Confronting Many-Many Problems: 
Attention and Agentive Control 

WAYNE WU 
Carnegie Mellon University 

Abstract 
I argue that when perception plays a guiding role in intentional bodily 
action, it is a necessary part of that action. The argument begins with a 
challenge that necessarily arises for embodied agents, what I call the Many-
Many Problem. The Problem is named after its most common case where 
agents face too many perceptual inputs and too many possible behavioral 
outputs. Action requires a solution to the Many-Many Problem by selec-
tion of a specific linkage between input and output. In bodily action the 
agent perceptually selects, and in this way perceptually attends to, relevant 
information so as to guide the execution of specific movements. Since per-
ceptual attention is a necessary part of solving the Many-Many Problem, 
it is a necessary part of bodily action. Indeed, the process of implementing 
a solution to the Many-Many Problem, as constrained by the agent’s moti-
vational state, just is the agent’s performing an intentional bodily action in 
the relevant way. 

1. Introduction 
Theories of bodily agency must accommodate a mundane truth: perception 
informs bodily action. The relevant notion of perception is that of an agent’s 
gaining information about the world, including her body, through her senses.1 
In this essay I will argue that where perception guides bodily action, it 
is a necessary part of that action. This stems from the role of perceptual 
attention in solving a problem every embodied agent necessarily faces when 
responding to the world as perceived, what I call the Many-Many Problem: in 
the typical case, an agent confronts (too) many perceptual inputs and (too) 
many possible behavioral outputs. The agent must be selective in the face 

© 2011 Wiley Periodicals, Inc.
Confronting Many-Many Problems

of this Problem on pain of failing to act: she must select a specific input to inform a specific output. Accordingly the Many-Many Problem might also be dubbed the Selection Problem.

The account I present, the Structural Theory of Action, focuses on the internal causal structure of action, the mental and bodily processes that constitute bodily agency. It contrasts with the received view, the Causal Theory of Action, which focuses on the efficient or antecedent causation of action. On this theory, an event is an action when it is caused by a numerically distinct mental event of an appropriate kind. This approach takes it that “a fundamental problem—possibly, the fundamental problem—in philosophical action theory is to adequately specify the nature of the proximate cause of action.” The basic picture, what Velleman (2000) dubs the Standard Story, depicts beliefs and desires interacting to generate intention, which then causes action. Most causal theorists begin with some variant of this model.

There are, however, two problems with the Causal Theory. First it neglects the mundane truth: it leaves out perception. While no Causal Theorist denies a role for perception, the Standard Story does not mention it. Yet perception is not merely a missing piece of a puzzle, something that can be simply added once its absence is recognized. Rather, leaving it out from the beginning distorts our account of action and agentive control. The reason is that perception is not just one of various potential antecedent causes of bodily action, as the Standard Story would have it, but an integral constituent of such action, or so I shall argue.

The second problem with the Causal Theory is the familiar problem of causal deviance. Various counterexamples involving deviant causal chains suggest that the Standard Story is not the story of agency. These involve the absence of agentive control as in Davidson’s example of the climber whose intention to let go of the rope holding his colleague leads to nervousness that triggers his loosening of his grip (Davidson 1980a). Although the intention causes the movement, the latter is not an action for the agent is not in control. Control is guaranteed, it is claimed, by requiring that the relevant event be caused in the right way by the proximate intention. Specifically the intention must control, guide and sustain the action. Yet I shall argue that this remedy fails to restore agentive control precisely because it misattributes these features to the antecedent cause of action. Indeed, the “solution” abolishes agency. The lesson I shall draw is that the locus of agentive control does not reside in the antecedent cause of action. Rather, control is internal to action, an essential feature of our doing things. Consequently, understanding action requires understanding its internal causal structure and where perception plays a central role, it is played as a necessary part of action.

I shall proceed as follows: in section 2 I explain a fundamental challenge that necessarily confronts every embodied agent, the Many-Many Problem: in the standard case, agents are faced with many perceptual inputs and many possible behavioral outputs. I argue that intentional action is possible only
if the agent solves this problem by selecting a specific target and response. Solving the Problem in a specific way is necessary for bodily agency. I then argue that solving the Problem in this way is sufficient for agentive control. I preface my account, in section 3, by arguing that the Causal Theory’s focus on the antecedent causation of action renders it unable to set aside causal deviance. To causally explain agentive control, we must instead focus on the internal structure of action. I then argue, in section 4, that perceptual attention—as required to guide action—is a necessary part of such action. Indeed I argue that bodily action just is the process of implementing a solution to the Many-Many Problem.5

2. Confronting Many-Many Problems

In this section, I argue for the following claim:

(N): Necessarily, for all agents, S, bodily action types B, motivational states, m, towards B-ing and action contexts C:

if S intentionally B's in C in the sense that she B's because she is in motivational state m (paradigm: m is an intention to B), then S's state m structurally causes the selection required in implementing a solution to the Non-deliberative Many-Many Problem appropriate to S's B-ing in C.

Let me make some brief clarifications. The necessity at issue in (N) is metaphysical necessity. Moreover, as the “because” implies causality of an appropriate sort, (N) articulates a causal account of action, one whose goal is to explicate the requisite relation between the motivational state and the action. In the most general terms, causal accounts hold that intentional bodily action is a kind of motivated action where this means that the agent’s action results in the right way from some appropriate motivational state towards that action kind. The paradigm motivational state towards B-ing is the explicit representation of B-ing in an intention and where S performs B because she intends to B.6 (N) leaves open other possible relations between B-ing and m. This is the task for elaborating the theory; here I argue for the basic case.7

I shall also take a broad view of possible motivational states including intentions, desires, pro-attitudes, beliefs, memories, emotions and perhaps others. Some of these may in fact not be genuinely motivating, but at this stage inclusiveness is my aim. The central assumption is that motivational states are intentional states with the power to generate action, so my account should be consistent with theories that identify only a subset of the above as genuinely motivating. As causal theorists of action, we are then concerned with those worlds in which an agent is in a suitable motivational state to act in way B and where the agent’s B-ing occurs because of that state and “because” implies causality of an appropriate sort.
What is the Many-Many Problem? The Problem can be clearly seen in contexts where an agent confronts many perceptual inputs and many possible behavioral outputs. On the one hand, consider vision: what we typically see is a field of view cluttered with many objects, each exemplifying many visible properties. We cannot at a given moment act on all of these, for we are faced with too many potential targets. Action requires that we be selective, identifying one target and selecting its relevant properties. In the absence of such selection, no target for action will be identified. Such visual, and broadly perceptual, selection of an object and property among others by the subject is plausibly a way that the subject attends to the world, a way of being attuned to specific features of relevance to action (psychologists often invoke the metaphor of a spotlight). So understood, attention is required to identify a target for action. On the other hand, consider bodily behavior: for each object, there are many things that we could do with it, yet we cannot at a given moment perform all these actions. Again we must be selective, identifying one of many behaviors to execute. Action requires selectivity: to solve the Many-Many Problem, we must select a specific target and response. In the simplest case, the agent must identify a relevant “one-one link” associating a specific target to a specific response where the relevant information from the target informs the production of the response.

Consider standing before a table cluttered with various tools. Visually I am confronted with many possible targets for action. Even where I am focusing on one such target, say a hammer, the other targets remain available. Certainly when I act, I must select a specific object, but until I commit myself to action perhaps by reaching for the hammer, I can survey the possibilities by shifting attention across the field of view. Now for each target, many things can be done requiring different types of movement. The possibilities on the side of what we do are also many. As I attend to the hammer, various actions are available, the number of which increases as I shift attention across the visual field to other objects. Again until I act, these possibilities remain open to me. The context of action typically presents an agent with this many-many manifold that delineates a behavioral space of possible actions available at a time, a multiplicity of potential input-output linkages. The generation of action requires that the agent select a specific path (input-output link) among all the paths that constitute the available behavioral space. The agent can solve the Problem by traversing a specific one-one link: the agent acts on this object in this specific way.

