

Attention as Selection for Action

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1. Introduction

Attention appears to be a ubiquitous feature in perceptual experience and some have argued that it is in fact necessary for such experience.¹ In this essay, I shall argue that attention is necessarily tied to agency. As attention is plausibly a feature of cognition as well, the implication is that an aspect of two fundamental psychological capacities, namely attention in perception and thought, has to be understood in terms of agency. This paper develops and expands ideas in Alan Allport's rich initial discussion.²

I shall provide a specific answer to the question, "What is attention?" that touches on four issues: (1) how attention works, (2) what attention is for, (3) how the subject is involved; and (4) whether attention implies phenomenal consciousness. My goal is to identify a theoretical conception that is psychologically and philosophically useful, and the core idea is that attention as a *subject* level phenomenon is a type of selection that plays a necessary role in agency: attention is (more or less) selection for action. The "more or less" acknowledges higher-ordered attentional states that supervene on selection for action, but the central point is that the nature of attention is illuminated through the nature of agency.

Let us begin with some general claims regarding how attention works. One idea that animates theoretical and folk conceptions of attention is that of *selectivity*. Specifically, one imagines the selection of specific items among many items. We find this in both perception and cognition: in perception, one can select spatial locations, objects, and features and regions of objects; in cognition, one can select the contents of various

¹ The latter claim has generated a wide literature. In this volume, see Prinz for the positive argument and Smithies and Phillips for critical discussion of relevant issues.

² See his (1987). See also Neumann (1987). Allport (personal correspondence) is in fact inclined to deny that all attention is selection for action though much is (for my response, see sections 3 & 4).

possible thoughts. Moreover, the familiar descriptions of attention as focusing, spotlighting, accentuating and highlighting suggest selection. The question is how to sharpen this idea. After all, selection is too broad to capture just attention. Think of a machine that sorts gum balls of different sizes or (to enter the brain) the response of a single neuron to a specific stimulus.³ Both exhibit selection without attention, so attention must be a more determinate form of selection. To sharpen ideas, let us consider the second point noted above, namely what selectivity might help us to do. The intuitive answer is that it helps us to get things done, namely to serve action, both bodily and mental behaviors (i.e. thinking, reasoning, imagining etc.). The sharpening that suggests itself is that attention is selection for action.

We should not lose sight, however, of the fact that attention is a capacity of a psychological subject. What we are concerned with is a personal level phenomenon: it is a subject who pays attention in the sense at issue here and not some neural subsystem although such subsystems can be part of the causal basis of attention. Moreover, once we speak of the subject attending, we raise the fourth issue: attention appears to be a characteristic form of consciousness. This is an important issue that I shall touch on in the end but to be blunt, attention does not necessarily involve phenomenal consciousness even if salient forms are closely tied to conscious experience.⁴ There are unconscious forms of attention: selection for action need not be conscious, though of course, it can be.

³ There will be selectivity without attention as one goes up in complexity of neurobiological processes. Chris Mole suggests that the selections required to resolve binocular rivalry might count as selection without attention. The issue (see (Tong, Meng, and Blake 2006) for a review) is worth further discussion though I agree: here we have a basic perceptual selection process that makes a specific object available to conscious perception; the subject is not involved in this case, though she benefits from this in that the resolution of binocular rivalry enables her to consciously perceive one of the rivals. On attention and rivalry, see also (Mitchell, Stoner, and Reynolds 2004).

⁴ See my (forthcoming) on the nature of "conscious attention" and Watzl this volume. For an argument for the more ambitious view where attention is selection for rational control (where this requires consciousness), see Smithies, this volume. One way of bridging Smithies' thesis with mine

In section 2, I shall argue that the correct form of selection is that required to solve what I call the Many-Many Problem, the challenge of sifting through many “inputs” and many potential “outputs” to generate coherent behavior. Attention is characterized first in the context of intentional action, action that is generated in light of the subject’s motivational state. This yields a conception of what psychologists call *voluntary* attention. In section 3, I briefly discuss specific forms of selection associated with action, namely attentive action, attention as action, and selection in slips of action. I then ask whether the selection for action account is too narrow or too broad. I argue in section 4 that the conception is not too narrow in that it accommodates *involuntary* attention. In section 5, I take up the question whether the conception is too broad because attention necessarily involves phenomenal consciousness yet selection for action does not.

2. Selection for Action

To speak of attention as selection for action is to speak of a way that the subject is attuned during action to relevant information such that it is deployed to inform the subject’s response. Seen from the perspective of action, it may seem that attention so understood is at least ever present in mundane action.⁵ The goal in this essay is to extract from reflection on agency a thesis about the nature of attention. The relevant conception of action, in the first instance, is *intentional* action where the subject acts in light of their motivational states, i.e. motivational states play a causal role in the generation of action. Such action is constituted by a response guided by the agent’s attunement to certain

is to recognize a hierarchy of functional accounts of attention, the most abstract being attention as selection for action with attention as selection for rational control in Smithies’ sense as a more determinate form of selection for action, a species of the genus discussed here.

