Conscious Intentions

The Social Creation Myth

Elisabeth Pacherie

What are intentions for? Do they have a primary purpose or function? If so, what is this function? I start with a discussion of three existing approaches to these questions. One account, associated with Michael Bratman's planning theory of agency, emphasizes the pragmatic functions of intentions: having the capacity to form intentions allows us to place our actions more firmly under the control of deliberation and to coordinate our actions over time. A second account, inspired by Elizabeth Anscombe's theory of intentions, emphasizes their epistemic function and their contribution to self-knowledge. A third account, developed by David Velleman, suggests instead that the capacity for intentions may be an accident or a spandrel, that is, a byproduct of some more general and fundamental endowments of human nature. I argue that these accounts are at best partial and largely overlook two important dimensions of intention. I introduce and motivate a further pragmatic function of intentions, namely their role in the control and monitoring of ongoing action and argue that acknowledging the existence and importance of this function allows us to plug gaps in these accounts. I further argue that this pragmatic function of intentions plays a crucial role in contexts of joint action where agents must align their representations in order to coordinate their actions towards a joint goal. I speculate that a capacity for conscious control might have become established because of the role it served in solving inter-agent coordination problems in social contexts and because of the benefit conferred by the forms of cooperation it thus made possible.

Keywords
Action coordination | Conscious action control | Intention | Joint action | Planning | Representational alignment | Self-knowledge

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1 Introduction

What are conscious intentions for? What do we gain from having a capacity for intentions as opposed to simply a capacity for desire-belief motivation? Do intentions have a function not just in the sense that they have a causal role but in the normative sense in which having this function confers benefits on intention-forming creatures that explain why these creatures have this capacity. In other words, do intentions have a teleofunction? Is there something they are for? And if so, what is this teleofunction?

Roughly, the notion of intention is that of a mental state that represents a goal (and means to that goal) and contributes through the guidance and control of behavior to the realization of what it represents. Thus, my intending to go to my office will control and guide my behavior (e.g., leaving my house, taking the bus, walking from the bus stop to my office), thus contributing to the realization of the goal represented by the intention. Many philosophers hold the view that if we do something intentionally, we must be aware of what we are doing.

Therefore, they consider that it is of the essence of intentions to be conscious. I have argued elsewhere (Pacherie 2008) in favor of a notion of motor intentions whose contents may not always be accessible to consciousness. On my view then, the phrase "conscious intentions" need not be pleonastic. Here, however, my focus will be on intentions qua conscious states and I will use "conscious intentions" and "intentions" interchangeably.

In his 2007 paper, "What good is a will?", David Velleman considers the question whether the human will, understood as the capacity for (conscious) intentions, has a purpose or teleofunction. He discusses two accounts that assume that the will has a purpose but disagree on what this purpose is. On one account, associated with Bratman's planning theory of agency, the primary function of intentions is pragmatic: having the capacity to form prior intentions is good because it allows us to place our actions more firmly under the control of deliberation and to coordinate our actions over time. On the other account, inspired by Anscombe's theory of intentions, the primary function of intentions is epistemic. Intentions are good because they provide self-knowledge: an intention on which one acts provides us with a special kind of knowledge of what one is doing.

David Velleman is himself skeptical that the attitude of intention has a teleofunction. Rather, he suspects that the human will is an accident or a spandrel, that is a byproduct of some more general and fundamental endowments of human nature. Velleman suggests, however, that our hypotheses about the origins of the will, including his own, must be closer to creation myths than to scientific theories. Talk of myths, of course, has both negative and positive connotations. On the negative side, myths are, if not downright false or unfounded, at least ultimately unverifiable. On the positive side, myths are dramatization devices that serve to highlight, and make sense of, the value or function of a practice, of an institution or, in the case at hand, of a cognitive capacity. Here, I will offer my own creation myth for intentions, a myth that emphasizes the social dimension and social function of conscious intentions. The main claim I will defend is that having conscious intentions is a good thing in large part because it facilitates coordination and cooperation with others and because cooperation is itself fitness enhancing. My aim in proposing this social creation myth is not to entirely displace other creation myths, but rather to complement them, to highlight an important facet of conscious intentions that traditional philosophy of action has tended to neglect and to plug some holes in the stories told in other myths.

Here's how I will proceed. In section 2, I will present the two creation myths considered and rejected by Velleman and discuss some difficulties they raise. In section 3, I will discuss Velleman's own creation myth. In section 4, I will introduce and motivate a pragmatic function of intention largely overlooked by these creation myths, namely their role in the control and monitoring of ongoing actions. In section 5, I will tell my own social creation myth. I'll argue that this pragmatic function of intentions plays a crucial role in contexts of joint action where agents have to align their representations in order to coordinate their actions towards a joint goal. I'll speculate that the main evolutionary benefit conferred by a capacity for conscious intentions is that it enables a considerable increase in the possibilities for joint action and cooperation.

2 Two teleological creation myths

Velleman (2007) points out a methodological assumption common in functionalist psychology, namely the assumption that our attitudes or cognitive faculties have a function not just in the sense that they have a causal role but in the sense that they have a purpose, something they are designed to do and thus ought to do. Functions in this latter sense are commonly called teleofunctions. This methodological assumption needs not entail a belief in some intelligent designer. Instead, it can be cashed out by appealing to evolutionary theory and to natural selection as a blind designer. Typically, the evolutionary story goes like this: a trait has the teleofunction of producing effect E just in case producing this effect conferred some benefit that

contributed to the reproductive success of organisms endowed with the trait and, thereby, to the propagation of the trait itself. This methodological assumption, when it guides our inquiry into intentions, leads us to take the question what intentions are for, i.e., what purpose are they meant to serve, as necessarily meaningful and demanding an answer.

Velleman discusses two teleological stories meant to answer this question. He links the first story to Bratman's theory of intentions (1987) and the second to Anscombe's theory (1963). I start with the story inspired by Bratman's theory.

We are, in Bratman's words, planning agents regularly making more or less complex plans for the future and guiding our later conduct by these plans. This planning ability appears to be if not unique to humans at least uniquely developed in the human species. People can, and frequently do, form intentions concerning actions not just in the near but also in the distant future. Why should we bother forming future-directed intentions? What purposes can it serve? What benefits does it bring us? What features of future-directed intentions allow them to serve these purposes?

Bratman offers two complementary answers to that challenge. The first stems from the fact that we are epistemically limited creatures: our cognitive resources for use in attending to problems, gathering information, deliberating about options and determining likely consequences are limited and these processes are time consuming. As a result, if our actions were influenced by deliberation only at the time of action, this influence would be minimal as time pressure isn't conducive to careful deliberation. Forming future-directed intentions makes advance planning possible, freeing us from that time pressure and allowing us to deploy the cognitive resources needed for successful deliberation. Second, intentions once formed commit us to future courses of action, thus making the future more predictable and making it possible for agents to coordinate their activities over time and to coordinate them with the activities of other agents. Making deliberation and coordination possible are thus the two main benefits that accrue from a capacity to form future-directed intentions.