To see the necessity of the Many-Many Problem for bodily agency, consider a world whose creatures do not face the Problem. The presentation of multiple behavioral possibilities is denied them at a given time. To the extent that they exhibit bodily behaviors in response to the environment, this is driven by a behavioral space that has a simple one-one structure, namely a single one-one link between stimulus and response at a time. For them, the available behavioral space at a time is limited to such a mapping: a given
stimulus when available and perceived at a time drives a preset response. What is by hypothesis not available to them is the possibility that that very stimulus can be mapped to different response at that time such that the creature could react to the stimulus in this alternative way rather than the preset way. Their behavior does not count as action, for at each time they are driven by what is essentially a reflex, and I take it that this never exemplifies agency. The absence of the Many-Many Problem in our imagined creatures is the absence of the possibility of agency itself.

This argument from reflex shows that action must emerge from a behavioral space constituted by more than a single one-one link and thus, action requires the presence of a Many-Many Problem. If there is to be action, there must be a behavioral space that is sufficiently complicated so as to allow for the possibility of selecting different paths at a time. Strictly speaking, however, the argument shows that what is required for action is the availability of a behavioral space constituted by more than a single one-one link. This condition is met by a behavioral space where the link between input and output is merely “one-many” or “many-one” as opposed to many-many. That is, a creature need only be able to react in multiple ways to one input or be able to react to many inputs in one way to escape from merely reflexive behavior.

This is correct, and so talk of the Many-Many Problem in (N) should be understood to include these other versions as specific instances of the Problem. The “Many-Many” terminology highlights the typical cases. This leads to a question, however, for I initially pointed out that given a set of many possible perceptual inputs, selection is required for action and this suggests that attention is required. This is a central claim of this paper, but how does it sit with the allowance that a Many-Many Problem can include behavioral spaces structured in terms of a one-many structure? Here it would seem that input selection, and hence attention, is not necessary. We can address this question and correspondingly broaden our conception of attention in two steps.

The first step is to relax our emphasis on what we can call synchronic instances of the Many-Many Problem, namely those cases where a multitude of perceptual inputs are simultaneously presented to the creature necessitating selection of one among many inputs given at that time. We should also recognize that there are diachronic instances of the Problem. To see this, consider a creature that possesses only a single perceptual modality, one that is capable of tracking only the presence or absence of light (this is obviously a perceptually impoverished creature). At a given instance in time, it does not register multiple objects nor does it register multiple properties of an object (light). Let us allow that the creature can move in a simple way in response to the presence of light. Thus when its “visual” channel is in the “on” position, i.e. when it perceives the presence of light, the creature moves intentionally because it is motivated to move when light is on; it does nothing when the sensory channel is in the “off” position for it perceives no light (it could also move in response to the absence of light). In this case, we lack
the simultaneous presentation of many inputs. Nevertheless, the creature still faces a diachronic version of the Many-Many Problem. It has to deal with two possible perceptual inputs, the presence or the absence of light, although these inputs can only be presented serially over time rather than simultaneously at a time. Thus when it reacts by selecting a specific linkage between input and output (e.g., move thus when light is present), it still exhibits selection of input even if the behavioral space at a time is only one-many. Diachronically there is still a Many-Many Problem: over time there are many inputs that it encounters and to which it can selectively respond (the presence or absence of light).

But consider a second possibility, a variation where the creature’s visual system represents only the presence of light. When light is not present, its visual system does nothing, is inactive. There is thus no visual representation of the absence of light, just the absence of any visual representation when light is absent (note the scope of “absence”). Put another way, vision for the creature works oddly as follows: when light is present it “sees” light, visually representing the presence of light; when light is absent, its visual system does not respond, does not generate any visual representation at all. The creature is thus selectively blind to darkness—an odd creature, but seemingly possible. In this case, it would also seem that there is no possibility of even diachronic selection. Nevertheless I would argue that attentional selection is required even here. To see this, we need to flesh out the relevant notion of attention, and this requires understanding how solutions to the Many-Many Problem are implemented. This is the second step. I discuss implementation now and will return to this “loose end”.11

While the possibility of action requires that subjects face a Many-Many Problem, executed action requires that the Problem be solved and in two ways. No coherent behavior will result until the agent selects a specific path in behavioral space. At a given moment in time, an agent cannot act on all targets nor act in all the available ways. Genuine agency requires that the Many-Many Problem be solved by appropriate selection. This linking of an input to output, the selection of a specific path in behavioral space, is what I mean by speaking henceforth of a solution to a Many-Many Problem. Of course unless that solution is executed, i.e. unless it gives rise to actual movements that are a response to how the environment is perceived, no action will arise. We might take this as part of the solution of the Many-Many Problem, but it will be helpful to isolate it in our discussion, so I will refer to it as the implementation of the solution, namely of the selected one-one linkage. So as per (N), action requires that the Many-Many Problem be solved and implemented. What remains is to show that intentional action requires that the Many-Many Problem be solved with the involvement of a relevant motivational state. What such involvement comes to is the crucial issue.

In one form, the Many-Many Problem is familiar. The point of practical reasoning is in part to solve a version of the Problem. In the context of
deciding what to do, we are often faced with many potential targets and many potential actions. In coming to a decision and forming an intention, we arrive at a one-one linkage: intending to act in a certain way on an object, we connect a type of action to a target. Standing before the table cluttered with objects, I confront many potential targets and for each, there are many things I could do. In this context, I may consider a course of action and having identified it, consider what instruments or tools I may need. I then look for the right object: I need to screw in the light fixture, so I scan for a screwdriver. Alternatively I may first look over the various tools and utensils, and one may remind me of an unfinished project that I decide I should now complete. In both cases, reflection leads to an intention to act in a specific way with an object. Intentions amount to a solution to what we can call the Deliberative Many-Many Problem.

The Deliberative Problem confronts only those agents capable of practical reflection or a capacity to plan, but there can be agency independent of these capacities or their exercise. So the Deliberative Problem, a problem concerning the choice or planning of action, is not the version of the Many-Many Problem at issue in (N). There is another form of the Problem that can arise independently of any capacity for reflection and is present in all bodily action. This non-deliberative version can be most clearly seen in the informational challenges that agents confront in the actual production of action. The Non-deliberative Problem is not the problem of choice but of implementation. A salient contrast between the Non-deliberative and Deliberative Problems is when the Problem occurs in relation to action: in the deliberative version, the Problem concerns choice and is solved by practical reflection. In the non-deliberative version, the Problem concerns implementation and is solved in part by the agent’s exercising perceptual and motor capacities.

Return to our cluttered table and my reaching for a hammer thereon. Visually I am confronted with many objects and their many properties. To grab the hammer, I must visually select it from among many additional objects irrelevant to my current goal. Thus I locate the hammer and ignore other tools or utensils. Moreover even after I locate the hammer, I am confronted with its many properties, many of these irrelevant to guiding my reach and grasp. I must visually select just those properties relevant to forming the correct movements and ignore others. Thus I ignore the hammer’s color and texture and focus on the spatial properties of its handle and the orientation of the head. What is required for such selection is visual attention. Where action is guided by other sensory modalities, the same points apply. Attention of this fine-grained sort is required to solve the perceptual side of the Many-Many Problem. Indeed it is attention to precise spatial information that is needed.