⁵ For the claim that it is metaphysically necessary, see my (forthcoming, a). We should not conflate the obviousness of the mundane point, which may thereby seem trivial and uninformative, with the metaphysical claim, which is not obvious.

features of the world including features of the subject herself. There are then two necessary “aspects” in attention so conceived: (a) the attunement (“selection”) and (b) the link between the response and that to which the subject is attuned (“for action”).⁶ Thus, not all types of selection will count as attention. Neither our mechanical sorters nor a single neuron perform intentional actions although the latter might play a causal role in the overall workings that generate the subject’s acting intentionally. What needs to be characterized, then, is action, and in what follows I first show how the relevant type of selection is driven by a constraint confronting agents like us (viz. embodied agents capable of perceiving and remembering several things).

Consider the following scenario. Two objects are in your field of view: a football and a basketball. Focus also on the possible use of your two legs to kick either ball, the left or right leg. We can then consider what I shall call a (restricted) *behavioral space* for the agent at that time that is constituted by a mapping that links “many” possible inputs to which the subject can respond and “many” possible outputs that count as the relevant responses. In the current case, the behavioral space is constituted in this way: for each of the two objects, two responses at a given time are available, namely kicking with the left leg or kicking with the right. So, four possible actions at a time, defined by specific input-output linkages, constitute the behavioral space available at that time to the agent: kicking the football with the left leg, kicking the football with the right leg, kicking the basketball with the left leg, kicking the basket ball with the right. In this scenario, you can only do one such action at a time. The Many-Many Problem is illustrated by noting that to do anything at all at a time, selection of one among the four behavioral possibilities must take

⁶ In certain cases, the response is itself the selection, perhaps transformed. For example, consider active conscious imagination of one’s mother’s face. Here, the agent selects a stored image of her mother (the “input”) to bring to consciousness (the “response”). In this case, the action is selecting a specific image as the content of one’s conscious awareness.

place within the behavioral space at that time. If selection does not happen, then nothing does. Thus, if there is to be action at this time, the Many-Many Problem must be solved: appropriate selections must be made where an input informs a specific output. Thus, a path in behavioral space is selected.

The demand for selection is greatly amplified in real life scenarios. First, consider visual input. Typically we are visually aware of multiple objects, not all of which are relevant to our current goals. Moreover, each object instantiates a variety of visible properties, again not all of which are relevant. Thus the location of the ball but not its color or texture is relevant to our kicking it. There has to be selection not just of an object but also of location and properties.⁸ Furthermore agents take in inputs through multiple exteroceptive channels. We need selection across multiple exteroceptive modalities. Finally, an embodied agent also receives relevant information through proprioceptive channels regarding the state of the body that will be used in action, and this is an additional input that must be selectively used. In real life scenarios, the amount of perceptual input is massive and multimodal.

It is clear that in the normal bodily case, selection is required to inform action, but the requirement also holds for mental actions such as imagining, recalling, and deliberating.⁹ In mental action, we act on the basis of what is retained in memory (in a broad sense of “memory”), some of which is relevant, but much irrelevant to our current goals. Thus, to imagine a specific image, to recall a fact, or to deliberate requires that only relevant memories be brought to bear on our current goals. To imagine my mother’s face, I must bring to bear the relevant stored images of my mother as opposed to my father; to

⁸ This gestures towards the distinction between attention to locations, objects and features discussed in psychology.

⁹ Allport (op. cit.) also makes some suggestive remarks in this direction, see fn. 3, p. 397.

recall the capital of Germany, I have to bring to bear the relevant proposition relating to Germany rather than France; to decide whether it is better to live in Europe rather than America, I have to bring to bear relevant information about quality of life rather than quantum mechanics. Thus, solving the Many-Many Problem and the implicated selections within a given behavioral space are necessary features of normal mental and bodily agency.¹⁰

The notion of a behavioral space, and the Many-Many Problem that it raises, is central. A behavioral space identifies the behavioral possibilities for a particular subject at a time and is constituted by multiple potential input-output linkages. This space is then structured by three basic elements: linkages, inputs and outputs. Minimally, the inputs and outputs are identified with intentional states *of the subject* encompassing both perceptual states (events), including somatic states such as states of pain, proprioception and kinaesthesia, and (broadly) cognitive states (events), including thoughts, memories, desires, intentions, emotional states, states of imagination etc.¹¹ I leave open ended whether some states can only serve as inputs or outputs (the issue deserves further discussion), but let me note that there is no requirement that the states at issue be conscious. This allows for the possibility of unconscious action. On the input side, these are typically either perceptual states (in the bulk of bodily actions) or memory states (in the bulk of mental actions), though of course we can act mentally (e.g. think about) what we perceive and we can act

¹⁰ The Many-Many Problem has synchronic and diachronic dimensions. Our capacity for attunement to one feature rather than others can be exemplified at a time or across time (e.g. diachronic selectivity might be the only form of selectivity in a hypothetical creature that can only process one input at a time). What is true in both synchronic and diachronic cases is that the creature is attuned to a certain feature rather than others so as to react to it.