What makes it possible for future-directed intentions to yield these benefits is, according to Bratman, the fact that they essentially involve commitments to action. Bratman distinguishes two dimensions of commitments: a volitional dimension and a reasoning-centered dimension. The volitional dimension concerns the relation of intention to action and can be characterized by saying that intentions are "conduct-controlling pro-attitudes" (Bratman 1987, p. 16). In other words, unless something unexpected happens that forces me to revise my intention, my intention today to go shopping tomorrow will control my conduct tomorrow. The reasoning-centered dimension of commitment is a commitment to norms of practical rationality and is most directly linked to planning. What is at stake here are the roles played by intentions in the period between their initial formation and their eventual execution. First, intentions have what Bratman calls a characteristic stability or inertia: once we have formed an intention to A, we will not normally continue to deliberate whether to A or not. In the absence of relevant new information, the intention is rationally required to resist reconsideration: we will see the matter as settled and continue to so intend until the time of action. Intentions are thus terminators of practical reasoning about ends or goals. Second, during this period between the formation of an intention and action, we will frequently reason from such an intention to further intentions. For instance, we reason from intended ends to intended means or to preliminary steps. When we first form an intention, our plans are typically only partial, but if they are to eventuate into action, they will need to be filled in. Thus intentions are also prompters of practical reasoning about means. Third, because intentions are commitments to action, our intentions should be jointly executable. Finally, taken together the volitional and the reasoning-centered dimensions of commitments help explain how intentions can promote coordination. They provide support for the expectation that agents will act as they intend to and these ex-

pectations are central in turn to both inter- and intra-personal coordination. In particular, this is what motivates the rational agglomerativity requirement on intentions, i.e., the requirement that my intentions be jointly executable.

The benefits that accrue from a capacity for intentions are, ultimately, pragmatic benefits. As Bratman puts it, future-directed intentions "enable us to avoid being merely time-slice-agents" (1987, p. 35). Instead of constantly starting from scratch in our deliberations and simply weighing current belief-desire reasons, intentions allow us to become temporally extended agents. They provide a background framework that allows us to expand the temporal horizon of our deliberation while at the same time narrowing its scope to a limited set of options. In so doing they contribute in the long run to our securing greater desire-satisfaction than simple desire-belief practical reasoning would.

Velleman (2007) sees three main problems with Bratman's pragmatic account of what intentions are for. The first problem concerns the status and role of present-directed intentions. On Bratman's account, a future-directed intention requires a present-directed intention to convey its motivational force and guide the action once the time to act is seen to have arrived. Bratman identifies no further role or function of present-directed intentions beyond conveying the motivational potential of future-directed intentions. At the same time, he insists that intentional actions, whether or not they are preceded by future-directed intentions, always involve present-directed intentions. This leaves us with a potentially large class of spontaneous intentional actions that involve present-directed intentions but are not preceded by future-directed intentions. These intentions do not incorporate the results of any prior deliberation, they don't set the stage for any further planning and they don't provide a basis for any coordination. The first worry raised by Velleman is thus that these intentions do not seem to serve any of the pragmatic purposes that, on Bratman's account, constitute the raison d'être of intentions. Second, Velleman points out that a similar worry arises for the intentions involved in various cases of planning. He illustrates his point with a voting example. He argues that while there may be good reasons for my starting to think about my vote in advance, such as giving me sufficient time to deliberate, there doesn't seem to be any good reason for settling in advance of my arrival in the voting booth whom I will vote for. On the contrary, settling in advance seems to carry potential costs, by making me resistant to reconsideration, without procuring any benefits, since the actual act of casting my ballot doesn't require any particular prior preparation. Thus, at least in these cases where no further planning is needed once one has settled on a course of action, it is unclear what purpose settling in advance could serve.

Velleman's third worry relates to Bratman's view that intention need not imply belief. Bratman indeed maintains that "there need be no irrationality in intending to A and yet still not believing one will", but that, in contrast, "there will normally be irrationality in intending to A and believing one will not A" (1987, p. 38). According to Velleman, this view of Bratman's leaves much of his functional account of intentions unmotivated. In particular, it becomes unclear why in intending to A, an agent should be rationally required to identify means of *A*-ing or to rationally constrain her subsequent practical reasoning by ruling out options inconsistent with her *A*-ing, if she is agnostic whether she will in fact carry out her intention. Similarly, it becomes unclear why we should impose an agglomerativity requirement on intentions. As Velleman points out, it is unclear why intentions should be jointly executable if the agent can be agnostic as to whether they will be executed.

In my view, Velleman's third worry is exaggerated. Firstly, while Bratman indeed maintains that an intention to *A* does not require belief that one will *A*, he insists at the same time that an intention to *A* normally supports the belief that one will *A*. Secondly, Bratman also makes the point that agnosticism about whether one will act as intended does not directly undermine coherent planning but makes it more complex, leading us to form conditional intentions and plans for both failure and success to act as intended. Of course,

the viability of such a move depends on agnosticism being the exception rather than the rule; otherwise, we would have an unmanageable proliferation of conditional branching in our plans.

Velleman's first and second worries run deeper. If the only purposes of intentions are the pragmatic functions Bratman identifies, then there appear to be many instances where intentions don't serve these purposes or where serving them is actually counterproductive. This may be taken to indicate that Bratman's account is incomplete and that he has overlooked some of the functions intentions serve. This line of thought can be pursued in two different directions. On the one hand, we may try to identify further pragmatic functions that intentions, including present-directed intentions, could serve; on the other hand, we may look for non-pragmatic functions that intentions could serve. As we will now see, Velleman explores the second option, turning to Anscombe's theory of intentions in search of an answer. In contrast, what I will do myself later in this paper is explore the first option, giving it a social twist.

Velleman argues that Bratman's account of intentions misses an important function of intention, a function that is a central theme in Anscombe's theory of intention. In her book Intention (1963), she argues that intentions provide us with a special kind of self-knowledge and claims that this knowledge is special in two ways. It is knowledge of our own intentional actions, i.e., knowledge not just of what one is attempting to do, but of what one is actually doing, and it is knowledge without observation. Much philosophical ink has been spilled on how exactly these two claims should be interpreted. Following Falvey (2000), Velleman favors a reliabilist interpretation of these claims. According to this interpretation, knowledge of one's own intentional actions is non-observational because it is given by the content of our intentions and intentions in turn normally constitute (practical) knowledge of our own intentional actions because they reliably cause the facts that make them true. Note also, that on this reliabilist reading, Anscombe's claim is not that the content of our intentions provides us with infallible knowledge of what we are doing. To say that there normally exists a reliable connection between our intentions and actions is not to say that there cannot be cases when this connection does not obtain. However, as Velleman emphasizes, on Anscombe's account, failures of reliability undermine not just the epistemic status of intentions, they also undermine the intentionality of actions. If my intending to A does not reliably cause my A-ing, then, on the one hand, my intending to A will not amount to knowledge that I am A-ing and, on the other hand, my A-ing when it happens will be an accident rather than an intentional action. According to Anscombe, intentional actions are those "to which the question 'Why?' is given application" (1963, p. 9) and having practical knowledge is knowing a description of what one is doing, has done or is proposing to do that answers the question "Why?". Thus, the basic epistemic function of intentions is to provide us with a form of self-knowledge and self-understanding qua intentional agents.

According to Velleman, acknowledging this epistemic function of intentions does much to alleviate the worries raised by Bratman's practical account. With respect to the first worry – that present-directed intentions serve no purpose – one can now argue that while they might serve no practical purpose they still serve an epistemic function. With respect to the second worry – that on many occasions making one's mind in advance serves no pragmatic purpose –, one can now reply that in matters that are important to one's self-conception, uncertainty about one's future behavior is both uncomfortable and undesirable and that forming an intention allows us to gain self-knowledge and avoid this mental discomfort. With respect to the third worry – that absent a strong enough connection between intention and belief, it is unclear why intentions should be subject to the practical rationality requirements emphasized by Bratman–, Anscombe's theory regarding the epistemic function of intentions lets us see how the epistemic role of intentions could support their pragmatic functions.