Similar issues arise on the side of the production of movement. Different movement types can be directed at the hammer: reaching, grabbing, throwing
etc. Moreover even after we select a type of movement, there are a variety of concrete movements that would exemplify that type. For example, we can reach for the hammer via different trajectories of the arm. Action emerges with the selection of a concrete movement individuated by specific parameters: trajectory, speed, grip force and so on. Thus on the motor side, selection both of action type and concrete implementation, including specification of the relevant spatial and physical parameters, is required.

The previous points show that there is a Many-Many Problem that agents face in the implementation of action. For us, the Problem is found at a basic level in that there is a need to select accurate fine-grained information about the target through perception and to select a concrete movement defined by precise spatial and physical magnitudes. Moreover since most actions lead to changes in the world, new information is constantly bombarding the agent requiring modifications and adjustments in bodily response throughout the course of the action. The Non-deliberative Many-Many Problem is a constant challenge, occurring in different ways as we act.

Now at this level of precision, we do not typically choose what information is relevant or what precise movement is to be made. That is to say, the specificity required in selecting appropriate perceptual information and programming precise parameters for movement is something that typically goes beyond the purview and powers of practical deliberation. Deliberation generates a conceptual representation of target and response. It does not work in the trenches of movement production. My intention to grab the hammer does not represent the precise size of the handle at the grasp point or the corresponding aperture of my grip, the speed and path of my reach, the force of my grasp and so on. Yet this information is required if the agent is to accurately move. Of course the solution is in a way straightforward, the agent perceptually registers the relevant information by selecting relevant features of the environment to inform a specific response. That is, the agent acts.

The critical point for our purposes is that the fine-grained processes at issue cannot generate just any one-one link. Selections of the required precision must be made that are consistent with the agent’s current goals. If selection yields a specific one-one link that is disconnected from any current motivation, the resulting behavior would not be intentional action. The agent in this case would be motivated to act, would exemplify behavior resulting from a specific one-one linkage, but would fail to act because of the motivational state. Indeed the resulting behavior, having no connection to the agent’s current motivational state, would be something alien and defective. Certainly it would from the agent’s perspective be not only unintentional but also incoherent and inexplicable. Motivational states must then play some role in solving the Non-deliberative Many-Many Problem. Specifically they must constrain what counts as an appropriate one-one link, presumably as determined by their content. Intuitively it is because I intend to grab a
that I am perceptually sensitive to information from the hammer rather than other objects and it is because I intend to grab a hammer that I am ready to make hand and arm as opposed to leg movements. This suggests that where there is intentional bodily action—that is an action generated by a motivational state—the agent faces a Non-deliberative Many-Many Problem solved and implemented under the influence of that motivational state. The state’s influence, namely in constraining the required selections in light of the represented goal, is to be understood in causal terms. What remains is to flesh out this idea of providing constraints on selection within the behavioral space available to an agent at a time.

What is needed to solve the Non-deliberative Many-Many Problem is a way to link perception and movement consistently with the agent’s current goals. In this context, Dretske’s notion of a structuring cause, with slight emendation, is to be taken as basic (1993). The idea of a structuring cause is that of an event that produces certain enabling conditions whereby one event, P, can cause another event, M. With respect to the Many-Many Problem, the issue concerns the structuring cause that enables attention to guide movement, that is, that enables a specific one-one mapping. It seems likely that intentions or other motivational states are structuring causes. For ease of explication, I shall focus on intentions.

We need to loosen Dretske’s restriction of structuring causes to events and allow that standing states can be structuring causes. There are two reasons for this. First many natural systems exemplify what is aptly described as structuring causation via their standing states. For example biological systems contain enzymes that catalyze biochemical reactions. Enzymes have complex physical structures that determine the chemicals (reactants) that they can bind and modify (think of a lock and key). A region of an enzyme (the active site) is contoured to bind specific reactants yielding new chemical products. To regulate an enzyme, say to inactivate it, a cell may alter the enzyme’s structure such that the contours of its active site no longer “fit” the targeted reactants (this is called allostery). Altering its structure again can turn on the enzyme. We can take the “active” structure or physical configuration as a standing or structural state that makes possible the enzyme’s binding of the reactants and subsequent chemical activity. Moreover an enzyme can persist in this standing state for some time without encountering its target. When it does bind a target, it is disposed to perform its “action”. This leads to the second point. As Bratman (1987) has emphasized, intentions allow the influence of practical deliberation to extend into the future, and in this way relieve the agent of having to rethink matters already reflected on in the past. When agents have specific intentions, they are in standing states that ready them for action when the conditions are right. These states are not events but persisting features of the agent. My proposal is that motivational states are structuring causes enabling specific links between attention and movement that amount to a solution to the Non-deliberative Many-Many Problem.
The mechanisms of perceptual and motor selection are matters for cognitive science, and the details are not crucial for my argument. It is enough to see in broad outline how to make good on the claim that motivational states like intention are involved in solving the Many-Many Problem as structuring causes. I have discussed this elsewhere (Wu 2008), but the basic idea is that conceptual states like intention employ representational resources to influence both perceptual and motor selection. To employ some psychological notions, the motivational state calibrates the agent’s attentional and task sets. That is, the agent’s intention calibrates her capacities to be sensitive to specific perceptual information (attentional set) and to produce specific movements in light of such information (task set). Intuitively it is because I intend to grab a hammer that I am sensitive to information from the hammer rather than other objects and it is because I intend to grab a hammer that I am ready to make hand and arm as opposed to leg movements.

On the side of perception, focusing on vision, we can think of the visual system as processing at some later stage representations of each visible object in the visual field. This processing is at least a necessary causal condition of the agent’s seeing those objects. The representation of the targeted object involves representing the spatial information required for guiding movements directed at the object, and it is this information that must be selected to inform subsequent movement (on the two visual streams, see the final section). According to a widely held model of attention, selection is achieved by introducing a bias that favors processing of one of the object-representations. This is the biased-competition model of attention (see Desimone and Duncan, (1995)). The question then is how intention or any motivational state influences such biasing. In this context, psychologists speak of top-down influences on visual processing, and in our case this can be understood as the deployment of conceptual representations to facilitate identification of the correct visual object representation to bias. A working hypothesis is that there must be some relevant isomorphism between the conceptual representations deployed in the subject’s motivational states and the representations deployed in the visual system that allows these top-down influences to lead to appropriate selection. These links, whatever they turn out to be, underwrite the following fact we have mentioned: it is because I intend to use the hammer that I am visually sensitive to the hammer such that my responses will be directed at it. The result is my selecting, i.e. my attending to, the hammer. Intentions thus constrain attention by deploying representational resources that help identify a specific target of relevance to action. Intentions thus structure the agent’s attention to the scene. A similar story can be told for attention to relevant properties of the object.

On the side of motor selection, the story is more complex for the number of possible movements is staggering. Wolpert and Ghahramani (2000, p. 212) point out that assuming 600 muscles in the human body and just two dimensions, contraction and relaxation, there are $2^{600}$ possible motor activations.
How can selection be performed in real-time given this overwhelming multitude of potential output? The abstract specification represented by intention cannot suffice on its own to select a specific concrete movement. Rather, intention enables selection by constraining the space of possibilities. By intending to move with a specific part of the body, e.g. the arm and hand, we greatly reduce the possibilities among which movement selection is to be made (e.g. restricting selection to muscles in the arm and hand). According to current motor control theory, a separate mechanism would then calculate a defined cost function assigned to each available movement for some cost and then select the concrete movement that minimizes cost. For example a system might take distance of movement as the relevant parameter and aim to produce movements that minimize distance traveled (cf. how in selecting a destination with a GPS system built into many cars, we are given a specific route). The picture is this: by intending specific actions, the set of possible movements is restricted in a way that eases computation of the relevant cost function. Once the lowest cost movement is identified, the agent’s body moves and does so in accordance with his intention.