¹¹ Typically, in action directed at external objects, we characterize the relevant space on the input side in terms of the *objects* perceived rather than the perceptual states themselves. This is simply a choice of presentation, but the perceptual states are themselves the fundamental inputs. The objects in the subject's environment define behavioral possibilities at a time only if they are perceived. As a whole, the behavioral space identifies a complex disposition for action. A solution to the problem that arises via selection of a specific path in behavioral space counts as action.

bodily in response to what we remember. In addition, the relevant states on the output side include motor states of the subject, namely movements of her body (holding a body steadfast, for example, counts as a relevant movement). These states are distinctive in that they are not intentional states, but how should we distinguish among the relevant class of movements?¹²

We do so in terms of linkages to possible inputs. A linkage between input and output identifies a possible causal connection between them at a time. If there is to be action, a specific link must be selected, one that is constituted by an input-output connection *where the former guides the latter*. This notion of guidance is familiar from philosophy of action, having been deployed to answer the problem of deviant causal chains. Indeed, this notion of guidance is necessary to salvage a causal account of action in the face of causal deviance, but action theorists are satisfied to invoke the notion without providing a substantive account of guidance. I think that such an account is needed, but for present purposes, I shall assume the same notion such theorists help themselves to.¹³ Once the notion of guidance is in play, the relevant motor outputs are just those motor states that can be generated under the guidance of relevant input, specifically some subject-level intentional state. In bodily action, movements are often guided by relevant perceptual input including proprioceptive states. Once the structure of behavioral space is thus characterized, a solution to the Many-Many Problem that arises therein plausibly identifies a form of attention, namely the subject's selection of information (input) that guides or otherwise informs her response. This was the mundane notion of being attuned in the relevant way that suggested the agent's being attentive and I suggest that if

¹² Goosebumps or one's hair standing on end, perhaps, can be seen as bodily movements or at least changes. These are not in the purview of the relevant bodily states.

¹³ This is not to be denied that the promissory note must be paid.

anything counts as a subject's attending to some item, then the subject's selecting that item to guide action does.

The demand for selection are not necessarily driven by *cognitive* capacity limitations, a point that is frequently cited as what makes attention necessary. Certainly, such limitations are not irrelevant, but attention is necessitated in all cases by constraints on agency, even in the absence of cognitive capacity limitations.¹⁴ In our kicking example, even if the agent is able to cognitively process the information needed to do all four actions at once, selection is still required. In this case, it is just the (physical) constraints on how many actions can be performed among those available in the behavioral space that necessitate attention (the agent cannot kick both balls with both legs at once). Cognitive constraints, then, are just a species of the relevant action constraints that motivate the need for attention.

Selection then is necessary for intentional action, but not any selection will do. Selection that is inconsistent or otherwise at odds with the agent's motivations will not yield intentional action but rather inexplicable behavior. So the selections must be *intelligible* in that they are consistent with and facilitate the satisfaction of the agent's intentions, and the way to ensure this is to take intentions as constraining appropriate selection. That is, intentions play a causal role in solving the Many-Many Problem.¹⁶ Let us call this the *intelligibility constraint*. Attention is thereby clarified by noting that selection for intentional action is *motivated* selection: the appropriate selection occurs because of the agent's intention. Thus, one selects a hammer and a specific object to pound because

¹⁴ A point also made by Allport and Neumann (op. cit.).

¹⁶ This conception of intention should not be foreign to certain perspectives in empirical psychology. For example, one can think of intentions as associated with a setting of weights within a neural network. Moreover, such ideas can be found in models of intention in cognitive and social psychology. See e.g. Hommel (2000) and Gollwitzer (1993). Another, more common, way to think of the role of intention: intentions establish what psychologists refer to as task and attentional sets, the attunement of subjects towards certain inputs and outputs given their goals.

one intends to hammer that object. Solving the Many-Many Problem so as to generate action is then regulated by the agent's motivational states. We have thus arrived at a characterization of what psychologists refer to variously as voluntary, endogenous or top-down driven attention. The broader insight, I suggest, is to situate this form of attention in a precise way within selection for intentional action.

The information that is selected so as to execute an intention is often quite fine-grained. The properties that are required to guide accurate action must be represented at a finer-grain than what is typically represented in intention. To see this, consider a case where the agent reaches for a glass with her right hand because she intends to drink its contents. Let us imagine that the agent selects one of many targets as that which she intends to grab. So we have selection of one object rather than another. The glass also exemplifies a variety of visible properties not all of which are relevant to the action (e.g. its color). What are relevant are certain spatial parameters including the precise dimensions at the grasp point. These properties must be selected to inform and guide the appropriate movement. It seems clear, however, that at the level of the agent's intention, which we can imagine to have the conceptual content *reach for that glass*, the precise spatial parameters are not explicitly represented.¹⁷ Rather, the agent's intention influences selection of the relevant information, say the precise metrical parameters that are registered to guide accurate movement.¹⁸ But a worry now arises: is the required attunement at the level of the

¹⁷ There is a demonstrative involved here, and perhaps one might think the content of the intention is this: reach for that glass at this point. The perceptual demonstrative "this" identifies a spatial location. For a discussion of the relation between demonstrative specifications and more fine-grained spatial processing as pertains to attention, see Campbell (2002).

