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Abstract: The question of what is shared in joint action has been conducted 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-creatural 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 recent neuroscientific evidence provides tentative support for my approach.

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Joint Actions, Shared Feelings, and Cross-Creatural Embodiment

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 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 can be at least tentatively supported by reference to recent neuroscientific evidence.

Simple Feelings and Perceptual Experience

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. In typical instances, such as the rowing example, 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 'mind-to-world' 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 to as to correspond to that representation. Motor intentions may not best be 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. And this spontaneous responsiveness may not be appropriately conceived in representational terms. Since a thorough discussion of the issue would lead us too far astray, I will simply subscribe, for the purposes of this paper, to an alternative, systemic approach to motor intentionality that is marshalled by Hubert Dreyfus (2008) and Erik Rietveld (2008), amongst others, and which conceives of an organism’s adaptive behaviour in the integrated terms of a system comprising both organism and environment.

While it seems fairly easy to distinguish between deliberate actions and their motor counterparts (the latter but not the former involving distal intentions), it is difficult to demarcate the precise fault lines between motor actions and instances of reflexive behaviour. For the purposes of this paper, I am going to stipulate that an event qualifies as a motor action if, in addition to the characteristics outlined above, the event features both a bodily movement and the agent enjoys some degree of control over that movement. I take bodily movements in the relevant sense to include not only changes in body state that modify the body’s position in space (hand and arm movements, posture adjustments, and the like), but also, following enactive accounts of perception, eye movements. I have no ultimate argument for differentiating between motor actions and reflexive behaviour along the lines of control, though I am not alone in thinking that agential control is a key characteristic of any event that may qualify as an action (e.g. Pacherie 2007). The consideration is simply that whatever one means by the term ‘action’ or ‘activity’, there has to be some sense in which the subject of the event is an agent – that is, a creature with a capacity to influence how things go. Even though the agent may be said to exercise control only in a fairly loose sense in motor activities (control will be manifest in an

overall responsiveness to the environment's demands rather than the explicit, deliberate pursuit of an action plan), this still constitutes a significant difference between events that can meaningfully be called actions or activities on the one hand, and instances of reflexive behaviour on the other.

I have already said that the conception of motor intentionality I recommend is relational, in the sense that the engaged creature's behaviour can't be made sense of independently of its relation to its surroundings. So perception plays a crucial role on the present account: the kind of joint action I am interested in occurs in episodes in which the engaged creatures enjoy perceptual awareness of their surroundings. And in order for two (or more) creatures to be in a position to act jointly, this awareness has to be shared in some sense. Creatures that are capable of joint motor action, and thus of jointly coping with environmental challenges, have to be able to attend to the environment together.

This observation gives rise to a number of questions. One of them is, how do you account for the 'jointness' in joint attention? The traditional answer to this question is that creatures that are jointly attending to some object are focusing on the same object and are mutually aware of this fact (Baron-Cohen 1995). Though 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 necessary condition for joint attention (Seemann 2008, 2010). Or at any rate, it isn't the most helpful way to account for a phenomenon that is much less static than that characterization would imply. Consider the kind of joint motor action at issue in the present paper: passing a football to and from with another person, for example. In these activities, 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.

To explain it, you need to account for the impact of the perceived environment on a creature's behaviour quite generally; and in the case of joint engagements, you need to account for the impact of a perceived environment that contains other persons. One helpful thought in this context is the idea, defended by Freeman (2002) and Rietveld (2008), that a creature's perceptual experience is shaped, in part, by the needs on the basis of which it acts. I will develop this thought in the remainder of the present section and will ask in what way it pertains to joint activities in the next one.

Perceptual experiences, on the present approach, always incorporate a stance of the creature towards its environment. Your perception of a tomato, say, is not just determined by the sensory properties of the fruit; the experience isn't only about the shape, size, and colour of the thing. Rather, your perceptual experience is of the tomato as an edible item, or perhaps as a tasty one, or as a kind of food you really can't stand. This aspect of the experience, your attitude towards it, may be informed by all sorts of things: by past experience (you will have tasted tomatoes before) as well as by the visual or otherwise sensory properties of the object (perhaps you just don't like red food, or tomatoes' mushy texture, or their scent). So the experience you enjoy is informed by more than just the strictly visual, auditory, or otherwise sensory properties

of the object or scene perceived; it is also informed by your attitude towards your surroundings. This attitude isn't, on that account, best described as an intention in the classical sense; it isn't a psychological item with a world-to-mind fit. It is, rather, that the attitude is *in* the experience.