The story as told so far suggests that we should think of the epistemic and pragmatic

functions of intentions as complementary. However, as Velleman points out, it still leaves us with two possible hypotheses or creation myths about the origin and ultimate purpose of intentions. On the pragmatic creation myth, the ultimate purpose of intentions would be pragmatic and their epistemic function would be subservient to their pragmatic functions, but may occasionally exemplify re-purposing: "That is, intention might have been designed to embody self-knowledge for the sake of facilitation coordination, but it might then be used on occasion, for the sake of self-knowledge alone, when coordination isn't necessary" (Velleman 2007, p. 208). By contrast, on the epistemic creation myth, the ultimate purpose of intentions may be to embody self-knowledge, and the pragmatic functions of intentions might have emerged simply as a fortuitous by-product of self-knowledge.

While Velleman has more sympathy for the epistemic than for the pragmatic creation myth, he thinks both should ultimately be rejected. In the next section, I'll consider his reasons for rejecting them, discuss the alternative story he proposes, and advance my own reasons for being skeptical about this story.

3 Velleman's spandrel

Despite their differences, the epistemic and the pragmatic creation myths rest on the common assumption that intentions have a teleofunction, some ultimate purpose they are designed to serve. Velleman thinks it is more plausible that their existence is an accident, that is to say, that they are the byproduct of some more general endowments of human nature. In other words, Velleman is tempted to think of the human will as, in Gould & Lewontin's phrase (1979), a spandrel, a feature formed not by design but as an accidental byproduct of some other designed feature or features. This leads him to be skeptical about both teleological myths. In telling his own creation myth, Velleman pursues two aims. His first aim is to show that the assumption behind the two teleological myths can be dispensed with. His second aim is to show that the accident that led to the emergence of the human will more closely approximates the epistemic than the pragmatic creation myth.

Velleman's own account of intentions characterizes them as an agent's commitment to the truth of some act-description of his or her forthcoming behavior that reliably causes this act-description to come true. He argues that this account of intentions "posits nothing more than the predictable consequences of two motivational states whose utility in the design of a creature is far more general than that of the human will" (Velleman 2007, p. 211). In other words, the human will is a spandrel, a feature arising from the accidental confluence of two designed features. What are these two features? The first, according to Velleman, is curiosity, defined as the creature's drive to understand what goes on in its environment. The second is self-awareness, through which the creature realizes that it is part of its environment and that its own behavior is part of what goes on in this environment. Self-awareness thus allows a creature to acquire an objective conception of itself. A creature that is both curious and self-aware will in turn be driven to understand its own behavior, that is, to understand "how the egocentrically conceived world of doing things is connected to the objectively conceived world of things understood" (Velleman 2007, p. 211). In understanding this, it will have acquired the capacity for intentions.

We can now see why Velleman thinks his own creation myth has more affinities with the epistemic than with the pragmatic creation myth. Curiosity is an epistemic drive and self-awareness is an epistemic capacity. As their byproduct, the capacity for intentions inherits this essential epistemic dimension. We can also understand why he means his own myth as an antidote to the methodological assumption inherent to the idea that intentions serve a specific teleofunction. Curiosity and self-awareness are, Velleman claims, designed for far more general purposes than that of the human will.

I think, however, that this is also where the creation myth told by Velleman reaches its limits. Important questions are left unanswered: What are these more general purposes served by curiosity and self-awareness? What good is curiosity?

What good is self-awareness? Unless he is willing to consider the will as a spandrel of spandrels, Velleman owes us answers to these questions. From an evolutionary point of view, it is unclear what benefits knowledge of their environment and knowledge of themselves could confer on creatures endowed with curiosity and self-awareness unless this knowledge found some behavioral expression. It isn't too difficult to see how a better understanding of their environment can promote more effective behavior, enhance the satisfaction of desires and needs, and ultimately have a differential impact on reproductive success in creatures endowed with curiosity. One should note, however, that pushing Velleman's story one step further in his direction has the effect of undermining his claim that his own myth has strong affinities with the epistemic creation myth for it suggests that the epistemic function of curiosity is ancillary to its pragmatic function, rather than the reverse.

It is less obvious how we should answer the question what good is self-awareness, what purposes it is designed for. My aim in the next two sections will be to remove two obstacles that prevent us from looking in the right direction for an answer to this question. The first obstacle lies in the fact that philosophers have tended to neglect an important pragmatic function of intentions. Thus, Velleman notes, rightly in my view, that Bratman's account of the pragmatic functions of intentions leaves many present-directed intentions without a purpose. However, rather than looking for some further pragmatic purpose intentions may serve, beyond scheduling deliberation and enhancing action coordination over time, Velleman turns his attention to epistemic functions. I will argue in section 4 that they both neglect a further important pragmatic function of intentions, namely their role in the online monitoring and control of action. The second obstacle lies in the fact that one central feature that makes us human, our deep sociality, is either ignored or at best a peripheral concern in philosophical accounts of intentions. Of course, I am not denying the obvious: many philosophers, and Bratman prominently among them, have explored joint agency and collective intentionality. Typically, however, their focus has been on whether or not joint agency should be seen as continuous with individual agency and thus on whether or not the conceptual framework developed to account for individual intentions could be fruitfully extended to shared intentions.[1] Rarely if ever, however, do they consider the possibility that shared intentions may shed light on some of the features and functions of individual intentions. In section 5, I will argue that the control and monitoring function of intentions plays a crucial role in contexts of joint action. I will further argue that this function might indeed be the primary function of intentions and might have become established because of the role it serves in solving the coordination problems that arise in joint action and because of the benefit thus conferred on creatures capable of solving these coordination problems.

4 Control: A further pragmatic function of intentions

Bratman (1987) considers future-directed intentions as the central case of intending to act and contrasts this approach to intention with an alternative approach that gives priority to immediate intentions or intentions in action. He notes that this second approach naturally leads to the idea that intentions in action reduce to complexes of beliefs and desires, i.e., that what makes it the case that an agent acts with a certain intentions are simply facts about the relation between the agent's actions and his beliefs and desires, and that this in turn tempts us into thinking that the same reductive strategy can be extended to future-directed intentions.[2] Focusing instead on future-directed intentions as the central case of intending allows us to identify functions of intentions that cannot easily be accommodated within a belief-desire model and thus makes the reductive strategy much less appealing. This would account for Bratman's emphasis on the deliberative and coordination functions of intentions. The flip side of the coin, however, is that present-directed intentions are then seen as little more than transmission belts needed to convey the motivational force of future-directed intentions. As noted by

1 See e.g., Bratman (2014) for a positive answer to these questions and Gilbert (1992, 2009) for a negative answer.

2 See for instance Davidson (1980, Essay 1) and Goldman (1970) for belief-desire reductive models of intentions.

Velleman, this leaves us with a potentially large class of actions where present-directed intentions appear to have no role to play, namely all these actions that are intentional yet not preceded by future-directed intentions. What belief-desire reductive approaches, Bratman's account and Velleman's account all seem to overlook is a specific pragmatic function of intentions in action or present-directed intentions, namely their role in the guidance, control and monitoring of action execution.

Harry Frankfurt (1978) was one of the first philosophers to criticize this oversight and insist on the importance of this pragmatic function of intentions. He emphasized that "a person must be in some particular relation to the movements of his body during the period of time in which he is presumed to be performing an action" (Frankfurt 1978, p. 157) and characterized this relation as one of guidance. Other philosophers have since shared his insight. For instance, Brand (1984), Bishop (1989) and Mele (1992) all insist that an adequate account of intentions should incorporate the guiding and monitoring roles of intentions in order to properly capture the close and continuous connection between intention and ongoing action.