In presenting these models, I have focused on conceptual states like intention, but the claims can be generalized to other motivational states whose representational properties involve concepts. It can also be generalized to motivational states that do not involve concepts. The central idea is that the selections required to solve the Non-deliberative Many-Many Problem are constrained by the representational resources involved in the agent’s current motivational state, resources that may be conceptual or not. For each type of creature, a different cognitive account will have to be given. Nevertheless the story of action for each exemplifies solving the Many-Many Problem.

The previous emphasis on information processing mechanisms may bring the charge that I am attempting to account for agency, a personal level phenomenon, at the wrong level of explanation, namely merely at the subpersonal. This worry would be warranted if solving the Many-Many Problem were merely a feature of the sub-personal level. But it is not. The fine-grained selectivity with respect to both perceptual and motor features required to solve the Many-Many Problem is the subject’s own selectivity. There must be such personal-level, fine-grained selectivity on pain of the absence of agency. After all, the idea of action at issue is that of an agent’s specific response to determinate features of the world, an event in which she must be a participant in that she responds as guided by her being perceptually attuned to the relevant features. The requisite attunement, exhibited in attentional selectivity, cannot be merely the work of a subpersonal part of the agent that is insulated from her participation. Specifically, the fine-grained processing that we are focusing on is the agent’s own perceptual selectivity to the relevant features. If it is not, because the selectivity at issue is merely subpersonal, then her bodily responses (which we grant as her responses for sake of argument) are responses that are guided by an attunement to the world
that is not her attunement. Rather, a subpersonal system that by hypothesis neither involves her nor entails her participation, would then be guiding her response. Consequently, she would fail to exemplify bodily action as we are conceiving it, namely as her response to how she takes things to be. Rather, a subpersonal causal mechanism would be controlling her response. As we shall see (section 3), these cases of external control are cases where agency is abolished for the subject is under the control of something that doesn’t involve her. Thus, action is not to be identified with mere selection mechanisms, though of course it causally depends on such mechanisms. Action is always the agent being appropriately selective, responding in appropriate ways to how the she takes the environment to be.

I believe that (N) has been established. To close the current section, I want to tie up one loose end and consider briefly some apparent counterexamples to (N), including habitual actions, subintentional actions, slips of action, and arational actions.

The loose end concerns attention as selection. I noted that reference to the Many-Many Problem in (N) includes one-many and many-one behavioral spaces as instances. In the one-many case, the question arose whether attention is required given the absence of diachronic or synchronic presentation of multiple inputs. What we have seen is that according to (N), intentional action implies one’s motivational state constraining the available paths in behavioral space so that a specific path is implemented. This means that an input is selected to guide a response. Now even in cases of a one-many manifold where perceptual selection of one input among many is not required—whether synchronically or diachronically—there is a difference between being in a motivational state that constrains selection of a specific one-one link and not being in any such motivational state. Even if the agent perceptually registers an input in the latter case, she has not selected that input to guide a response. That is, a path in behavioral space has not been selected in light of her intention. Intentional action necessarily requires perceptual selection in the sense that it requires motivated attunement to a specific input so that this input comes to inform the generation of a response even if there is only one possible input. Attention so understood is selection for action, namely input selection of the sort that amounts to an implemented solution to the Many-Many Problem, a selection of a specific path in behavioral space constrained by the agent’s intention. Psychologists speak of this form of attention as top-down driven or endogenous attention, and it is present whenever the Many-Many Problem is solved in the context of intentional action and a fortiori in traversing a path in a one-many behavioral space.

Let us consider some counterexamples (readers sufficiently convinced can skip to the next section and return to these cases). In many habitual actions, there exists in the agent a fairly rigid link between a specific stimulus and response due to past behavior. That is to say, past repetition of behavior can
rigidify a specific target-movement mapping such that in certain contexts where we have no specific motivation to act in a particular way, we may nevertheless produce that behavior. Thus we may rub our chin as we ponder a problem, jiggle our feet as we sit studying in the library, or twist our hair as we talk. For these, repetition of a certain type of behavior in one’s past leads to acquisition of a behavioral habit that can be triggered by various circumstances such as when we are restless or nervous. Many of these actions, I submit, are not intentional and consequently are not in the purview of my account (O’Shaughnessy has called these “subintentional”).

Other habitual actions may seem intentional as when we immediately swat a mosquito whose bite we feel, when we look to the left (in the U. S.) as we cross a street, and when we flick on the light switch as we enter a room. The worry for my account is that some of these behaviors will count as intentional and yet the required map between target and response is already established due to earlier repetition. Thus, there would be no need for solving a Many-Many Problem at the time of action and (N) is falsified. Note that what is assumed in this case is that there is a relevant intention or goal-representational state in place, else the example is of the subintentional variety just noted.

In response, we should understand habits as pre-established linkages between types of input and types of output. Nevertheless, the implementation of habitual responses still requires solving the Many-Many Problem at a fine-grained level in a way influenced by one’s intentions. For example, I have a habit of swatting mosquitoes that bite me and this is grounded in a mapping between input type (biting mosquito) and output type (swatting). Now when I am bit, the mosquito’s bite is only one of various perceptual inputs I receive at a given moment. I feel it and glance at what causes the prick. Not wanting to be eaten alive by bugs, I decide to take my normal action: I swat away with every subsequent bite (I don’t need to make a conscious decision, of course). Still, I must select information from the mosquito as against other perceptual information to guide my movement (if the bite suffices on its own to drive the response than we have at best a subintentional action or reflex, see above). Moreover, while my habit immediately inclines me to swat, I have to select a specific hand and trajectory, depending on the location of the mosquito (e.g. my left hand if the mosquito is to the right, my right hand if the mosquito is to the left). Thus, the implementation of habitual responses still requires solving the Many-Many Problem in a way that is influenced by the relevant intention. The need for fine-grained selection is not obviated, though it is in a way facilitated by one’s habits.

In the most extreme case, we can imagine a habitual response driving behavior in such a way that it is more like a reflex, but such behavior is certainly not intentional. For example utilization behavior is a syndrome that exhibits something like this character. Afflicted subjects are strongly driven to act in a certain way by an object (say the handle of a mug) such
that an intention to do otherwise is generally powerless to alter behavior. Told
to grab the mug in an atypical way, the patient cannot help but grab it in the
normal way. The handle wrings from them a specific response, independent
of their current motivations. Such behavior is certainly unintentional action;
it is not constrained by the agent’s current motivations.

Utilization behavior may be described as a (pathological) slip of action.
Habitual actions also underlie many slips. Consider William James’ striking
case of the agent who goes up to his bedroom to dress for dinner and who
instead puts on his pajamas and climbs into bed. I do not think that such
behavior is intentional though it has that appearance. Considering this action
in light of a set of mappings between potential targets and response, what
happens is this: the agent intends an action that favors attention to a specific
target, say the agent’s bedroom understood as a destination. At the same
time, the intention fails to select the appropriate response precisely because
our habits form a sort of behavioral inertia. We intend to change for dinner
in the bedroom, but our habit lets us slide into changing for bed. Slips of
action plausibly result from failure of attention. In any case, they are not
intentional and (N) allows us to explain why: the one-one link driving action
is neither appropriate to nor selected by the agent’s current intention.