¹⁸ The distinction here can be set in the context of Milner and Goodale's influential work (1995) on the two cortical visual streams in primates, the dorsal stream which they claim functions to program accurate movement and the ventral stream which they claim functions primarily to serve thought. They propose, however, that despite this functional division, both streams work together to generate action. We can think of this as grounding the point in the text: intentions, via their conceptual content, influence via the ventral stream, the fine grained processing in the dorsal stream, including

subject or is it rather the activity of a sub-personal perceptual system that is somehow distinct from the agent's own involvement. If the latter is the case, than selection as required to solve the Many-Many Problem is not a subject level phenomenon, and hence is not attention as we are conceiving it.

We are now considering a challenge grounded in a mundane phenomenon, perceptually guided bodily action such as grasping a visible glass. That there is subject level behavior of this sort, namely the agent's responding to the world in light of how she perceives things to be, is not in question. This is a canonical form of bodily action. To respond to the charge that selection for action is merely a sub-personal phenomenon, let us assume (for *reductio*) that the perceptual selection of spatial information in solving the Many-Many Problem does not involve the agent, *S*. Thus, the *subject* is not attending to the precise spatial parameters, *P*, needed to guide accurate bodily movement. Rather it is some part of the subject, a subpersonal cognitive system, *C*, that is doing the required selection. So *C* solves the input side of the Many-Many Problem: it is sufficient to do the perceptual work needed to guide the intended action. By assumption, *C* is neither *S* nor constitutes or suffices for *S*'s involvement (by hypothesis). But what we have then is *S*'s performing a bodily movement in a certain determinate way (namely accurately grasping the glass as she does) where the resulting perceptual attunement that guides her action does not involve her. The perceptual guidance that informs the agent's action is not the *agent's* perceiving the relevant features. Rather, something else that registers information but is not her perceptually registering it plays the role of perceptually guiding her action. This, however, is contrary to our mundane assumption: we do not then have an agent's acting in response to the world guided by how *she* perceives it to be but rather by the "perception"

attentional selection of specific parameters. For some discussion of this within an account of the conceptual content of vision, see my (2008).

of something that is not identical to her nor sufficient for her perceiving how things are.¹⁹ The role of C in solving the Many-Many Problem cannot then be insulated from S's own involvement.

C is a part of the agent, S, so what we have is a part of S contributing to S's reaching and grasping. Now the mundane fact is that S performs the action precisely because she is attuned to the relevant features, i.e. selects the appropriate spatial properties. So if C's selection of the relevant parameters stands in the right relation to S's attunement (e.g. it constitutes S's or is sufficient for S's attunement), then we have the ground for S's attending to the relevant spatial properties. There may be a worry that attention has to be conscious yet the activity of C does not guarantee consciousness.²⁰ I shall return to this, but let us conclude at least provisionally that if perceptual guidance need not involve conscious perception, then it is the subject that is attending to the relevant fine-grained features of the world so as to guide her response. A similar form of argument can be given for the mental case, namely mental actions as guided by the way the subject remembers things to be as given by the specific memory selections made to solve the Many-Many Problem. I suggest that selection within the Many-Many Problem is or suffices for a subject level phenomenon of selection and thus of attention.

As we shall see, we will need to broaden the account to accommodate involuntary attention, but I want first to briefly comment on a metaphysical point: what sort of ontological category does attention belong in? When we speak of attention or selection we

¹⁹ Indeed, so described, it is not clear that the agent is acting at all if C is thereby "insulated" from the subject. What we have, instead, is a bodily behavior (that involves the agent) but which is guided by something other than the agent. This is a case where the agent is no longer in control and hence no longer acting.

²⁰ Bridgeman (1975) has done interesting experiments where subject's are asked to point to a moving target which suddenly shifts direction while the subject's eyes are saccading. The subject is not consciously aware of the change, yet somehow compensates for the shift. In such cases, the subject attends to the shift without being consciously aware of the shift. This would be case of attention that is not itself conscious (see the last section for other cases and discussion).

might mean the *process* of selecting/attending or a *state* of selection/attention. Intuitively, this difference can be seen in talk of *shifting* attention (presumably a process) and *maintaining* attention (presumably, something like a state). On my account, the metaphysics of attention is a process metaphysics by which I mean that attention is in the first instance identified with the processes involved in solving the Many-Many Problem, namely selection of a specific input to inform a specific response.²¹ These processes constitute the subject's attending to that input: attending to X is selecting X to guide or inform a response. Here attention is itself an action or activity, one that is typically part of larger actions. Thus, a wolf might visually attend to a moving prey by tracking it with the eyes (overt attention), and this may itself be part of a larger action, say running after the target. It's attending to the prey is constituted by the dynamics of solving the Many-Many Problem throughout the time-course of its pursuing that object.

At the same time, subjects can be in states of attention, where states are ontologically distinct from the relevant processes. For example, the wolf can be characterized as occupying a single persistent state of attending to the same prey over time even as the underlying dynamics of solving the Many-Many Problem radically changes over that time as it follows the prey over different terrains. Such states of attention to X are to be understood as supervening on the process of solving the Many-Many Problem where X is relevant. The relation at issue is similar to the following: we can distinguish between the various processes that occur within our bodies over time and the state of bodily health that persists (hopefully!) over that time, a state that supervenes on those processes. Being healthy and explaining what it is to be healthy are both posterior to the underlying

²¹ Cf. Mole, this volume and forthcoming, and Allport, this volume, for a critical discussion of process accounts of attention and related issues. For a discussion of the recent literature on the dynamics of solving the Many-Many Problem and a computational model of this dynamics, see Botvinick et al. (2009).

biological processes and their characterizations. Thus, the metaphysical and explanatory assumptions I am working with subordinate attentional states to attentional processes: the former supervene on and are explained in terms of the latter.