The question thus arises how to spell this out: how is a scene's qualitative (and thus action-motivating) character presented to the perceiver? Reference to an object's purely sensory features won't exhaustively answer this question, since these do not account for the practical, action-oriented attitude of the perceiver towards her surroundings that is also part of the experience. You cannot explain perceptual experience in terms of a perceived object's shape, colour, or weight alone. You may, of course, try to accommodate the motivational character of a perceptual experience in representational terms by suggesting that the representation of the perceived scene somehow incorporates the creature's attitude towards the object - a representation of the tomato *as* tasty, say. But I am not going to discuss this suggestion in the present paper, since it would lead us too far astray and since it is incompatible with Freeman's and Rietveld's approach. Instead, I am going to suggest that what provides a perceived scene with motivational power is that its mode of presentation involves feelings – 'simple feelings', as I have called them elsewhere (Seemann 2008; see also Frijda 1986; Gallagher 2008). The term 'feeling' is bound to mislead in this context, since one tends to hear it as somehow akin to emotions – as designating complex subjective states like jealousy, pity, or guilt. What I have in mind, however, is much simpler than that. Simple feelings are experiences that occur, directly, on the grounds of a particular feature of or event in the environment. They are what one may call 'world-involving': they are integral parts of a perceptual experience; since the individuation of such experiences, on the relational account, involves the object of the experience, the simple feelings that are part of this experience stand in a direct relation to that object. They are thus not

‘about’ that object in a classic intentional sense, but neither are they mere blips in a creature’s psychological economy. They put the creature in a particular action-guiding position towards its perceptual environment: you will be disposed to eat a fruit that you perceive as tasty and to avoid food you perceive as disgusting. So the claim is that perceptual experiences come with feelings that occur as an integral part of the experience and that can be described (though not reductively defined) in terms of a behavioural attitude of the creature towards the perceived object.

Examples of simple feelings, in the sense I am using the term, may be pain, pleasure, tastiness, and so on. I rather doubt that the whole range of such feelings can be couched in words, and it doesn’t matter. What does matter, for present purposes, is that these feelings are part and parcel of the perceptual experience. The integration of sensory information and the felt attitude towards the perceived object occurs, on my account, below the threshold of perceptual experience. So we might say, about the role of feelings in perceptual experience:

(FPE) If you enjoy a perceptual experience, you are subject to simple feelings that are presented as integral parts of that experience and that play a causal role in determining your focus of attention, and behaviour more generally.

One important feature of (FPE) is that these perceptually presented feelings are action-guiding; they create an attitude towards its surroundings in the experiencing organism, and they thus provide it with a motivation to manipulate these surroundings in accordance with that attitude. They play a direct role in the organism’s motor engagement, and so a comprehensive characterization of such engagements makes it necessary to take into account the subjective, action-guiding quality of the perceptual experiences that are bound up with them.

Intersubjectivity and Sharing Feelings

The consideration that simple feelings are crucially involved in an organism's motor engagement with its surroundings is at the heart of the account of joint action presented here. As I said before, I am concerned with the epistemic rather than the normative dimension of the topic, and thus not with the question of how (if at all) distal intentions can be jointly entertained. My question is, rather, what makes joint motor engagement possible.

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 prominently defended by Vasu Reddy (2005, 2008) and Peter Hobson (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, what explains this adjustment of gaze is the attunement of the involved persons' subjective lives – their 'intersubjective' engagement with each other. And 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 behaviour possible, the idea is that joint motor behaviour is made possible by, and can be partly explained in terms of, the sharing of simple feelings that occurs in intersubjective perceptual episodes.