Finally Hursthouse (1991) has identified arational actions as counterex-
amples to the Causal Theory’s claim to provide a necessary condition for
intentional action. Arational actions primarily involve intentional behavior
motivated by the agent’s emotions. In many cases, the emotions that she
emphasizes such as anger, love, grief, fear have an intentional object that
can partly explain selection of the target. It is my overwhelming fear of
an object perceptually presented to me that drives attention to it in a way
that motivates behavior away from it. Although I wish that the source of
my fear would disappear, I must keep track of the object in order to react
appropriately to it. These emotions can be connected to a variety of beliefs
and desires that also contribute constraints on the selection process. A full
account of arational actions is needed, one that is sensitive to the disparate
ways emotions influence action. Nevertheless, the intentionality of emotions
and associated motivational states can explain the required selection needed
to solve the Many-Many Problem. I believe that (N) can accommodate and
indeed help illuminate these cases.

3. Causal Deviance and Control

In the rest of the paper, I shall argue for the following claim:

(S): Necessarily, for all agents, $S$, bodily action types $B$, motivational states, $m$,
towards $B$-ing and action contexts $C$:

if $S$’s motivational state $m$ (paradigm: an intention to $B$) structurally causes
the selection required in implementing a solution to the Non-deliberative
Many-Many Problem appropriate to $S$’s $B$-ing in $C$, then $S$ intentionally $B$’s in $C$ in the sense that she $B$’s because she is in motivational state $m$.

We shall have then identified necessary and sufficient conditions for bodily action. Indeed as I shall argue in the next section, the whole of the process of implementing a solution to the Non-deliberative Many-Many Problem just is intentional bodily action. Moreover I will argue that in perceptually guided action, perception functions as a necessary part of action. My account, what I call the *Structural Theory of Action*, is at least a plausible alternative to the Causal Theory (they are both broadly causal accounts of action). In this section I argue that it is to be preferred because the Causal Theory cannot solve the problem of deviance. Its focus on the antecedent cause of action guarantees the loss of control.

To avoid causal deviance, Causal Theorists require that the antecedent cause of action not only trigger but also guide, control, and sustain action. This, they claim, guarantees agentive control. Of course the relevant causal notions must not themselves be understood in agentive terms. For example, in requiring that intentions control, guide and sustain action, we must not simply mean that the *agent* controls, guides and sustains action since this is what is to be explained. I shall assume that the Causal Theorist can account for these notions in non-agentive terms. Yet a genuine problem arises when the Theory applies the proposed notions to the antecedent causes of action, for this surprisingly abolishes agency.

What is problematic about the Causal Theory’s solution to deviant causal chains is that action is made an object of control when it should be understood as the source of control. The agent’s action (i.e. the agent’s doing something) is construed as the *target* of executive processes numerically distinct from it. In this way, the Causal Theory mislocates the basic form of agentive control. It treats actions as the target of control, guidance, and sustaining processes external to them since they are targets of an external causal process. It follows that the agent, as immersed in action, is not in control but subject to control. This problem does not depend on the executive notions being given an agentive reading. Even if the notions of control and guidance are given non-agentive analyses such as in terms of control mechanisms in the brain, the problem will still arise. On the Causal Theory when I act, something else—even if only a brain or psychological mechanism—controls my action, guides, and sustains my doing it. Being subject to this sort of control is inconsistent with my exerting control as agent. Thus agency is abolished.¹⁶

One may reply that the controlling element, the motivational state, is the agent’s own mental state, so in one sense the agent is still exerting control, now on action. This response is unsatisfactory. It yields the oddity of speaking of agents as exerting causal control on their action, the latter already understood as the agent’s exertion of control. This introduces one act too many (cf. Davidson’s point against agent-causation, (1980c)). In any case, the response
does not address the basic problem, for the threat to agency resides not in the fact that the controlling cause is distinct from the agent but rather in the fact that an element numerically distinct from the agent’s action is the source of control with action as its target. That the postulated controlling element is part of me does not deflect the criticism that control has been incorrectly located in something distinct from my acting rather than as a constitutive feature of it.

After all, consider the dialectic. The Causal Theory attempts to explain action, the agent’s exercise of control, in terms of its numerically distinct mental cause. The problem of deviant causal chains highlights cases where the agent does not exercise control but where the Causal Theory’s conditions are met. The counterexamples are rebutted when the analysis can guarantee that agentive control is restored, but how can it when the additional causal features that embellish the story are distinct from the action and located causally prior to it? The Causal Theory attempts to identify causal processes that yield agentive control, but it errs when it locates the relevant properties in the numerically distinct cause of action rather than as features of action itself. The nature of agency is not to be subject to control and guidance of any form; agency itself exemplifies control and guidance. The requisite form of control must then be an internal property of action. Accordingly no amount of additional detail concerning the causal antecedents of action will restore the control that is lost in cases of deviance. So long as the processes that realize agentive control and guidance are located external to action, the Causal Theory will be unable to explain action as the exercise of agentive control.

We must then reject the Causal Theory’s emphasis on the antecedents of action in an explanation of agentive control. Rather, we must focus on actions themselves (cf. Frankfurt, (1988)). There are causal theorists who take this line, construing action as the process of a mental state’s causing specific movements of the body. I shall pursue a similar line guided by the results of the previous section. We need an account of action in terms of the Many-Many Problem. In this way we bring perception, specifically attention, to the fore in the theory of bodily action.

4. The Nature of Agentive Control

In this final section, I argue that the whole process of implementing a solution to the Non-deliberative Many-Many Problem, given an agent’s motivation, is not only sufficient for but is the agent’s exerting control with the body. To implement a solution to the Many-Many Problem in this way is to act intentionally with one’s body. Moreover perception as guiding action is a necessary part of action.

Agentive control as exhibited in bodily action is intentional in being directed; it has an object, namely the target of the agent’s action. Reflection on
everyday action reveals that the target is an object in the world, typically the physical objects that inhabit the agent’s immediate environment but in the simplest case of mere bodily movement, the agent’s own body. It is important to see that the primary target of control is not action itself. Even if we acknowledge, as I am inclined to do, that a movement of the body is a proper part of bodily action and thus that in the simplest bodily actions where we just move, the agent is in a sense directing control at a part of action, the unifying characterization of the intentional objects of action is that they are physical objects. We act on the world.

Our exertions of control are selective. In the face of many possible targets, we identify a specific item to control. This requires attention to the target and its relevant properties so that appropriate movements can be made. In the course of manipulating the target, new information from the environment is relevant as changes arise. The agent must remain perceptually attuned to relevant changes and make compensatory adjustments with the body. Agentive control is typically a dynamic process essentially characterized by perceptual selection and compensatory movement in a way that must conform to the agent’s current goals. An implemented solution to the Non-deliberative Many-Many Problem is the key.