3. Acting Attentively and Active Attention

Let's consider special cases of attention/selection that are tied to action. I have in mind (a) attentive action (versus inattentive action), (b) attention as itself action, and (c) selection in slips of action. The account should accommodate or illuminate these cases.

Let me focus on attention to bodily action.²² One way of understanding acting attentively in bodily action is in terms of attention to the targets of action, the objects we intend to manipulate with our bodies. This form of attention, however, is easily accommodated on the account given here: it involves a form of consciously attending to those objects. Another way of understanding acting attentively is in terms of attention to the body. On a natural reading, to attend to bodily action is to attend consciously to one's body as deployed in action (the movement of our bodies are plausibly constituents of bodily action). In normal cases of bodily action, one's body is typically not salient to us when we act. Yet like the targets of action just considered, one's body is one of many objects that must be selected to solve the Many-Many Problem: we must both select the target to manipulate and the part of the body to manipulate with. Plausibly, attention to action works by making certain extant selections for action, say proprioceptive selection of relevant parts of the body, salient to consciousness. So, attention to action is a form of attention in action.

²² Thanks to Declan Smithies for bringing up the first two cases. The mental case raises more complicated issues that I deal with elsewhere (it can be accommodated on the account given here).

Selection of objects as required to solve the Many-Many Problem, however, may strike one as insufficient to completely explain attentive action. Christopher Peacocke, for example, has argued that attention to objects (and events) cannot explain the distinctive phenomenology of acting attentively. In his terms, an action's *occupying* one's attention when acting attentively cannot be reduced to one's attending to objects. Peacocke (1998, 68) considers the case of attentively driving down a narrow street so as to avoid hitting the parked cars. He points out that the phenomenology of driving attentively (a) cannot be explained by attention to external objects for someone who is not driving can, in principle, attend to the same objects; (b) is not explained by the driver's attending to other features such as movements of their body or of the steering wheel for an experienced driver who drives attentively need not attend to those features;²³ (c) is not explained by attending to one's trying or action (say in the sense just explained). We can, as it were, imagine relevant duplicates for each case as counterexamples. Let us grant these points.

While attentive action is not merely selection of objects, it nevertheless supervenes on such selection. I earlier mentioned an intelligibility constraint on selection for action that necessitated the involvement of the agent's motivational states: selections have to be made consistent with the agent's goals. Implicit in this is not just that the correct objects are selected, but that these selections also cohere with each other so as to implement the agent's intention. This coherence among selection (input and output) can be understood as a higher-ordered (selective) attentive state that supervenes on relations between the selections required to solve the Many-Many Problem.

²³ Certainly, an experienced driver will not be attending to such things in the sense of consciously selecting them. However, if he is to drive at all, he has to select them for action and in that sense attend to them, though perhaps unconsciously. See the last section.

We can see this in Peacocke's example. Our driver moves his hands on the steering wheel (and not his feet on the pedal) as guided by his attention to the location of the parked cars (and not to the location of the trees also in view). Given that he intends to avoid hitting the other cars, he moves *this* hand (and steering wheel) in *that* way precisely because he selects *this* car to avoid.²⁴ Movement and perception attention are in this way coordinated, and such coordination (a) is present only in our driver but not in a non-acting duplicate who attends to the same "objects", (b) makes a difference in what it is like for the driver that plausibly explains the phenomenal difference between attentive and inattentive action, and (c) can be understood as a higher-ordered sort of "attentiveness" that supervenes on selection of input and output for action.²⁵

What of active attention, i.e. cases where the action just is the agent's attending in some way? Consider the case of covert attention, namely attention that does not imply any overt movement of the body. These cases can involve shifts and maintenance of attention on an object, say in the visual case when one keeps one's eyes fixed while tracking a moving object or in the auditory case when one focuses on a particular instrument in an orchestra. Since active attention is just attention as action, this involves solving the Many-Many Problem so as to traverse a specific path in behavioral space constrained by one's intention to attend to some specific target. But while the input is clear, namely the object we attend to, what is the output? Here, the output is simply altering our perceptual representations such that the attended object may come to be more or less salient and in general, this involves some alteration in the perception of the object over time in contrast

²⁴ See Watzl, this volume for the idea of attention as "structuring" the field of consciousness.

²⁵ Conscious attention to some object is presumably necessary for attentive action in the relevant sense. In the example above, without conscious attention to a parked car (say), we would have *inattentive* driving. As Peacocke notes, the agent *A* need not consciously attend to his hand (he is an "experienced driver"), but were *A* also to do so, then this would then be another way of driving attentively or driving hyper-attentively. Such hyper-attention is often disruptive of skilled behavior.

with other objects. Such effects have been identified at the level of subjective appearances as in the increase in apparent contrast of attended objects (e.g. see Carrasco (2004)). In other words, we are able, via attention, to alter how we perceive things to be, specifically by altering the appearance of a specific item in relation to other items. Shifting and maintaining attention in this active way is just a type of mental action, altering the appearances of a consciously perceived input or maintaining that alteration. Here, input and output are perceptual states.