The main reason why this connection between intention and ongoing action is needed is that human agents are neither infallible nor omniscient. Their expectations about the circumstances in which the action is to take place may not always be correct and they may fail to anticipate some of the relevant aspects of the situation of action. In other words, their situational beliefs may be incorrect or incomplete. The same goes for their instrumental beliefs. Suppose, for instance, that I intend to visit a colleague in her office. I may be wrong in thinking that this is the door to her office (incorrect situational belief) or unsure which door is her office door (lack of relevant situational belief). Similarly, I may also be wrong in thinking that I should pull the door to open it (incorrect instrumental belief) or unsure whether to push or pull (lack of relevant instrumental belief). If intentions are to reliably produce behavior matching their representational content (e.g., visiting my colleague in her office), they should have some flexibility and incorporate monitoring processes to detect deviations that jeopardize the success of the action and correction processes to trigger compensatory activity.

This emphasis on control finds a strong echo in the literature on motor cognition (see, e.g., Jeannerod 1997, 2006). Indeed, it is in this literature that we can find the most precise characterization of the monitoring and control functions of intentions and of the mechanisms that support them. According to the very influential internal model theory of motor control, motor control strategies are based on the coupling of two types of internal models: inverse models and forward models (Frith et al. 2000; Jordan & Wolpert 1999; Wolpert 1997). Inverse models compute the motor commands needed for achieving a desired state given the current state of the system and of the environment. An efference copy of these commands is fed to forward models, whose role is to make predictions about the consequences of the execution of these commands. The control of action is thought to depend on the coupling of inverse and forward models through a series of comparators: error signals arising from the comparison of desired, predicted, and actual states (monitoring) are used for various kinds of regulation (control). In particular, they can be used to correct and adjust the ongoing action in the face of perturbations, as well as to update both inverse and forward models to improve their future functioning.

Recent experimental work in motor cognition also suggests, however, that much of action control is automatic and proceeds independently of conscious awareness. For instance, in an experiment (Castiello et al. 1991) participants were asked to reach for and grasp a target as quickly as possible and their hand trajectories were recorded. On some trials, though, the target shifted position after the movement had started. When this happened, participants were instructed to correct their movement in order to reach accurately for the target and to signal the time at which they became aware of its displacement by shouting "Tah!". The experiment showed that the participants started correcting

their movements more than 300ms before they signaled awareness of the target displacement. A subsequent study (Pisella et al. 2000) was especially instructive. In a first experiment they used a similar paradigm but introduced a condition where participants were requested to interrupt their movement when the target changed location. Despite the instruction, the participants could not prevent themselves from correcting their movements instead of stopping for a good 200 ms. In contrast, however, in a second experiment green and red targets were presented simultaneously in the two positions and the participants' task was to point at the green one. On some trials, the color of the two targets could be unexpectedly interchanged at movement onset. When this happened, one group of participants was instructed to interrupt their ongoing movement and the other group to correct it. In contrast to what happened in the first experiment, no automatic corrective movements were observed in the group instructed to interrupt their movement and in the other group corrections involved a significant increase in movement time. Thus, these results suggest that while corrections made in response to spatial perturbations are under automatic control, corrections in response to chromatic perturbations require intentional control.

On the one hand, the mere fact that some or much of action control can be automatic is not a sufficient reason to deny a control function to intentions. The experimental studies presented in the previous paragraph suggest that action control can indeed operate automatically and outside of conscious awareness and that when there is a conflict between automatic and intentional control, automatic control may take precedence over intentional control. Yet, they also provide evidence that some corrections cannot be carried out automatically but depend on intentional control. On the other hand, the mere fact that intentional control seems needed to compensate for chromatic perturbations may not provide sufficient ground for considering that the intentional control of action execution is a central function of intentions. One would want a more systematic account of the respective roles of automatic and intentional control. Recent developments of the internal model approach to motor control may constitute a useful guide.

While the internal model approach to motor control was initially introduced to account for fine-grained aspects of motor control, more recent versions of this approach emphasize the hierarchical nature of motor control (Hamilton & Grafton 2007; Jeannerod 1997; Kilner et al. 2007). They propose that internal inverse and forward models are arranged in a hierarchy and that error signals generated at one level of the hierarchy can propagate to the next level when correction mechanisms at this level are not able to make the necessary compensations. I have suggested elsewhere (Pacherie 2008) that one can distinguish three broad levels in an action specification hierarchy. At the highest level, action representations represent the whole action as a unit, in terms of its overarching goal and of the sequence of steps or subgoals needed to achieve that goal. At this level, the action may still be represented in a rather abstract format. The second level is concerned with the implementation of each step in the action plan and involves selecting an appropriate motor program given the immediate goal and contextual information about the current state of the agent and the current state of its environment. In other words, processes at this level are in charge of anchoring the successive steps of the action plan in the current situation and of selecting appropriate motor programs. Finally, once a motor program has been selected, the exact values of its parameters must still be set. This is done at the third level, where incoming sensory information about external constraints is used to specify these values.

Acknowledging the existence of different levels of action control corresponding to these different levels in the action specification hierarchy may allow us to accommodate both automatic and intentional action control processes. As long as error signals can be reduced by automatic corrections made at lower levels in the hierarchy, there is no need for the intervention of intentional control. However, there are two classes of cases where automatic corrections may not be sufficient to put an action back on

track. First, important external perturbations can lead to discrepancies that are too large to be automatically compensated. In such a case, error signals would propagate upwards, we would become aware of them and shift to a conscious, intentional compensation strategy. Second, in some instances there may also be discrepancies in the ways the action is or can be specified at different levels of the action representation hierarchy (inter-level representational misalignment). Thus, the study by Pisella and colleagues (Pisella et al. 2000) suggests that action specification at the sensorimotor level does not encode chromatic information and uses spatial information as a proxy for it. When chromatic information and spatial information vary independently, as they do in one of the conditions of the experiment, representations at different levels of the action representation hierarchy become misaligned and the intervention of conscious control becomes necessary to realign them.

Importantly, on this conception of intentional control and as Frankfurt had already noted, what is essential for actions to be intentionally controlled is not that intentional control processes actually affect their course, but that these control mechanisms would have intervened to adjust the action had the need arisen. In other words, an action may be intentionally controlled even though automatic rather than voluntary control mechanisms intervene to compensate for deviations, provided these voluntary control mechanisms would have kicked in, had automatic corrections proved insufficient.

Even more importantly, if action control is an essential function of intentions, then we should stop thinking of intentions as simply mental representations of goals somehow triggering motor processes that, if everything goes well, will yield the desired outcome. Rather, we should think of monitoring and control processes as intrinsic to intentions, that is, of intentions as encompassing not just representations of goals but also a specific set of monitoring and control processes organizing and structuring the motor processes that themselves generate movements.

In this section, I argued for the idea that the control of action execution is an important pragmatic function of intentions. Acknowledging the existence and importance of this function allows us to plug gaps in the creation myths considered earlier. First, it allows us to attribute a specific pragmatic function to present-directed intentions rather than considering them as mere transmission belts in charge of conveying the motivational force of future-directed intentions. We can thus assuage one of the main worries raised by Velleman against Bratman's pragmatic account of intentions and the pragmatic creation myth derived from it. Second, Anscombe's and Velleman's accounts of intentions both assume that intentions reliably cause behavior that matches their representational content. Human agents, however, are neither infallible nor omniscient. Their situational and instrumental beliefs can be incorrect or they can lack situational and instrumental beliefs that are relevant to the successful execution of their intentions. Thus, the reliability demanded by Anscombe's and Velleman's accounts largely depends on our having powerful and flexible control processes allowing us to put our actions back on track when perturbations deviate their course.