Let’s begin with a general description of what happens when an agent acts in normal cases. There are specific changes that occur in the world: an object of some sort moves or is otherwise altered. The change in this object is a result of or is identical to some movement of the agent’s own body. In the case where the body altered is external to the agent’s body, there is a seamless coordination between the two: the agent’s body moves and the object is altered while at the same time, the agent’s body compensates and adjusts in relation to the resulting changes that the agent attends to, this cycle of mutual interaction and change exemplifying a continuous solution to different Non-deliberative Many-Many Problems that arise over time. The compensation and adjustment of movement depends on some form of perceptual attention to the world, a process that must be constrained by the agent’s motivational state if it is to conform to the agent’s goals. In the case where the object that is moved is the agent’s body, we have a similar account: proprioceptive and kinaesthetic information is selected to guide modifications to the body (or even to holding the body fast, as in standing at attention, where specific muscles must be controlled). In any case of bodily action, the general picture is just this: the resultant changes in the world are due to the implementation of solutions to Non-deliberative Many-Many Problems as constrained by the agent’s goals. When an object changes as a result of the agent’s movements as guided throughout by the agent’s attention to that object as constrained by how she is motivated, we have identified an agent’s exerting control on that object and thus intentional bodily action. I submit that the process described, i.e. an implemented solution to the Non-deliberative Many-Many Problem, is sufficient for agentive control and thus, intentional action.
I have presented a causal account that gives necessary and sufficient conditions for intentional action, and like other causal accounts, mine must also face the problem of deviant causal chains. My response is to emphasize that the Causal Theory was right to deploy the notions of control, guidance and sustaining influences. Where it went wrong, I have argued, was in characterizing these notions in terms of the causal influence of a numerically distinct state on action, a move that abolishes agency. We can, however, give up the misapplication without jettisoning the relevant notions. This allows us to retain an insight of the Causal Theory while keeping agency in view. We could then follow Causal Theorists by saying that intention and perception must play a guiding, controlling and sustaining influence on movement. If the Causal Theorist takes the invocations of these notions to suffice in their own case, they should not object to a similar invocation here.

Still, I think we can say more by way of explanation than Causal Theorists typically do. A central challenge for a causal account of action is to explain what control, guidance and sustaining influences come to in a way that does not smuggle in agency. My account suggests that a motivational state’s structurally causing the selection required to solve and implement the Many-Many Problem is both necessary and sufficient for intentional bodily action. Accordingly the notions of control, guiding and sustaining influences are to be characterized as causal features of this process. What can we say about each?

We should treat the notion of control as the target *explanandum*. There is no non-agentive notion of control that can be used to explain it. Rather, agentive control is to be understood in terms of guiding and sustaining influences where each of these is partitioned in respect of the role of perception and intention respectively in the Many-Many Problem. On the one hand, perception guides action: the perceptual selection of, or attention to, relevant information is deployed to guide movement. The specific spatial parameters required to generate accurate output are to be found in perception. On the other hand, intention sustains action. Selection of both relevant perceptual input and appropriate motor output continues as long as the intention remains, serving as a structuring cause.

Of course this gloss on the role of guiding and sustaining influences in underwriting control does not completely explicate the notion of a non-deviant causal process. Nevertheless this initial account provides us with a response to Davidson’s homicidal climber. The standard response is to point out that the climber’s intention does not play the right role, for while the intention may indirectly trigger the releasing movement, it does not guide it. This is partly correct, though it leaves unexplained what guidance comes to and on this we can say more: what is lacking in the climber’s behavior is proprioceptive guidance of movement. In intentional action, given the Many-Many Problem, attentional selection of relevant information is required, information needed to program the appropriate motor response given the
agent’s goal. But attentional selection plays no such role in the climber’s jittered release of his companion. That is, the guidance inherent in agency, via the role of attention, is missing. The motor response is driven by some other internal state, a bout of nervousness, and not by perceptual selection of information such as proprioceptive information regarding the position of the hand. The latter plays no role at all and this would explain why the agent is not in control. His movement is not a result of the use of relevant information. The antecedent of (S) is not met in Davidson’s case, and the counterexample is deflected.

Another possible counterexample is the syndrome referred to as anarchic hand. Here the agent has lost control of one of his hands. This hand may exhibit stereotypical behaviors such as grasping a pen and doodling with it. More interestingly, the hand may exhibit complex and devious behaviors such as extinguishing a cigarette that the other hand has lit, knocking down a bowl of soup that the other hand has picked up, and unbuttoning a shirt just buttoned. The sense of loss of control is in part due to the hand’s acting in ways that are not explicitly intended or even contrary to the agent’s wishes. Indeed the agent cannot stop the hand’s behavior without intervening physically, say by sitting on it. In many of these cases, the Many-Many Problem must have been solved, yet the agent is not in control and hence not acting intentionally. These actions, however, are clearly disconnected from any of the agent’s current motivations, at least those motivations that the agent would acknowledge. Consequently the antecedent of (S) is not met and we are not forced to judge such actions as intentional.

Philosophy being what it is, I expect to be confronted with scenarios that challenge (S) and (N). Still I hope to have shown that the Structural Theory provides a different framework that allows various questions about agency to be fruitfully addressed, that avoids the deficiencies of the Causal Theory, and that does at least as well as (indeed, I think better than) the Causal Theory in answering well-known counterexamples.

If the previous arguments are correct, then solving the Non-deliberative Problem in the way described is necessary and sufficient for intentional bodily agency and control. Hence,

\[(\text{NS}): \text{Necessarily, for all agents, } S, \text{ bodily action types } B, \text{ motivational states, } m, \text{ towards } B\text{-ing and action contexts } C:\]

\[S's \text{ motivational state } m \text{ (paradigm: an intention to } B) \text{ structurally causes the selection required in implementing a solution to the Non-deliberative Many-Many Problem appropriate to action } B \text{ for } S \text{ in } C \text{ if and only if } S \text{ intentionally } B\text{'s in } C \text{ in the sense that she } B\text{'s because she is in motivational state } m.\]

We have seen that solving the Many-Many Problem requires attentional selection of information needed to guide movement. That is, perceptual attention
plays the role of guidance in action. Accordingly, what (NS) implies is that intentional bodily action would not be possible without perceptual attention playing this role (remember, this includes proprioception).

Strictly speaking, the Causal Theory can accommodate (NS) and its implication that perception is necessary for action. Causal Theorists treat perception as an antecedent, numerically distinct cause of action, something that is part of action’s causal history. On the Standard Story, to accommodate the mundane truth with which we began, perception will serve as a direct and dynamic input into action. The Causal Theorist can acknowledge (NS) by maintaining that perception’s causal role is necessary (we leave the details to them).

This account, however, will not work as it distorts the phenomenon of agency. The distortion derives again from the Causal Theory’s analysis of agentive control in terms of the antecedent causes of action. As I argued in section 3, this approach abolishes agency. If the relevant perceptual event is a numerically distinct event from action and yet plays the role required to solve the Many-Many Problem, namely attentional guidance, then agency will disappear. For if in doing something, i.e. in acting a certain way, I am guided by something distinct from my action, namely a perceptual process distinct from my doing what I do, then I am not exerting control. Rather, the event identified as my doing something comes under the control of something distinct from it, something that exerts the executive role of guidance. This again shows that I am not in control but merely subject to control. So the relevant event is not an action; it fails to count as my exerting control. Thus (NS) as stated fails to fully express how perception is related to action since it does not rule out the Causal Theorist’s emended theory. I shall now argue that where perception plays the role of guiding action, it does so as a necessary part of action.