What, then, does it mean to share simple feelings? This tricky question has not yet been adequately discussed in the literature. The obvious answers are unappealing. To share a feeling has to amount to more than just to enjoy an experience of the same kind as someone else, since

you and I could both be subject to the same type of experience without standing in any perceptual relation at all. We might both be in an episode of perceptually presented pain even though an ocean divides us. On the other hand, sharing a simple feeling can't mean enjoying the same token visual experience, since simple feelings are part and parcel of particular perceptual episodes and since your experience will not be identical to mine even if we are jointly engaged. If the account presented here is on the right track, there has to be something that remains constant throughout the perceptual experiences of mutually or jointly engaged creatures even where these experiences' visual or otherwise sensory characteristics are quite distinct.

To say that simple feelings are part of perceptual episodes is to say that they could not be experienced if the subject of the experience were disembodied, or if none of its sense organs were in working order. And it is tempting to suppose that the bodily properties of such a perceptual event are, necessarily and exclusively, the creature's own. But I think this consideration ought to be resisted. I want to make room for the idea that simple feelings can be tied to changes in body state of *another*, perceptually present and mentally attuned creature. This is an unusual thought, of course, and to make it a bit easier to see what I have in mind it may be helpful to first consider that basic types of feelings can quite generally be presented to the experiencing subject in a variety of modes. Take an experience of pain: you can suffer from pain in your head or your foot; you can be in physical or in mental pain. These are very different experiences; the phenomenology of a heartache is quite distinct from that of a headache. Yet there is something to both of them that entitles us to classify them as instances of pain. What accounts for this, I think, is a general feature of pain that is best couched in terms of the experiencing creature's attitude towards the object of the experience. What makes your experience an instance of pain is that you will be disposed to act in ways that eliminate, or at

least reduce, the pain. You will be disposed to remove your hand from the hot stove, and to seek reconciliation with (or avoid, as the case may be) the lover with whom you have fallen out. Pain, you may say, is an experience that can be described in terms of an ‘avoidance attitude’ of the experiencing creature towards the source of the experience.¹ So simple feelings can be presented in a variety of modes; what makes them instances of a particular type of experience is that they can be characterised in terms of the experiencing creature’s behavioural attitude towards the object of experience.

If you accept that much, the door is open for an account of feeling perception which takes it that the same type of feeling can be presented, to the experiencing creature, both perceptually and what I have called ‘interoceptively’ elsewhere (Seemann 2010). Along those lines, when you perceive another creature with whom you are intersubjectively engaged, you experience an instance of the same type of simple feeling that she is experiencing also and that is (since it is a simple feeling) expressed in her body state. When you see another such creature in pain, you undergo an experience of pain yourself. It is presented to you in a different mode, and it may well be weaker than that of the other creature, but it still qualifies as pain because it manifests itself in a particular kind of behavioural attitude towards the object of the experience. When you see someone else cutting her finger, you will typically display much the same attitude as you would if you had cut yourself: you may hiss, contort your face, look away, reach for a plaster, and so on. So the idea is that your experience of a simple feeling can be tied to a perceived creature’s body state. It has to be tied to her body state in roughly the same way as her own experience is, since you could otherwise not distinguish between (say) your perceptual

¹ The characterisation of an experience of pain in these terms is, of course, not definite; an episode of disgust, for instance, could also be described in these terms. A definite description of the experience would presumably have to involve more specific bodily attributes of the subject of the experience, such as particular facial expression, posture, and so on.

experience of another's genuine pain and an expression she is merely faking. What the intersubjective sharing of feelings is based on, then, is a particular kind of perceptual experience:

- (FP) An episode of feeling perception is an event in which the subjective life of an organism is constitutively tied to the body state of another organism in its perceptual environment, whose own embodied psychological life is tied to that state in roughly the same way.

Note that (FP) is not saying that the perceptual presence of the other person *causes* a certain experience in you. Even though jointly engaged creatures are causally sensitive to the other's behaviour, their perceptual experience is individuated by reference to the object of that experience (should this claim strike you as self-contradictory, I will elaborate on it in the last section of this paper). It follows that the possibility of embodiment, on my account, is not restricted to the experiencing creature's own body; in the case of feeling perception, some of the experience's bodily properties are those of the perceived creature's. I will call this kind of embodiment 'cross-creatural'.