One may agree that the conscious control of individual action is a function of intention in the sense that intentions have this causal role, but still be skeptical that this is the role intentions are designed for, or to put it in other words, that it is a teleofunction of intentions. Thus, one could argue that very large external perturbations are rare and that inter-level representational misalignment is the exception rather than the rule. If so, most of action control would be automatic anyway and intentional action control would play at best a marginal role. It would therefore be unlikely to confer on intention-forming creatures benefits important enough to warrant the claim that intentions are designed for action control. As I have tried to argue in this section, the benefits conferred by online conscious control over actions are not as negligible as this deflationary view implies. In addition, I think we can build a very strong case that conscious action control confers im-

portant benefits if we consider joint activities rather than just individual actions. Acting jointly demands that we solve coordination problems that do not arise (or arise only in a very attenuated form) in individual action. In what follows, I will argue that online conscious control plays a crucial role in solving these coordination problems. I will further speculate that conscious online control over actions might indeed have become established as the primary function of intentions because of the role it served in solving these coordination problems and because of the benefit this conferred on creatures capable of solving these coordination problems and thus of acting jointly in an efficient and flexible way.

5 The social creation myth

Humans have been characterized as the ultra-cooperative species (Tomasello 2009, 2011). This ultra-cooperativeness has made us one of the most successful species on earth, spreading all over the planet, creating and developing cultural artifacts and practices that are themselves culturally transmitted and accumulate over time, thus giving us a further competitive edge over other species. According to Tomasello, underlying humans' ultra-cooperativeness are a set of species-unique skills and motivations for shared intentionality, involving "such things as the ability and motivation to form shared goals and intentions with others in collaborative activities, and the ability and motivation to share experience with others via joint attention, cooperative communication, and teaching" (2011, p. 6).

The gist of the social creation myth I am proposing in this section is that the main benefits associated with intentions and with the kind of control over actions they make possible arise in social cooperative contexts where agents have to coordinate their actions to achieve a shared goal. I start with an examination of the special demands for coordination acting jointly with others creates. I then explain how the capacity to form conscious intentions is a crucial component of our ability to meet these demands.

Successful joint action depends on the efficient coordination of participant agents' goals, intentions, plans, and actions. As I argued elsewhere (Pacherie 2012), it is not enough that agents control their own actions, i.e., correctly predict their effects, monitor their execution and make adjustments if needed. They must also coordinate their actions with those of their co-agents so as to achieve their joint goal. For that they must monitor their partner's intentions and actions, predict their expected consequences and use these predictions to adjust what they are doing to what their partners are doing. The implication of these processes, however, is not unique to joint action nor enough to promote their success. In competitive contexts they also play an important role. For instance, in a fight being able to anticipate your opponent's moves and to act accordingly is also crucial. What is furthermore required in the case of joint action is that co-agents share a goal and understand the combined impact of their respective intentions and actions on their joint goal and adjust them accordingly. In competitive contexts, an agent should typically aim at predicting his opponents' moves, while at the same time endeavoring to make his own moves unpredictable to his opponents. In contrast, in cooperative contexts mutual predictability must be achieved for efficient coordination towards a shared goal to be possible. Agents should be able to align their representations of what themselves and their partners are doing and of how these actions together contribute to the shared goal.

Various forms of uncertainty can undermine mutual predictability, the alignment of representations and hence coordination. They can be organized into three broad categories. The first category involves motivational uncertainty: we can be unsure how convergent a potential partner's interests are with our own interests and thus unsure whether there are goals we share and can promote together. The second category involves instrumental uncertainty: even assuming that we share a goal, we can be unsure what we should do to achieve that goal, or, if we have a plan, unsure how roles should be distributed among us, or, yet, unsure when and where we should act. The third category involves common ground uncertainty: we can be

unsure how much of what is relevant to our deciding on a joint goal, planning for that goal and executing our plan is common ground or mutually manifest to us.

Philosophical accounts of joint agency, including Bratman's (2009, 2014) do not ignore these challenges but they are essentially concerned with high-level processes involved in making decisions about whether or not to act together and in advance planning. Their focus is on the coordination of agent's intentions prior to acting and they pay little heed to the processes enabling people to coordinate during action execution. In contrast, in the last decade, cognitive scientists have investigated joint action by focusing on lower-level online coordination processes in relatively simple joint tasks and on the factors that affect these coordination processes. In what follows, I will argue that there are important limitations to what these advance and online coordination processes can achieve and that high-level online intentional control is crucial to overcoming these limitations. First, however, let us consider the main characteristics of the two sets of coordination processes philosophers and psychologists typically focus on.

Bratman's account of shared intentions is a good illustration of the way philosophical accounts approach coordination issues in joint action. In addition, its explicitness makes it possible to see clearly what advance coordination involves and how it is achieved.

Bratman (2009) proposes that shared intention involves the following conditions as its main building blocks:

1. Intentions on the part of each in favor of the joint activity.
2. Interlocking intentions: each intends that the joint activity go in part by way of the relevant intentions of each of the participants.
3. Intentions in favor of meshing subplans: each intends that the joint activity proceed by way of subplans of the participants that are co-realizable and can be consistently agglomerated.
4. Disposition to help if needed: given that the contribution of the other participants to the joint activity is part of what each intends, and given the demands of means-end coherence and of consistency that apply to intentions, each is under rational pressure to help others fulfill their role if needed.
5. Interdependence in the persistence of each participant's relevant intention: each believes that the persistence of the other participants' intention in favor of the joint activity depends on the persistence of his own and vice-versa.
6. Joint-action-tracking mutual responsiveness: each is responsive to each in relevant subsidiary intentions and in relevant actions in a way that tracks the joint action.
7. Common knowledge among all participants of all these conditions.

Let me offer some comments on these conditions. First, Bratman offers these conditions as a set of sufficient conditions for a shared intention, leaving it open that shared intentions may be realized in other ways, in particular in cases of joint activities involving institutions. Second, conditions (1), (2) and (5) are meant to deal with motivational uncertainty. Bratman points out that the concept of a joint activity that figures in the contents of the intentions in (1) should be understood in a way that is neutral with respect to shared intentionality. So condition (1) only insures that agents share goals in a weak sense of the notion. Rather it is condition (2) that is in charge of insuring that the motivational states of the agents align in the way required for joint cooperative activity: it is the fact that for each participant, the content of their intention refers to the role of the intentions of other participants that, for Bratman, captures the intentional jointness of their actions. Condition (5) in turn specifies how these motivations stay aligned. Third, conditions (3), (4) and (6) relate to means-end uncertainty and are meant to reduce it. According to Bratman, they can be derived from condition (2) taken together with the norms of practical rationality that already govern individual planning and acting. Bratman's key idea is that the interlocking and interdependent intentions of individual participants, in responding to the norms of

practical rationality governing individual planning agency, will also respond to the norms of social agglomeration and consistency, social coherence and social stability shared intentions are subject to. This would involve, in Bratman's terms, commitments to mutual compatibility of relevant sub-plans, commitments to mutual support, and joint-action tracking mutual responsiveness. Finally, the function of condition (7) is, rather obviously, to reduce common ground uncertainty.

Bratman's basic idea is thus that this structure of interlocking and interdependent intentions, when it functions properly, frames relevant bargaining and shared deliberation and thus supports and guides coordinated planning and action in pursuit of the intended shared activity. Unsurprisingly, since Bratman's theory of joint agency is continuous with his planning theory of individual intentions, it is in virtue of the pragmatic functions intentions already serve in the individual action case that the interlocking and interdependent intentions of individual participants can also support coordination in the joint action case.