(NS) holds that in every possible world where there is an intentional bodily action, there is a process that implements a solution to the Many-Many Problem. Given that this solution requires attentional selection, the existence of an intentional bodily action implies that there is an attentional selection process that guides that action. Now, consider some arbitrary possible world where there is a perceptually-guided intentional bodily action A by subject S. It follows by (NS) that there is some perceptual attentional process P that plays the guidance role for A, namely the process of perceptual selection that solves the associated Many-Many Problem. Now either P is numerically distinct from A or it is not. Let us assume the Causal Theorist’s view (for reductio) that P is numerically distinct from A because it is among the causal antecedents of action. But we have seen that P’s playing a guiding role in respect of A would then abolish agency. Under the current assumption, if P guides the event A, then A would not be the agent’s exerting control and hence would not be an action. Rather A would be subject to the executive control of P. But we have assumed that A is an action.
Accordingly, $P$ is not numerically distinct from $A$. Assuming that $P$ and $A$ are events (or event-like), a type of concrete particular, and that events can compose other events, this means that either (1) $P$ is identical to $A$, (2) $P$ overlaps with $A$ but they each have parts not contained in the other, (3) $P$ is a proper part of $A$ or (4) $A$ is a proper part of $P$. Most action theorists would reject (1) since $P$ does not seem to have movement as a part but $A$ does. This would also rule out (4), leaving (2) and (3). I find (2) difficult to understand in this context, and it is not clear what would lead us to accept it rather than (3). Nevertheless let us express the ideas given in (2) and (3) by saying that $P$ is a part of $A$ (and likely a proper part, as per (3)). Thus for some arbitrary possible world, if there is an intentional bodily action $A$ performed by $S$, then there is a perceptual event $P$ which plays the guidance role in respect of $A$ and which is also a part of $A$. Generalizing, we get:

(C): Necessarily, if $S$ performs an intentional bodily action $B$ then there is a perceptual event $P$ that plays the guidance role in respect of $B$ and $P$ is a part of $B$.

Accordingly where perception guides bodily action, and this is plausibly true in all actions, perception is a necessary part of action.22 How do we secure (C) in light of (NS)? I think the way we have to do it is to transform (NS) to an identity claim:

(I): $S$’s motivational state $m$ towards $B$-ing (paradigm: an intention to $B$) structurally causing the selection required in implementing a solution to the Non-deliberative Many-Many Problem appropriate to $S$’s $B$-ing in $C$ is $S$’s intentionally $B$-ing in $C$.

As this implementation involves selection (attention), selection will be part of the process that is the agent’s acting intentionally and hence is part of intentional action. There are, in any event, independent reasons to endorse this identity claim. Recall the claim of some Causal Theorists that action is identical with a bodily movement caused in the right way. We must, however, reject this account. Hornsby (1981) has pointed out that mere movements are referred to by nominalizations of intransitive verbs (“John’s arm rising”), yet we never use such nominalizations to say what we do (cf. “John’s raising his arm”). This grammatical distinction suggests that in speaking of actions, we are not speaking of mere movements. Myles Brand (1984) has argued that the temporal and spatial features of action are not identical to those of mere movement. In part, the control of movement inherent in action must involve more than just the body’s movement. Moreover we might expect that action as a phenomenon characterized by intentionality has to involve more than just mere movement; there must be some relevant intentional state to account for the fact that there is an object of control when one acts. Finally
in section 3, I argued that if intentions as the proximate cause of action also control, guide and sustain action, action is abolished. Thus if the motivating state plays a specific controlling role in respect of action, that state cannot be numerically distinct from action.  

We find a more congenial position held by those Causal Theorists who take action as identical with the process of the motivating state’s causing the movement (e.g. Dretske, Searle op. cit.). The lessons of the Many-Many Problem, as argued above, require us to take perceptual guidance of bodily action as part of that action. Yet once this step is made, once motivation, movement and perception are taken as parts of action, it seems plausible that we have not left out anything of relevance to basic agentive control. The whole of the process of implementing a solution to the Many-Many Problem, where this involves intention, perception and movement bound up in a specific way, just is intentional bodily action. (I) is thus prima facie plausible.

The discussion of the Non-deliberative Many-Many Problem has focused on the relation between perception and movement. There has been much recent work on vision and action in cognitive science. Let me briefly put the current results in that context. David Milner and Melvyn Goodale have argued that the two anatomically separable cortical visual streams in primates are functionally differentiated. One stream, the *dorsal stream*, functions in finely-tuned spatial processing relevant to guiding precise motor movements, where the relevant processing is in an egocentric coordinate frame. The second stream, the ventral stream, functions to provide representations geared primarily towards cognition and categorization, processing in an allocentric coordinate frame. Moreover the ventral stream seems to have an influence on the nature of visual consciousness, though these issues are complex. These results are supported by a variety of patient data and behavioral studies.  

There are striking consequences of damage to the two streams. Damage to the ventral stream can affect the phenomenology of vision and lead to various forms of visual agnosia. Such patients exhibit severe deficits in how objects appear to them. In one well-studied case, the patient D.F., the agnosia is of shapes and higher-level structure though color and texture perception remains intact. Strikingly despite this distortion in how things appear, D.F. is able to grasp many structurally simple objects with near normal kinematics and accuracy. Accordingly some have suggested that the ventral stream has a special role to play in respect of conscious vision but not in the guidance of movement. On the other hand, damage to the dorsal stream impacts visually guided movements but does not appear to affect phenomenology. While such patients, for example those suffering from optic ataxia, can clearly see objects before them, they grasp them incredibly inefficiently, groping for the objects. This suggests a double dissociation, with the conclusion that the dorsal stream concerns action; the ventral, thought and experience.

There are many complicated issues here that must be set aside, but I want to very briefly flag two: the location of the Many-Many Problem and the
issue of consciousness. By “location”, I mean the issue of whether solving the Problem in respect of visual selection is associated with one particular stream. What is likely is that both streams may confront some version of the Many-Many Problem, an overabundance of visual information and the need for selection. Indeed one possibility that Milner and Goodale endorse is the ventral stream’s role in setting the targets for dorsal stream processing.\(^{25}\) We might then say that if this account is correct, the solution to the Non-deliberative Many-Many Problem in us requires not only the structuring influence of intention but also the interaction between two functionally differentiated visual streams. At the same time, and this is the second issue, the involvement of the ventral stream does not imply the involvement of conscious experience. Even if the relevant visual capacities are not conscious, they remain the agent’s own capacities (no need to speak of the \textit{subpersonal}).

When D.F. accurately grasps a block whose features she cannot describe, it is nevertheless via her visually taking in relevant spatial features of the object or its affordances that enables appropriate movements to be made. Whether conscious perception in some sense is necessary for basic intentional bodily agency is a question I leave open. (C) is silent on this.

D.F.’s case does reveal that we are inclined to speak of gradations of control and thus, gradations of agency. In her case, the deficiency in conscious perception suggests a deficiency of agency and we typically have in mind further conditions on higher-ordered forms of action. Thus we can also speak of an agent’s acting consciously, freely, rationally, or virtuously, where these properties of action are exemplified in part due to the connection between the agent’s proximal motivations with prior motivational states and deliberation. Higher-ordered forms of control of this sort will build on the basic form of bodily control at issue in this paper. Thus for conscious control, we may propose that perception as involved in solving the Many-Many Problem must be conscious or that there is some typical phenomenology in action that must be present; for rational, free, and moral action we may propose that the motivating state that enables appropriate selection must meet certain further conditions. These are matters for another time, but I hope it is clear that what it is to act consciously, virtuously, rationally and freely will only be clarified when we understand what it is to act in the most basic sense.\(^{26}\)

Notes

1 This notion does not imply that perception is conscious. The crucial point is that it is the \textit{agent} who registers this information received from a perceptual channel.


3 As an exercise, find any monograph on action and compare the number of entries for intention, desire or belief relative to perception and to attention. The point of the exercise is to see that if the latter are mentioned at all, they are less frequently mentioned.

4 See (Thalberg, 1984), (Brand, 1984), (Bishop, 1989), (Mele, 1992). These conditions are well accepted. For an alternative response, see (Searle, 1983), chapter 3.
The Many-Many Problem is also an essential feature of mental actions, but the focus in this essay is bodily actions, the primary target of contemporary philosophical accounts. When I speak simply of actions in this work, I refer to bodily actions. I shall deal with mental actions elsewhere.