One consequence of the idea that simple feelings can be cross-creaturally embodied is that the perceptual episodes of which they are part are temporally extended. If, to take up my earlier example, you see another person smile at you, and smile back at her in return, you undergo a particular embodied mental event (your smile) which is constitutively tied to the smiling face of the other perceived person. Part of what individuates this smile – what makes it a particular, singular event – is its connection to the other person. You could not, on my view, spell out the individuation criteria of the event if you did not account for its tie to the other person's smile. And you could not account for this tie in causal terms because in order for two events to be causally related, they have to be ontologically independent (removing one will not make it impossible to individuate the other) in a way in which your smile and that of the other perceived

person are not. The result of this consideration is that the perceptual episodes of which simple feelings form part are not to be thought of as snapshots, if you will – they can comprise changes in body state of more than one creature which occur over time.

It is important to not read the proposal as advocating some sort of *replacement* of the constitutive tie between the creature's experience and her own body state with a tie between her experience and the body state of another perceived creature. This idea would obviously not make sense. In any occurrence of an embodied feeling, the body of the experiencing creature will play a constitutive role. When you smile, you undergo a change in body state as part of the smile; and when you perceive a smile, and experience something like it yourself, your body is involved in that experience also – in an intersubjective episode, you respond to the smile by smiling yourself after all. Hence one might say that the tie obtaining between mental life and body state is *dual*: it obtains both between a creature's mental life and her own body state, and between her mental life and that of the perceived creature's.

The idea that the perception of feelings is subject to cross-creatural embodiment makes available a way of thinking about what it means to share feelings. In episodes of primary or secondary intersubjectivity, the attunement of the involved creatures' mental lives requires some kind of mutuality: if we are smiling at each other, you and I will have to be in a position to perceive *each others'* facial expressions. So the cross-creatural embodiment that characterizes feeling perception is mutual: just as my embodied feeling is constitutively tied to your body state, so yours is to mine. And it is this mutual tie that explains how feelings can be shared in intersubjective perceptual episodes whose visual (or otherwise sensory) characteristics are quite distinct for each of the involved creatures. Consider a paradigmatic instance of primary intersubjectivity: when I see you smile, and share aspects of your experience, I am not seeing the

same thing as you do – I am looking at you while you are looking at me after all. Nevertheless, it is an episode in which our mental lives are attuned to one another. They are so attuned, on the present account, because of my mental life's constitutive tie to your body state, and vice versa. And what is being preserved in an instance of gaze diversion that leads from mutual to joint attention – what provides the episode with a continuum of shared simple feelings - is that the mutual tie of each perceiving creature's mental life to the other creature's body state remains intact. It isn't, necessarily, that the type of feeling at issue remains the same; the felt aspect of seeing you smile at me will be very different from an experience of jointly observing a swan in the pond, say. But the former can lead to the latter; and what puts the 'jointness' into the shared focus on the swan is that it is an instance of continued cross-creatural (thus dual), and mutual, embodiment.

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 visual presence of the other. It is this presence that makes mutual, cross-creaturally embodied feeling perception 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

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.

Mirror Neurons and Joint Engagements

You may think the idea that simple feelings can be cross-creaturally embodied implausible, on the grounds that it denies the possibility of a causal relation between behavioural events pertaining to two (or more) creatures that are intersubjectively engaged. And you would be right in thinking this. Regardless of whether or not an intersubjective engagement obtains between creatures, one will want to allow for the possibility that one creature's doings exert causal influence on the other's behaviour. Consider an episode of joint attention, for instance. Along my lines, the possibility of joint attention depends on an intersubjective, and thus cross-creaturally embodied, sharing of simple feelings. But you would still want to say that in such episodes, one creature's shift of attention can have causal influence on the other's focus. There is a perfectly straightforward sense in which, when we are jointly attending to the road through the windscreen of the car I am driving, your sudden shift of focus to the right (you may have seen a child running into the street) can cause me to look in the same direction.

