodily movements are concerned, you may understand it as the other's capacity to act in synchrony with you (and vice versa); to look where you are looking; to lift when you are lifting; to walk at the speed you are walking. And you may surmise, though this is a highly speculative hypothesis, that synchrony is also what characterizes the attunement of jointly involved creatures' neural systems. Along the lines of this hypothesis, if each of such creatures' neural systems is embodied across the other creature, the attunement of their doings will be reflected in the synchrony of the neuronal discharges in each creature's brain with those of the other. They will have a common rhythm, whatever that rhythm turns out to be.

4 Conclusion

On the approach developed here, the ultimate response to the question motivating the present volume—the question of what is shared in joint action—is quite a radical one. My train of thought suggests that the notion of 'sharing' in joint episodes may actually be a misnomer. It suggests that jointly engaged creatures are best thought of as complex systems, in which each creature plays a constitutive role. The individual's experience ought to be understood from this cross-creature systemic view. It isn't, necessarily, that the involved individuals' experiences are identical, or even relevantly similar; it is, rather, that they can be properly individuated only by reference to the creature with whom they are jointly engaged. On such a view, the suggestion that jointly engaged creatures 'share' experiences turns out to be rather misleading. For sharing to be possible, you have to start from the assumption that two ontologically distinct individuals somehow get together in the joint enterprise. But this assumption is just what the present account denies. It rejects, in other words, what you may call a 'bottom-up' or individualist view of joint agency. The notion of cross-creature embodiment commits you to the view that the basic, irreducible unit of joint action is a system comprising both (or perhaps, in some instances, more than two) individuals. Only thus can you make sense of the idea that the perceptual, enacted relation obtaining between the jointly engaged creatures is irreducibly basic. And only thus can you, as far as I can see, convincingly explain what it is to be jointly engaged.

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