While Bratman, in his condition (6), stipulates that agents should be mutually responsive not just in their relevant intentions and subsidiary intentions but also in relevant actions in a way that tracks the joint action, his account doesn't tell us by what means mutual responsiveness in action is achieved. To know more about this, we have to turn our attention to recent psychological work on joint agency. In contrast to philosophical approaches, cognitive psychology studies of joint action typically focus on the perceptual, cognitive, and motor processes that enable individuals to coordinate their actions with others online.

Knoblich and colleagues (Knoblich et al. 2011) distinguish between two broad categories of coordination processes, emergent and planned. In emergent coordination, coordinated behavior occurs due to perception-action couplings that make multiple individuals act in similar ways. One source of emergent coordination is entrainment, the process of synchronizing two or more actors' rhythmic behaviors with respect to phase (e.g., Richardson et al. 2007). A second source of emergent coordination is perception-action matching, whereby observed actions are matched onto the observer's own action repertoire and can induce the same action tendencies in different agents who observe one another's actions (Jeannerod 1999; Prinz 1997; Rizzolatti & Sinigaglia 2010; Knoblich & Sebanz 2008). Importantly, emergent forms of coordination are independent of any joint plans or common knowledge, which may be altogether absent. They support basic forms of motor and representational alignment that can facilitate mutual responsiveness in action, but they do not ensure that the agent's actions track a joint goal. Indeed, the successful performance of some joint actions may require that these automatic coordination processes be inhibited. For instance, the performance of composer Steve Reich's famous piece, *Drumming*, based on the technique of phasing, requires the musicians to play the same rhythmic pattern out of sync.

In planned coordination, agents plan their own actions in relation to the joint goal and also to some extent to their partners' actions. As emphasized by Knoblich et al. (2011), shared task representations play an important role in planned coordination. Shared task representations do not only specify in advance what the respective tasks of each of the co-agents are, they also provide control structures that allow agents to monitor and predict what their partners are doing, thus enabling interpersonal coordination in real time. Empirical evidence shows that having shared task representations influences perceptual information processing, action monitoring, control and prediction during the ensuing interaction (Heed et al. 2010; Schuch & Tipper 2007; Sebanz et al. 2006; Tsai et al. 2006). Furthermore, several studies (Sebanz et al. 2005; Sebanz et al. 2006) have shown that actors may form shared representations of tasks quasi-automatically, even when it is more effective to ignore one another.

Several researchers have also suggested that joint attention provides a basic mechanism for sharing representations of objects and events and thus for creating a perceptual common ground in joint action (Tomasello & Carpenter 2007; Tollefsen 2005). To act jointly, it is often

necessary not only that the co-agents identify the objects to be acted upon, their location as well as the location of possible obstacles, but also be mutually aware that they do. Joint attention may thus play an important role in ensuring that co-agents track the same objects and features of the situation and be mutually aware that they do. In a recent study, Böckler et al. (2011) showed that attending to objects together from opposite perspectives makes people adopt an allocentric rather than the default egocentric frame of reference. These authors suggest that taking an allocentric reference may support the efficiency of joint actions from different spatial orientations. Independently of mutual manifestness, being able to assess what others are perceiving, or can or cannot perceive at a given moment in time may also facilitate coordination. For instance, a study by Brennan and colleagues (Brennan et al. 2007) demonstrated that co-agents in joint visual search space were able to distribute a common space between them by directing their attention depending on where the other was looking and that their joint search performance was thus much more efficient than their performance in an individual version of the search task.

There are, however, important limitations to what these emergent and planned online coordination processes can achieve. First, to the extent that they exploit perceptual information, they can be of no help unless a certain amount of common perceptual information is indeed available to co-agents. Second, even when common perceptual information is available, there are limits to our processing capacities. An agent may be able to simultaneously track what a small number of other agents are currently doing or attending to, but when the number of agents increases, this capacity soon finds its limits. Our capacity to co-represent the actions, goals, and intentions of other agents we observe acting encounters similar limitations. Understanding of actions through motor resonance and mirroring works only to the extent that the observed actions are part of the action repertoire of the observer. Similarly, when actions are relatively novel, agents may not yet have formed sufficiently detailed shared task representations. Finally, unexpected effects of action execution or failures of coordination may reveal various forms of misalignment between partners' representations or indicate that their representations, though aligned, were inaccurate.

When pre-alignment is insufficient or breakdowns occur due to misalignment in the action execution phase, the deliberate and conscious production of social signals aimed at aligning or realigning relevant representations becomes crucial. Agents cannot count on alignment arising spontaneously. They have to make it happen. Intentional communication, whether verbal or not, is then needed to make it happen.

As emphasized by Herbert Clark (2006), joint activities can typically be partitioned into two sets of actions: a basic joint activity and coordinating joint actions. The basic joint activity comprises all the actions essential to achieving the basic joint goal, while the coordinating joint actions consists in the set of communicative acts about the basic activities that insure relevant representational alignment. To study this partitioning of joint activities, Clark and his co-workers ushered two people in a small room, gave them the parts of a kit for a TV stand and asked them to assemble the stand, videotaping them and recording their verbal exchanges while putting they did it. Here's a short extract of their exchanges, taken from Clark (2006, p. 128):

> Ann Should we put this in, this, this little like kinda cross bar, like the T? like the I bar?
>
> Burton Yeah ((we can do that))
>
> Ann So, you wanna stick the ((screws in)). Or wait is, is, are these these things, or?
>
> Burton That's these things I bet. Because there's no screws.
>
> Ann Yeah, you're right. Yeah, probably. If they'll stay in.
>
> Burton I don't know how they'll stay in ((but))

Ann Right there.

Burton Is this one big enough?

Ann Oh ((xxx)) I guess cause like there's no other side for it to come out.

Burton M-hm.

[8.15 sec]

Burton ((Now let's do this one))

Ann Okay

First, it should be noted that, as often happens in daily life, this joint activity was not planned in advance. Instead, Ann and Burton discover that they have to assemble a TV stand and work out together what they should do as they go along. Second, Clark points out that Ann and Burton's coordinating joint actions are structured in what he calls projective pairs, comprising a proposal and an uptake (i.e., full acceptance, altered acceptance or rejection of proposal). Third, the exchanges can be gestural as well as verbal. For instance, instead of, or concomitantly with, asking verbally whether Burton is ready to fasten the screws, Ann may present him with the screwdriver and his taking it count as acceptance. Fourth, the contents of these exchanges show that they are aimed at reducing instrumental uncertainty. Typically, they are about what should be done and how, who should do what, and when and where it should be done. When the task presents difficulties, they may also serve to reduce motivational uncertainty. For instance, Burton might ask whether they should give it a last try and Ann either acquiesce or reject the proposal. Finally, the structure of the projective pairs shows that at the same time they aim at reducing common ground uncertainty. Proposals are about potential alignments and full acceptance confirms alignment and common ground. Tellingly, with altered acceptance uptakes, projective pairs evolve into projective triads, the third element of the exchange being the proposer's uptake on the alteration.

Importantly, to negotiate and achieve alignment in this way, we must be aware of our own and others' intentions and beliefs and this at two levels, corresponding to the two sides of the partitioning characterized by Clark. On the one hand, it is essential to the fulfillment of communicative intentions that they be recognized as such by the addressee (Grice 1957; Recanati 1986; Sperber & Wilson 1986). On the other hand, what agents communicate in these contexts is information about their beliefs and intentions regarding the joint action. This suggests that the development of self-consciousness and consciousness of other minds, of intentional communication, and of increasingly complex forms of coordinated joint action go hand in hand.