To see why my account is not committed to denying the possibility of a causal relation between jointly engaged creatures' behaviour, it is important to bear in mind that cross-creaturally embodied simple feelings are events that build on a very particular kind of connection between the involved creatures' mental lives. In order to account for the possibility of gaze following, however, no such connection is necessary. You may say that gaze following is a relatively simple causal-behavioural phenomenon; the perception of another creature's shift of

focus simply triggers a reflexive reaction in the perceiving creature, on the grounds that monkeys and humans follow head and eye gaze quickly, using neural pathways that operate within a few hundred milliseconds (Deaner & Platt, 2003).² And you may think this even about intersubjectively engaged creatures. In what follows, I am going to take seriously the distinction between reflexive gaze following and intersubjective joint attention in order to pursue the question of how one might accommodate recent neuroscientific evidence about gaze following in a comprehensive account of joint attention and action. Before continuing, however, I ought to point out that I am going to simplify grossly in order to get across as clearly as possible, within the limited space at hand, one main idea. The rest of this paper thus ought not to be understood as an attempt to discuss the neuronal correlates of gaze following and joint attention/action in a way that takes into account all of our best current evidence. I will not, for instance, discuss the well-known sets of experiments of Rizzolatti (1988) and Gallese et al. (1996), amongst others, that are concerned with the role of mirror neurons in action perception; nor will I consider the important criticisms that have been raised against attempts to explain social cognition by reference to mirror neuronal activity (Borg 2007; Jacob 2008; Hickok 2009). I will also not take into account the quite considerable amount of current knowledge of the neural mechanisms in gaze following and joint attention (see Shepherd 2010 and Cappuccio & Shepherd 2011 for an overview). Instead, I am going to focus on a recent experiment (Shepherd et al. 2009) that shows mirror neuronal activity to be involved in gaze following in macaque monkeys. I am doing so because gaze following plays an important role in (though it ought not to be identified with) joint attention, and because I think a plausible hypothesis about the role of mirror neurons in joint phenomena, of which there isn't any direct evidence as yet, can be developed on the basis of

² I ought to point out, however, that some gaze-following behaviour in both human and nonhuman animals is quite sophisticated, which suggests that gaze following is integrated with other social pathways (Shepherd 2010, Cappuccio & Shepherd 2011).

Shepherd et al.'s study. A word of caution is in order here: I am not suggesting that the results of this study will provide conclusive evidence for my (or indeed any other) hypothesis about the social-cognitive function of mirror neurons. It is an important piece of work, however, in that it forces certain questions about the cognitive properties of mirror neuronal activity, which I will highlight and speculatively address in the remainder of this paper.

Gaze Following

Shepherd et al.'s (2009) study presents a subject (a macaque monkey) with a yellow square in the centre of the monkey's visual field, which is subsequently replaced with a social cue (the face of a conspecific that looks either to the left or to the right). The social cue is subsequently extinguished and a yellow square flashes up either in the direction of the observed monkey's face or in the opposite direction. The study finds that the subject focuses on the square significantly faster when it is aligned with the observed monkey's gaze than when it is not; further, the shorter the time period during which the social cue is displayed the more quickly the monkey's focus shifts onto the square.

These behavioural results are correlated to neuronal activity in the subject's lateral intraparietal area (LIP). The experiment measured the activity of a number of single neurons in that area in connection with social gaze cues. About a third of these neurons were sensitive to these cues; of these, about half mirrored observed gaze. Other neurons were suppressed by gaze cues towards their response fields. Where mirroring activity occurred, the neuronal response was quick enough to predict the time-course of gaze following behaviour. Shepherd et al. thus take their findings to suggest that LIP plays a role in behavioural responses to gaze; they are,

however, adamant that their experiment does not warrant a conclusion about the causal role of the observed neurons' activity in gaze following behaviour.

One reason why the discovery of mirror neuronal activity in conjunction with gaze following behaviour is so important is that such behaviour can at least possibly be accounted for without reference to social cognition. This distinguishes gaze following from action perception: in order to explain why mirror neurons are sensitive to acts of 'grasping', for instance, you may think it necessary, with e.g. Gallese (2005), Sinigaglia (2008), and Pacherie (2011), to invoke some recognition of the act's motor goal. By contrast, the most parsimonious explanation of gaze following will suggest that such behaviour is a reflexive reaction to a visual trigger (the direction of the eyes in the observed creature's face) which does not require any awareness of the observed creature's mental life even where it is sensitive to social context. So the function of the kinds of mirror neurons at issue is not, on such an explanation, cognitive but reflexive. This consideration goes directly against the view that mirror neurons *always* are conjoined with events (action understanding, empathizing, and so on) that in some sense qualify as cognitive.