Acting attentively and active attention can be explained in terms of selection for action. Let me now consider selection in cases of slips of action and ask whether we have attention here.²⁶ Slips of action are a type of defective action where the slips occur because we are being inattentive. Thus at a traffic light where one normally turns right to go home, one may instead have earlier decided to pick up some milk at the market which requires a left turn. Yet despite this intention, we instead turn right at the light, a slip in what we intended to do. William James, I believe, speaks of the case of his going up to his bedroom to dress for dinner but inadvertently putting on his bedclothes and climbing into bed. James Reason recounts an anecdote, I believe from Freud, of the speaker of an assembly who in announcing the opening of the session exclaimed: "Gentleman, I now pronounce this session closed!"²⁷

The complication is that we identify inattention as the source of the slip and yet since a defective form of *action* is produced, it looks like the agent must have solved the Many-Many Problem. This implies that the agent was thereby attentive, yet by assumption, the agent is being inattentive. There is, however, no conflict as both features can be

²⁶ This discussion was prompted by questions from Santiago Amaya.

²⁷ Alas, I cannot find the exact reference, but the example even if fictional highlights the well-known phenomenon of a Freudian slip.

explained on my account. At root in slips of action are failures of attention, specifically the inattentiveness that arises precisely because the relevant selections as required by the governing intention fail to materialize. Accordingly, the agent is not appropriately attuned and in that way is inattentive in a specific way that amounts to a failure to conform to the intelligibility constraint. Nevertheless, there is a form of attention that also obtains, but one that contravenes the intelligibility constraint and thereby can be seen as a defective form of attention: the subject focuses on the wrong thing, exhibits a clear form of distraction or lack of focus. Thus, the account identifies both the failure of appropriate attention and the misdirection of attention.

What slips of action illustrate is that not all attention is driven by the subject's goals. Rather, we have attention that is not in that sense voluntary. Perhaps the relevant selection was driven by habitual responses that resist one's intentions or perhaps there was some malfunction that disrupts our best intentions. If attention is selection for action, this selection is not always voluntary or consistent with our current goals. In the remainder of the paper, I shall complete the case that my account is neither too narrow nor too broad: rather, it cuts precisely at the joints. In the next section, I deal with the involuntary case.

4. Attentional capture: Is Selection for Action too Narrow?

Have we sharpened the notion of selection too finely so as to leave out clear forms of attention? Is selection for action too narrow? In this section, I consider three cases.

The first is that psychologists study various attentional phenomena and many are not forms of selection for action (e.g. Treisman and Gelade's (1980) feature integration theory). My response is that some of the processes psychologists study occur within but do not involve the subject although these processes often subserve personal level phenomena.

To the extent that such processes are not forms of subject-level attention, we can ignore them in our metaphysical account of what subject level attention is. There is, of course, an important empirical question as to how to connect fundamental biological mechanisms associated with attention in a full account of attention in specific organisms like humans.²⁸ The proposal I am giving provides a frame against which to locate and organize the various mechanisms at issue. The relevant question to ask is this: how do the relevant mechanisms relate to selection for action? For example, one question to ask is how the process of binding early representation of perceived features in early visual processing, as Treisman has studied, contributes to subject level attention. On the face of it, binding is causally necessary to provide objects (or representations of objects) for selection for action.²⁹ It is, however, neither constitutive of nor sufficient for the subject's attending to those objects.

The second objection is the case of involuntary attention as when our attention is captured by the sudden appearance of an object in our perceptual field or a sudden change in the properties of a perceived object. The worry is that these are clearly forms of subject level attention and yet do not involve selection for action, at least at the time our attention is initially captured. If this is right, then my conception is too narrow. Some common forms of attention are not for action. I began characterizing attention in terms of intentional action and this led to a conception of voluntary attention. But as we saw in slips of action, there are involuntary forms of attention as well, so for the account to be sufficiently inclusive, it has to deploy a more general notion of action. This is provided by the notion of a behavioral space against which the Many-Many Problem arises.

²⁸ One empirical upshot of the account is that perceptual capacities cannot be studied in isolation from action (and vice versa). This divide and conquer strategy is longstanding in empirical psychology, though more recent work has looked to integrate these issues.

²⁹ See Treisman (1996) for a review of these issues. This is not to deny, as Chris Mole has pointed out, that when Treisman instructs her subjects, she asks them to perform attentional tasks, say visually searching a display. But the primary target of investigation is a process that subserves attention rather than one that constitutes attention.

It is worth noting that typically, involuntary attention (or attentional capture) drives action, even if only briefly.³⁰ The utility of having a capacity that renders an object salient to us despite our being involved in other activities is that it can serve our goals by forcing us to act on the relevant object. Still, we can imagine cases where involuntary attention seems fully disconnected from action. Consider the involuntary *maintenance* of attention on an object. One example may be the case of the beautiful person walking across the room from whom one cannot move one's eyes. Similar cases can occur in thought and are perhaps more common: an idea or image that we cannot let go despite ourselves, say a tune that pops into our heads. The challenge here is that the maintenance of attention neither serves a particular goal nor is an intentional action. It simply happens.