The success of both individual and joint action depends on representational alignment. In the case of individual action, representation alignment takes two main forms. First, at a given level of action specification, a match should be achieved between representations of desired, predicted and actual states. We can call this first form of alignment intra-level alignment. Second, inter-level alignment is also necessary; that is, despite differences in representational format and resources, action specifications at different levels of the action representation hierarchy should be kept aligned. Conscious online control may be needed to restore alignment when severe intra- or inter-level discrepancies occur. However, it may be argued that in the individual case alignments are taking place within a single cognitive system and that this system is normally sufficiently integrated or unified that serious misalignments are rare and thus that the need for online conscious control is limited.

The main difference between individual and joint actions lies in the coordination demands essential to joint action. Thus, a third form of representational alignment becomes crucial in joint action. In addition to individual intra-and inter-level representational alignment, inter-agent representational alignment is necessary to meet coordination demands. Inter-agent alignment may be achieved in part through advanced planning, as proposed by Bratman. It

can also be achieved in part through online emergent and planned coordination processes of the types explored and described in the recent psychological literature. However, there are important limitations to what these coordination processes can achieve. Advance planning, when it takes place, may help define a shared background framework for the joint action, but at this stage it is typically impossible to anticipate all the coordination demands that will arise at the execution stage. Some of these demands may be met by the kinds of online coordination processes reviewed earlier in this section, but, as I pointed out, there are also important limitations to what they can achieve. In many instances, the progress of a joint action is hindered or the action breaks down due to various forms of misalignment between agents' representations. In such instances, individual corrections do not suffice to put the joint action back on track. Rather, to overcome these failures, agents need to align or realign their representations. This process calls for what Clark calls coordinating joint actions, that is, communicative acts about the basic joint activity. These communicative acts in turn are intentional and aim at communicating information about the agents' intentions and beliefs with a view to achieve alignment. But one can only communicate intentionally about one's beliefs and intentions if one is aware of them. Conversely, one can only understand the communicative acts of other agents if one realizes that these agents have a capacity for intentions. Finally and crucially, as already emphasized by Velleman (2007) in his discussion of Bratman's account, intentions could not serve their pragmatic functions unless they also had an epistemic role. In other words, if my having the intention to *A* didn't count as a form of practical self-knowledge and didn't give me grounds to believe that I would act as intended, my communicating (sincerely) about my intention to *A* would not license other agents to form beliefs about my future actions and thus would not yield the kind of inter-agent representational alignment needed to achieve coordination.

To recap, joint actions create more comprehensive demands for representational alignment than individual actions, since their success depends not just on individual intra- and inter-level representational alignment but also on inter-agent representational alignment. New resources are needed to meet these demands. On the social creation myth proposed here, a capacity for conscious intentions is crucial to inter-agent representational alignment. Having conscious intentions allows us to communicate about them and engage in coordinating joint actions that create common ground and promote the success of basic joint activity. The answer this myth offers to the question what is the purpose of conscious intentions is then that it is to enable more efficient inter-personal coordination in joint action and thus reap the benefits that come with increasingly complex and flexible forms of coordinated actions. The social creation myth doesn't deny intentions an epistemic role. On the contrary, it acknowledges that intentions couldn't serve their inter-personal coordination function if they did not at the same time provide us with a form of self-knowledge. However, it views their epistemic function as subservient to their coordination function. The social creation myth does not deny either that conscious intentions play a role in the online control of individual action. Rather, it proposes that conscious control of individual action may be a by-product of a capacity for conscious control that became established in social contexts because of the role it served in solving inter-agent coordination problems and because of the benefit conferred by the forms of cooperation it made possible.

6 Conclusion: Relating creation myths

The Bratmanian creation myth is pragmatic but also diachronic and individualist. Intentions have a purpose or teleofunction. This function is pragmatic insofar as the main benefit attached to intentions is to allow us to secure greater desire satisfaction. The way intentions secure this benefit is by allowing us to organize and coordinate our actions diachronically, in other words to become planning agents. As noted by Velleman, this emphasis of diachronicity and future-directed intentions leaves present-directed

intentions without a clear function. Finally, this myth is to a large extent individualist. While planning agency also enables inter-individual coordination, the social dimension of intentions remains secondary in Bratman's account and again his main concern is with diachronically organized joint actions.

While the social creation myth also sees intentions as having a pragmatic purpose, in contrast to the Bratmanian myth, it emphasizes the social and synchronous dimension of intentions. Instead of self-coordination over time, it emphasizes cooperation and flexibly coordinated joint action as the main route to greater desire satisfaction. It thus reverses the Bratmanian perspective in proposing that intentions are designed to enable a more efficient online coordination of joint action and in considering future-directed individual or joint planning as derivative or secondary functions of intentions.

Because its main emphasis is on synchronicity rather than diachronicity, the social creation myth has no problem attributing a pragmatic control function to present-directed intentions. It is thus impervious to one of the attractions of the Anscombian creation myth. We need feel no temptation to attribute an epistemic function to present-directed intentions for lack of any other plausible option. The social creation myth, however, does not dispense with epistemic functions altogether, quite the reverse. Not only is the fact that intentions embody a form of self-knowledge essential to their role in the coordination of joint actions, but in addition the way intentions play their coordinative role is by contributing to the alignment of representations with co-agents and thus to the production of shared knowledge. Thus, on the social creation myth, the epistemic function of intentions is not just to provide us with self-knowledge about our intentions and actions, it is also to contribute to the formation of shared knowledge. However, the social creation myth remains closer to the pragmatic than to the epistemic creation myth in considering that the epistemic function of intentions is ancillary to its pragmatic purpose.

Finally, is the social creation myth a teleological myth or, like Velleman's myth, the story of a spandrel? I must admit that I am not sure what the answer to this question is or should be. Indeed, this was one of the reasons why I chose to call my story a creation myth. One thing is sure though, if it is a story about a spandrel, this spandrel is not the same as Velleman's. His spandrel is a by-product of curiosity and self-awareness. This spandrel, if it is one, would involve a third element, sociality or cooperativeness. Social theories of consciousness (Frith 2010; Graziano & Kastner 2011) propose that consciousness has evolved to facilitate social interactions and enhance social cooperation. On the one hand, a capacity for consciousness is of course a much more general capacity than a capacity for conscious intentions and this may suggest that the latter, as a by-product of this more general capacity, is itself merely a spandrel. On the other hand, if the ultimate purpose of consciousness is to enhance social cooperation, then conscious intentions are a key element in making this possible and calling our capacity for intention a spandrel would fail to do justice to their role.

References

Anscombe, G. E. M. (1963). *Intention.* Oxford, UK: Blackwell.

Bishop, J. C. (1989). *Natural agency: An essay on the causal theory of action.* Cambridge, UK: Cambridge University Press.

Brand, M. (1984). *Intending and acting: Toward a naturalized action theory.* Cambridge, MA: MIT Press.

Bratman, M. (1987). *Intention, plans, and practical reason.* Cambridge, MA: Harvard University Press.

——— (2009). Modest sociality and the distinctiveness of intention. *Philosophical Studies*, *144* (1), 149-165. 10.1007/s11098-009-9375-9

——— (2014). *Shared agency.* Oxford, UK: Oxford University Press.

Brennan, S. E., Chen, X., Dickinson, C., Neider, M. & Zelinsky, G. (2007). Coordinating cognition: The costs and benefits of shared gaze during collaborative search. *Cognition*, *106* (3), 1465-1477. 10.1016/j.cognition.2007.05.012

Böckler, A., Knoblich, G. & Sebanz, N. (2011). Giving a helping hand: Effects of joint attention on mental rotation of body parts. *Experimental Brain Research*, *211* (3-4), 531-545. 10.1007/s00221-011-2625-z

Castiello, U., Paulignan, Y. & Jeannerod, M. (1991). Temporal dissociation of motor responses and subjective awareness a study in normal subjects. *Brain*, *114* (6), 2639-2655. 10.1093/brain/114.6.2639

Clark, H. H. (2006). Social actions, social commitments. In N. J. Enfield & S. C. Levinson (Eds.) *Roots of human sociality: Culture, cognition, and interaction* (pp. 126-150). Oxford, UK: Berg.