At the beginning of this section, I said that one ought to carefully distinguish between gaze following and joint attention. It is generally agreed that joint endeavours demand quite sophisticated cognitive capacities (though there is significant disagreement as to exactly what is required); at the same time, it is also clear that gaze following plays a crucial role in joint attention. So the question arises what, if any, role the kind of mirroring activity recorded by Shepherd et al. plays in episodes of joint attention. In the absence of direct empirical evidence about neuronal activity in joint attention, which is unlikely to be forthcoming anytime soon (one reason being that joint attention may only be evident in humans, another one being the rather elusive, not always behaviourally evident character of the phenomenon), the best approach will

be to outline the available options. You may think, along broadly simulationist lines, that all mirror neuronal activity has a cognitive function. This will commit you to the view that gaze-following is really a cognitive capacity, and it may lead you to speculate that there is mirror neuronal activity in joint attention, and that the types of mirror neurons involved in action perception and those in gaze following are broadly on a par as far as their cognitive function is concerned. Alternatively, you may think that we ought to adopt a more parsimonious non-cognitive account of gaze following. You may then suppose that a typological distinction needs to be drawn between mirror neurons with cognitive functions and those with merely reflexive-behavioural properties, and you may speculate that both are involved in prolonged episodes of joint attention that involve adjustment of gaze of the involved creatures.

Neither position strikes me as plausible. There is no good reason for thinking that gaze following necessarily involves social cognitive skills unless you are independently committed to a simulationist account of mindreading, which I am sceptical about (Seemann 2008, 2011). On the other hand, drawing a distinction between types of mirror neurons with different cognitive functions and then claiming that these different types are all involved in what is, after all, one unified phenomenon, commits you to a neuronal model whose complexity is just not warranted by the evidence. So I want to advocate a third option, which flows from the account developed in this paper. This option takes it that the capacity for gaze following ought to be accounted for as parsimoniously as possible, and should hence not be understood as a cognitive phenomenon. Secondly, the view I am recommending holds that gaze following is a necessary component of joint attention, and that joint attention really does presuppose social cognitive abilities. Thirdly, it resists the idea that a typological distinction ought to be drawn between mirror neurons with and those without cognitive function.

On my view, the simple feelings whose sharing, on an intersubjectivist account, is at the core of joint attention and action are not to be thought of as directly correlated to the activity of single mirror neurons. But since the social cognitive aspect of joint attention should not be accounted for by assuming a cognitive difference between types of mirror neurons either, the hypothesis is that the difference in cognitive import between gaze following and joint attention is of a *systemic* kind. On that view, the complex phenomenon of joint attention is underpinned by a neuronal system which integrates the mirroring activity occurring in conjunction with gaze following, in such a way that the system's higher-level properties include the organism's capacity to share feelings, and thus to relate directly to aspects of another, perceptually present and intersubjectively engaged creature's mental life. The ability to follow gaze, along these lines, can be enjoyed by creatures that do not have the capacity for primary intersubjectivity, though it relies on mirror neurons of the same type as those involved in joint attention. It is just that in such creatures, the neuronal systems underpinning gaze following are not sufficiently complex (in a way I will spell out below) to allow for intersubjective sharing. But these simpler systems are still active in creatures capable of that kind of sharing, so that such creatures are still in a position to reflexively follow gaze.