Nevertheless, attention only enters the scene if we can connect the awareness of the object in question to our capacities for action. Let me begin making the case more abstractly. Imagine a creature that is capable of awareness of a manifold of objects but which lacks attention. That is to say, the creature can be simultaneously aware of objects in what we can call its sensory manifold but given that it lacks a capacity for attunement, each object is equally salient to the creature. Let there be three objects currently in that manifold and now a fourth suddenly appears, the sort of situation that in us captures attention. By hypothesis, since there is no capacity for attention, the creature simply comes to be perceptually aware of four rather than three objects. There is just a change in what is represented. Moreover, we do not endow the creature with attention just by according to it the following (nonvoluntary) capacity: new objects that enter the sensory field have a hyper-enhanced appearance. That is, perhaps the color of new objects appears

³⁰ The brief action may be simply an assessment of the object in respect of its importance to our current or long-standing goals. This is driven by a standing motivation to assess new objects on the scene for goal-relevance.

momentarily more vivid or their apparent brightness increases (again, see Carrasco on contrast (op. cit.)). But why should this additional faculty for selective coloring or spotlighting count as *attention*? If I could press my eyeball to selectively render one specific object blurry or more clear, that *on its own* would not constitute attention to that object. We would have only ways in which the representation in the sensory manifold changes. I suggest that only when the relevant selectivity is *for something* can we make sense of an attunement that is plausibly a subject's way of attending to the world. The proposal is that it is just selection for action.

Now in the case of the beautiful person or the intrusive thought, there is no intentional response to those stimuli. Nevertheless, two points need to be recognized. First, the object that is attended is still selected for action in that it is *available* for action. This entails that the relevant object attended at a time must be located in the available behavioral space for the creature at that time, namely as one possible input that can inform a response, i.e. be selected so as to solve the Many-Many Problem. The input is thus located within a mapping between possible inputs and outputs that constitutes the subject's behavioral space at that time, a behavioral space in which intentional action along the paths identified is in principle possible. After all, assume that the object is not integrated in such a behavioral space. Then we return to the case of the creature just discussed that is merely confronted with a sensory manifold that delineates the space of what it is aware of but to which no form of attunement is on the scene. The creature is not attending to one object rather than another, but only representing what is perceptible at that time and any changes therein. So, objects of involuntary attention must be located within a behavioral space and are thus available for action.

This availability of input as integrated within a behavioral space, however, is not enough to account for why one object is involuntarily attended rather than another. After all, in our imagined creature, all four objects in its sensory manifold might be available for behavior. What renders the one that suddenly appears salient? This leads to the second point: attention only occurs within the context of *actual* selections within a behavioral space. We still need selection for action within which one object informs a response. Objects so selected are objects of attention. What then divides voluntary from involuntary attention is that the relevant selections are in the first case driven by intentions or motivational states, the second case, driven without such constraints. Thus, we clarified the first in light of selection for intentional action, the second in light of selection for unintentional action. In both, the objects attended to are salient because they are selected to solve the Many-Many Problem, namely the selection of a specific path in behavioral space.

Returning to the beautiful person and the tune that pops into our head. Even in these cases, the stimulus is driving (unintentional) behavior. The beautiful person forces me to maintain attention, perhaps because my eyes involuntarily track that person or because the person forces itself as the subject of my subsequent thoughts. The tune that pops into my head is the generation of a conscious auditory experience that is driven by unintentional selection of stored memory of music. This latter perhaps identifies a common minimal case, the bringing to consciousness of unconsciously stored information. The crucial point is that in both cases, a behavioral path is selected that involves, in part, the selection of an object that guides a response.³¹

³¹ Remember that the behavioral space here is one that gives rise to the Many-Many Problem. Thus, a reflexive reaction to a stimulus does not traverse a path within a behavioral space of the sort at

Let us then explicitly state the conception of attention in terms of a suitably broad conception of action, namely the idea of traversing a behavioral space. For all subjects *S*, appropriate item (objects, properties, spaces, etc.) *X*, and times *t*:

(SfA) *S*'s attention to *X* is *S*'s selection of *X* so as to solve the Many-Many Problem present to *S* at *t*, namely selection of *X* inherent in *S*'s traversing a specific path in the available behavioral space at *t* (i.e. *S* selects *X* for action).

SfA defines the basic notion of attention of which voluntary and involuntary attention are more determinate forms. Voluntary attention to *X* is just where selection of *X* is constrained by certain motivational states; involuntary attention to *X* is just where selection of *X* is automatic, namely occurs in the absence of motivational constraints. These points allow that the realization of attentional selection can differ in the two cases, as seems to be the case in humans. Psychologists speak of involuntary attention as exogenous or bottom-up driven while voluntary attention is described as endogenous or top-down modulated. What unites them is the connection to solving the Many-Many Problem.