Davidson (1980b), for example, begins with the idea that the primary reason for $B$-ing was that the agent has a pro-attitude towards actions with property $F$ and believes that $B$-ing has property $F$.

For example, some may wish to say that if $F$-ing in context $C$ is required for $S$'s $B$-ing, the subject's $F$-ing might also be intentional even if she does not explicitly intend to $F$. For example, $S$ may intend to go to the party and have to cross the river to do so. $S$ may then cross intentionally even if she never explicitly forms an intention to cross. Perhaps the intentionality of $F$-ing is due to the fact that in $C$, $F$-ing facilitates the satisfying of her intention to $B$ and is represented in her knowledge of how to $B$ in $C$. These additional representations in respect of how to execute $B$ via $F$ will also contribute to solving the Many-Many Problem. I leave these details for elaboration of the theory; I argue here for the plausibility of the framework.

We can select multiple targets or even multiple responses, so the point here is the need for a selectivity within the noted Many-Many manifold. I shall assume the simpler case of selecting one target for ease of exposition. Note also that the Problem is exacerbated because other sensory modalities are simultaneously giving us a similar wealth of information. The Many-Many Problem is typically multimodal.

To flag an important point: I will sharpen this conception of attention as selection below. It is not simply selection of “input” but selection of input so as to solve the Many-Many Problem, specifically selection so as to guide a response. The notion of perceptual selection as attention is long-standing in psychology, at least as far as William James (1890). For recent work on attention, see the articles in Mole, Smithies and Wu, (forthcoming). Among contemporary psychologists, Alan Allport has emphasized the link between attention and action (1987).

I owe this example to Fahrid Masour and am grateful to him and Imogen Dickie for discussing this recently. I am inclined to think that this creature must be capable of proprioception as well, if it is to be capable of bodily action. See below.

Mere bodily movements may provide a challenge. When I raise my arm, there is no multitude of external targets. I just move my arm. We must not forget, however, that there are various forms of bodily awareness that give us information about our bodies. Moreover our bodies are complex, both in their parts and in relevant properties. In being confronted with proprioceptive and kinaesthetic information, we can only act effectively, even in the simplest bodily movements, by selecting relevant information regarding the body and relevant properties regarding the part selected. Intentional action with the body requires some form of attunement to specific parts of the body. I treat these ways of selectively taking in information about one's body as perceptual attention. Even in simple movements, one faces the Many-Many Problem and the need for selection. Consider, however, a creature that is simply structured and which can make only simple ballistic movements in one direction (I owe this sort of case to Daniel Friedrich). It might seem that no proprioceptive information is required but only an intention to move that suffices to produce a movement. So perception and a fortiori perceptual attention is not necessary for intentional action. There are difficult issues concerning egocentric identification in the background of this case that make it not an obvious counterexample. Let me sketch the response. The first point is that while one might think that all that is required to generate the movement is an intention to move the body—and hence, perception is not required—a problem arises as to how the body is represented in the intention. To count as a case of agentive control,
the intention has to be intelligibly directed towards one specific body, namely the agent's own. Now given the possibility of massive reduplication as Strawson noted in a different context (1959, 20) it seems to me that the representation of the body cannot be merely descriptive. One does not simply intend to move a body or the R body where “R” is purely descriptive; there must be a demonstrative element (move this/my body). Such demonstrative representations, it seems to me, requires a stable informational connection to the body in question, and this would plausibly count as an impoverished perceptual, viz. proprioceptive, link to the body. So a case can be made even here for perception of the body. The second point concerns whether attention is required given the impoverished proprioceptive channel. That is, do we now have the worrisome one-many case as in the text above? On this point, see my response to the “loose end” at the end of this section.

12 There is some empirical evidence that the deployment of action concepts specifically activates those motor representations specific to the parts of the body that are involved in executing those actions. See Pulvermüller (2005) for a discussion of some evidence when subjects read action verbs. Perhaps in humans, the deployment of specific action concepts will constrain possibilities by activating specific motor representations.

13 Attention is selection for action understood as selection needed to solve the Many-Many Problem. In most common cases, this implies selecting one from many, whether diachronically or synchronically. But in its most abstract characterization, it is a specific attunement to perceived features that guides a behavioral response in light of the agent's motivations.

14 An aside: these behaviors are plausibly actions, for they exhibit some form of control. They are not reflexes but arise from an earlier solution to a Many-Many Problem. We may have a more general conception of action that includes subintentional and intentional varieties. On this conception, behavior counts as an action if and only if the one-one map that it implements is due to a solution to the Many-Many Problem at some point in the agent's life. Intentional actions would then be differentiated by solution of a Many-Many Problem in light of current motivation. This is a provisional proposal and I will not pursue it further here.

15 I am grateful to an anonymous referee here for suggestions in responding to this problem more succinctly. I am inclined to take such cases as largely of the subintentional variety, but intuitions differ.

16 This is not to deny that we do exert control on our actions as themselves targets of control, but this form of control with action as its object is more abstract in perspective, tied up with our capacities for planning and reasoning. Thus agents exert such control when they recognize that they have reason to terminate their actions or when they reassess their reasonability, efficacy and compatibility with other goals in light of new information. This form of control is rooted in reflection, and it is a higher-ordered, self-reflective form defined in part by having action-types or intentions as its object. In asking about the primary form of control exemplified in bodily action, however, we are asking about control of a more basic form where action, understood as a concrete exemplification of the agent’s causal powers, is not the object of control but rather the embodiment of it.

17 I do not object to the idea that our actions can be triggered by some other event. Our actions are often prompted, after all. It is only when we require the causing event to do much more that we lose our grip on what is essential to action itself.


19 Thanks to Declan Smithies for reminding me that this case must be considered. For a very concise overview of the cases, see Spence (2002).

20 This leaves open the possibility that the subject’s behavior might sometimes be driven by a motivational state that is unconscious and manages to flout the agent’s consciously accessible motivations (see this as combining the motivational defects found in addicts and the inaccessibility that characterize unconscious, “Freudian”, behaviors). In this case, we would have a defective form of intentional action but defective intentional actions are still intentional actions. This would not threaten (S).
Confronting Many-Many Problems

21 I am grateful to an anonymous referee for prompting a more forceful response on this point.
22 Thanks to David Sanson for discussion that helped me make more perspicuous the argument presented here.
23 Actually, we should not think of the intention as a concrete particular, an event. Standing states have, I would think, a different ontological status, and motivational states are often just standing states. This is another challenge to the Causal Theory, denying a specific view of intention as concrete particular. A metaphysical account of action must instead combine the following claims: intention is not literally a part of the action event since it is not itself a concrete particular but a state; intention or equivalent motivational state is necessary for action vis-à-vis the Many-Many Problem. This raises difficult metaphysical issues about how to speak of both events and states as broadly (necessary) features of actions, but I set this aside here. Thanks to Helen Steward for discussion on this. I’m not sure she will be fully satisfied with the result.
25 See also Campbell (2003).
26 I am grateful to an anonymous referee for very helpful and constructive suggestions that enabled me to refine many points. This material was presented at a colloquium at The Ohio State University and I thank the audience there for their suggestions. For comments on previous versions and/or discussion, I am grateful to Andreas Anagostopoulos, Hemdat Lerman, Abe Roth, David Sanson, Tim Schroeder, John Searle, Declan Smithies, Helen Steward, and Jay Wallace.

References