To substantiate this view, it will be helpful to begin with a reflection on the function of mirror neurons in episodes of gaze following. In order for a creature to be capable of gaze following, it has to enjoy a particular kind of spatial awareness of its surroundings. It has to be aware, in some minimal sense (for a good account of the relevant kind of awareness, see Dretske 1993), of the broad location at which the observed other's focus is directed, and this awareness has to be construed as relative to that other creature's spatial position. Furthermore, the subject has to be aware of this broad location relative to its own spatial position. Both requirements have

to be met for gaze following to be possible. The creature's awareness of the other's direction of gaze has to be relative to that creature's spatial position, since it is otherwise not clear how the creature could come to acquire this awareness in the first place. Still further, it also has to be relative to the observing creature's own position, since it is otherwise not clear how the creature could come to engage in gaze following *behaviour*. So it turns out that the perceptual experience of the gaze-following creature is shaped by a kind of spatial awareness that is relational. It is an awareness of a point in space as the location of both the other's and its own focus. Note that for this relational spatial awareness to be available, no understanding of the distinction between 'self' and 'other' needs to be in place. It really is just spatial awareness I am talking about; after all, the point is precisely to account for gaze following without invoking a cognitive dimension.

If this line of thought is on the right track, you may suppose that the mirror neurons involved in gaze following are sensitive to *relations* between spatial locations. In order to be in a position to follow gaze, a creature has to be able to relate the spatial position of a perceived other's direction of gaze to both the position of that other creature, and to its own. The suggestion is that mirror neurons pick up on that relation: their involvement in gaze following explains the causal sensitivity to a perceived creature's direction of gaze. They register both the spatial location of the observing creature's focus (they are active when the monkey in Shepherd's experiment focuses on the square that suddenly lights up) and the location of the perceived creature's focus (they are active when the experimental subject perceives another monkey focusing on the same spatial location). So the core characteristic of 'mirror' neurons is not, along the lines of the current proposal, that their activity is correlated to imitative or simulationist processes. In gaze following, it is their ability to pick up on spatial relations. And on the present approach, it is this spatial-relational sensitivity of mirror neurons that gives rise, as part of the

perceptual experience, to the simple feelings that cause the observing creature to follow the other's direction of gaze. The perceptual experience is such, in other words, that its subject is aware of the triangular relation between its own spatial position, the other creature's position, and the spatial position of the other creature's direction of gaze. And this perceptual awareness has a subjective dimension which causes the creature to adjust its gaze.

Importantly for present purposes, the simple feelings that a perceptual experience of the kind at issue in Shepherd's experiment gives rise to are not shared between creatures. Part of the experience of seeing a conspecific look in a particular direction is a simple feeling that causes the observing monkey to adjust its gaze. The relation between the observed monkey's gaze and the observing monkey's readjustment of its own really is of a strictly causal kind; no joint engagement is necessary for gaze following. After all, you can be sensitive to a creature's direction of gaze even if that creature is unaware of your presence; your perceptual experience of the creature needn't have anything in common with that of the creature itself.

Joint Attention and Action

The question before us now is how to conceive the role of mirror neurons in the sharing of feelings, and thus to account for their role in joint attention and action. One critical issue here is that my account construes the jointness of motor action in terms of action-guiding simple feelings which are part of perceptual episodes and which are cross-creaturally shared. But as I pointed out, the visual aspect of such episodes is different for each of these creatures: after all, each of them enjoys a different perspective on their surroundings, and on my dynamic view of joint attention it needn't even be the case that they constantly focus on the same object. So what

needs to be tackled is the question of how it is that perceptual experiences which are visually distinct, for each involved creature, can still give rise to action-guiding feelings that are cross-creaturally shared between them. If we are passing a ball to each other on the football field, and are thus jointly attending to and acting upon the thing, the object of our attention will look quite differently to you than it will to me. We will see it from different perspectives after all, and sometimes we may not even look at it while still being jointly engaged. Hence there needs to be a mechanism which integrates these different perspectives, so as to make available, to each creature, a perceptual experience that is characterised by the enjoyment of the same, cross-creaturally embodied (token) feeling.