Davidson, D. (1980). *Essays on Actions and Events.* Oxford, UK: Oxford University Press.

Falvey, K. (2000). Knowledge in intention. *Philosophical Studies*, *99* (1), 21-44. 10.1023/a:1018775307559

Frankfurt, H. (1978). The problem of action. *American Philosophical Quarterly*, *15* (2), 157-162.

Frith, C. (2010). What is consciousness for? *Pragmatics & Cognition*, *18* (3), 497-551. 10.1075/pc.18.3.03fri

Frith, C. D., Blakemore, S.-J. & Wolpert, D. M. (2000). Abnormalities in the awareness and control of action. *Philosophical Transactions of the Royal Society of London*, *355* (1404), 1771-1788. 10.1098/rstb.2000.0734

Gilbert, M. (1992). *On social facts.* Princeton, NJ: Princeton University Press.

——— (2009). Shared intention and personal intentions. *Philosophical Studies*, *144* (1), 167-187. 10.1007/s11098-009-9372-z

Goldman, A. (1970). *A theory of human action.* Englewood Cliffs, NJ: Prentice-Hall.

Gould, S. J. & Lewontin, R. C. (1979). The spandrels of San Marco and the Panglossian paradigm: A critique of the adaptationist programme. *Proceedings of the Royal Society B*, *205* (1161), 581-598. 10.1098/rspb.1979.0086

Graziano, M. S. & Kastner, S. (2011). Human consciousness and its relationship to social neuroscience: A novel hypothesis. *Cognitive Neuroscience*, *2* (2), 98-113. 10.1080/17588928.2011.565121

Grice, H. P. (1957). Meaning. *Philosophical Review*, *66* (3), 377-388. 10.2307/2182440

Hamilton, A. F. & Grafton, S. T. (2007). The motor hierarchy: From kinematics to goals and intentions. In P. Haggard, Y. Rossetti & M. Kawato (Eds.) *Sensorimotor foundations of higher cognition* (pp. 381-408). Oxford, UK: Oxford University Press.

Heed, T., Habets, B., Sebanz, N. & Knoblich, G. (2010). Others' actions reduce crossmodal integration in peripersonal space. *Current Biology*, *20* (15), 1345-1349. 10.1016/j.cub.2010.05.068

Jeannerod, M. (1997). *The cognitive neuroscience of action.* Oxford, UK: Blackwell.

——— (1999). The 25th Bartlett Lecture. To act or not to act: Perspectives on the representation of actions. *Quarterly Journal of Experimental Psychology*, *52* (3), 1-29. 10.1080/713755803

——— (2006). *Motor cognition.* Oxford, UK: Oxford University Press.

Jordan, M. I. & Wolpert, D. M. (1999). Computational motor control. *The cognitive neurosciences* (pp. 485-493). Cambridge, MA: MIT Press.

Kilner, J. M., Friston, K. J. & Frith, C. D. (2007). Predictive coding: An account of the mirror neuron system. *Cognitive Processing*, *8* (3), 159-166. 10.1007/s10339-007-0170-2

Knoblich, G., Butterfill, S. & Sebanz, N. (2011). Psychological research on joint action: Theory and data. *Psychology of Learning and Motivation - Advances in Research and Theory*, *54*, 59-101. 10.1016/B978-0-12-385527-5.00003-6

Knoblich, G. & Sebanz, N. (2008). Evolving intentions for social interaction: From entrainment to joint action. *Philosophical Transactions of the Royal Society B*, *363* (1499), 2021-2031. 10.1098/rstb.2008.0006

Mele, A. R. (1992). *Springs of action: Understanding intentional behavior.* Oxford, UK: Oxford University Press.

Pacherie, E. (2008). The phenomenology of action: A conceptual framework. *Cognition*, *107* (1), 179-217. 10.1016/j.cognition.2007.09.003

——— (2012). The phenomenology of joint action: Self-agency vs. joint-agency. In A. Seemann (Ed.) *Joint attention: New developments* (pp. 343-389). Cambridge MA: MIT Press.

Pisella, L., Grea, H., Tilikete, C., Vighetto, A., Desmurget, M., Rode, G. & Rossetti, Y. (2000). An 'automatic pilot' for the hand in human posterior parietal cortex: Toward reinterpreting optic ataxia. *Nature Neuroscience*, *3* (7), 729-736. 10.3389/fnhum.2013.00336

Prinz, W. (1997). Perception and action planning. *European Journal of Cognitive Psychology*, *9* (2), 129-154. 10.1080/713752551

Recanati, F. (1986). On defining communicative Intentions. *Mind and Language*, *1* (3), 213-242. 10.1111/j.1468-0017.1986.tb00102.x

Richardson, M. J., Marsh, K. L., Isenhower, R. W., Goodman, J. R. L. & Schmidt, R. C. (2007). Rocking together: Dynamics of unintentional and intentional interpersonal coordination. *Human Movement Science*, *26* (6), 867-891. 10.1016/j.humov.2007.07.002

Rizzolatti, G. & Sinigaglia, C. (2010). The functional role of the parieto-frontal mirror circuit: Interpretations and misinterpretations. *Nature Reviews Neuroscience*, *11* (4), 264-274. 10.1038/nrn2805

Schuch, S. & Tipper, S. P. (2007). On observing another person's actions: Influences of observed inhibition and errors. *Perception & Psychophysics*, *69* (5), 828-837. 10.3758/BF03193782

Sebanz, N., Knoblich, G. & Prinz, W. (2005). How two share a task: Corepresenting stimulus–response mappings. *Journal of Experimental Psychology: Human Perception and Performance*, *31* (6), 1234-1246. 10.1037/0096-1523.31.6.1234

Sebanz, N., Knoblich, G., Prinz, W. & Wascher, E. (2006). Twin Peaks: An ERP study of action planning and control in co-acting individuals. *Journal of Cognitive Neuroscience*, *18* (5), 859-870. 10.1162/jocn.2006.18.5.859

Sperber, D. & Wilson, D. (1986). *Relevance: Communication and cognition.* Oxford, UK: Blackwell.

Tollefsen, D. (2005). Let's pretend: Children and joint action. *Philosophy of the Social Sciences*, *35* (75), 74-97. 10.1177/0048393104271925

Tomasello, M. (2009). *Why we cooperate.* Cambridge, MA: MIT Press.

——— (2011). Human culture in evolutionary perspective. In M. Gelfand (Ed.) *Advances in Culture and Psychology* (pp. 5-51). Oxford, UK: Oxford University Press.

Tomasello, M. & Carpenter, M. (2007). Shared intentionality. *Developmental Science*, *10* (1), 121-125. 10.1111/j.1467-7687.2007.00573.x

Tsai, C.-C., Kuo, W.-J., Jing, J.-T., Hung, D. L. & Tzeng, O. J.-L. (2006). A common coding framework in self-other interaction: Evidence from joint action task. *Experimental Brain Research*, *175* (2), 353-362. 10.1007/s00221-006-0557-9

Velleman, D. (2007). What good is a will? In A. Leist & H. Baumann (Eds.) *Action in context* (pp. 193-215). Berlin, GER: de Gruyter.

Wolpert, D. M. (1997). Computational approaches to motor control. *Trends in Cognitive Sciences*, *1* (6), 209-216. 10.1016/S1364-6613(97)01070-X