The thought is that joint engagements are underpinned by mirror neuronal systems which extend across creatures, and which constitute this sort of mechanism. That is the core idea: there are cross-creatural mirror neuronal systems which build on the spatial-relational sensitivity of the simpler kind of mirroring activity that is correlated to gaze following, so as to make possible integrated joint perceptual experiences. Cross-creatural neuronal systems make available, to the jointly engaged creatures, an experience of their perceptual surroundings that is characterised by an awareness of these surroundings' spatial properties *from a shared perspective*. When we are jointly attending to a football, passing it to and fro between us, we are experiencing the visual scene before us in a way that involves the awareness of that scene as being before *us*. I have to be aware of what the spatial arrangements are from your perspective in order to act jointly with you. In order to pass you the ball so that you can then kick it back to me, I have to have some awareness of the necessity of positioning it about two feet in front of you, say. So what is needed for joint action is a kind of spatial awareness that is really quite complex. It is an awareness which goes beyond what you actually see, and which is characterised by the understanding of

how things are being presented to your co-attenders. It thus is an awareness that integrates a variety of spatial perspectives. It does not only, as the kinds of mirroring systems involved in gaze following do, integrate visual perspectives relative to one's own. It integrates such perspectives in a way that each jointly perceiving creature enjoys an understanding of the other's spatial perspective. And the way in which this integration comes about, on my account, is through mirror neuronal activity within a complex system that comprises the involved creatures. Cross-creatural mirror neuronal systems, on this view, integrate not only the activity of neurons in one creature's brain; they also, via the perceptual channels of the involved creatures, are attuned to such activity in (intersubjectively engaged) others. Thus, when you and I are passing our football to each other, and hence are jointly engaged, the perceptual link between us is such that it makes mirror neurons in my brain pick up on the activity of such neurons in yours, and vice versa. Perceptual information about another, jointly engaged person on this view connects neurons, or neuronal systems, across bodies.

The phenomenal correlate of this cross-creatural neuronal integration are experiences that build on the informational content provided by each involved creature's senses so as to integrate different spatial perspectives. You still see things from your own viewpoint; but you are aware, as a key feature of your joint engagement, of the other's spatial relation to the scene perceived. This feature is reflected in the idea of a cross-creaturally integrated view of joint motor acts. When you perceive, in a joint engagement, another creature's shift of focus of attention, and consequently adjust yours, you are involved in a temporally extended motor activity that is constitutively tied to the body state of the other creature and to your own. It isn't, on this view, that the other creature's shift of focus *causes* you to adjust your own (that is what happens in gaze following). It is, rather, that the other's shift of focus is part and parcel of a spatially and

temporally extended perceptual experience that is shared between the involved creatures and that also comprises your subsequent adjustment of focus. It is shared not because the visual content of the experience is identical for all concerned creatures (it plainly is not), but because the event takes place in a space that is experienced as shared between the involved creatures. And it is so experienced because of the cross-creatural integration of spatial perspectives that can be accounted for in terms of a corresponding integration of the involved creatures' mirror neuronal systems.

Of course, this all-too-brief sketch raises more questions than it answers. But it makes available an explanation of how it can be that the simple action-guiding feelings which, on my account, form part and parcel of perceptual episodes are mutually cross-creaturally embodied, and thus shared between the involved creatures. I said that in order for such feelings to be so embodied, a constitutive tie has to obtain between the body state of the perceiver and the embodied mental life of the perceived creature; and the same has to be true *vice versa*. It is this dual, and mutual, connection that gives rise to shared experience. I sketched above what this meant for the phenomenology of space in such experiences. And a parallel story can be told about action-guiding simple feelings, which on my account are part and parcel of perceptual episodes quite generally. To characterise a cross-creaturally embodied simple feeling, I have to invoke a constitutive tie between the subjective aspect of my perceptual experience, and both my and your body state. The embodiment of my felt desire to advance the ball (say) is to be spelled out by means of reference not only to my behaviour, but also to yours; and the reverse holds true for you. Just as the enjoyment of an experience of the space in which intersubjective activity takes place as *ours* is possible even where the visual content of the experience is distinct for each creature, sharing a feeling in this sense does not depend on the identity of the experience's visual

content for all concerned. It is simply that the non-sensory aspects of the experience (spatial awareness, subjective component) are integrated in a complex system which, on both the empirical-neuronal and conceptual levels, is extended across the involved creatures. This, of course, is a highly speculative idea whose substantiation will ultimately have to involve empirical experiments. But it has the undeniable advantage of being able to integrate the insight that certain social cognitive capacities are correlated to mirror neuronal activity without placing undue stress on the explanatory power of experiments that observe, as all current evidence involving mirror neurons does, the discharge of very small numbers of such neurons.

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