The third case is one that has led Allport to question whether attention can be just selection for action. Specifically, he has suggested the possibility of attention in memory where there is no selection for action, for there does not appear to be any "action related coding".³² Once we identify what action related coding amounts to, it is of course an empirical question whether attention always involves it. But notice that there is a prior conceptual question of what counts as action. Action, I am suggesting, concerns less the nature of how it is implemented (e.g. as involving certain kinds of coding) as opposed to a "structural feature", namely the Many-Many Problem and the underlying behavioral space.

issue here, since the input is not available for multiple responses. Nor does being pushed count as a path within that space, given that the stimulus does not guide the response.

³² Allport (personal correspondence; see also his op. cit. p. 414-5 for some discussion). Declan Smithies has also suggested to me a similar case, that of passive belief formation though I think he agrees that this selection is not a form of attention.

In the case of selection for memory, two questions are crucial. First, does selection for memory involve the subject? If not, then it concerns a sub-personal process that is neither sufficient for nor identical to attention in the relevant sense. The interesting question would be how this process relates to subject level attention (the sort of question we directed at Treisman concerning binding). For example, selection for memory so understood might provide materials needed for action (e.g. to inform thought—it would then be *for* action in a more indirect sense). Second, can the relevant selections themselves sometimes amount to actions, something the agent does? If the answer is negative, then it is again questionable whether we have identified a subject-level phenomenon. So, the case of selection for memory is relevant to characterizing subject level attention only if it can sometimes be something the agent does. But this situates selection for memory within the context of the Many-Many Problem: the items that are stored are located within a mental behavioral space where specific items can be selected for memory, though sometimes, such memory formation is involuntary.³³ So, appropriately understood, selection for memory is a form of selection for action. SfA, I conclude, is not too narrow; the final question is whether it is too broad.

5. Blindsight and Perceptual Consciousness: Is Selection for Action too broad?

We might deny that selection for action provides a sufficient condition because it does not guarantee what many might consider a necessary condition for attention, namely some distinctive form of phenomenal consciousness. In this way, the condition I have

³³ The much discussed experiments by Sperling illustrate selection for memory in the action sense (see Phillips, this volume). That one intends to remember as many of the letters as possible in an array of letters is an intentional action, one characterized by a somewhat indeterminate goal. “Indeterminate” in that one is not remembering any specific letter; “somewhat” in that one is selectively remembering the identity of the letters as opposed to their other visible properties.

offered will be too broad. Now it seems odd that a general psychological capacity that is deployed in action would *necessarily* be conscious. After all, for many psychological capacities, whether those regarding thought, desire, mood, perception and so on, we allow for a distinction between conscious versus unconscious forms and for actions that can be driven by the latter. I see no reason why attention is uniquely exempted from this duality.³⁵

One way of understanding the connection between attention and consciousness is that there is a specific attentional phenomenal character. Necessarily where we have attention, we have this phenomenal feature. In that respect, attention is sufficient for consciousness. Elsewhere, I have labeled this feature the *phenomenal salience* of an attended object. The notion of phenomenal salience identifies a phenomenal feature that is essential to conscious attention (to what it is like to attend to x). Such an account will explicate talk of spotlighting, highlighting, focusing, taking hold of, and so on. I am, however, going to consider a weaker link to consciousness in what follows. This claim is strong enough to rule out the account at issue here: perceptual attention to x implies that one is phenomenally conscious of x. For example, it may be false that there is a distinctive perceptual phenomenology that necessarily accompanies perceptual attention (as I argue elsewhere, Wu (forthcoming, b), and yet, it may also be that one can attend to x only if one is phenomenally conscious of x.

Nevertheless, there is some recent empirical work on blindsight and attention that suggests that this requirement does not hold in the actual world. Work by Robert Kentridge and coworkers (1999) provide empirical evidence that the blindsight patient GY can select for action objects in his blind hemi-field (see Kentridge, this volume). Since GY claims in the relevant cases not to have any phenomenal perceptual experience of the object, we

³⁵ For a different view, see Smithies, this volume.

seem to have selection of x for action without phenomenal experience of x . The experimental paradigm used in these experiments is the standard Posner spatial cuing paradigm which have the following structure: a subject begins by maintaining fixation on a central point. After a certain interval, a cue appears indicating a potential target location. In *direct* cuing, the cue appears either at a location where the target subsequently appears (valid cues) or alternatively, in a lower portion of the trials, at a location where the target subsequently does not (invalid cues). A similar sampling occurs in *indirect* cuing, save that the cue here is a symbol at the point of fixation that directs the subject to a specific location (the subject must understand the convention linking symbol to spatial location, say the significance of an arrow).³⁶ Using the Posner paradigm, Kentridge et al. showed that GY demonstrated recognizable spatial cuing effects to spatial locations in the blind hemifield on both direct and indirect cuing.³⁷

I claim that GY is attending to the target (stimulus/object) while at the same time is not phenomenally aware of the target. The latter claim is the received view of how to characterize GY's visual experience so I shall not argue for that (it is part of what it is like to have blindsight); the former claim is what is at issue. From the perspective of selection from action, GY is selecting the circle to inform his response. The task instruction requires that he react as quickly as possible in each trial, reporting on whether a target is present or not (or in a later experiment, whether a target line is horizontal or vertical). To perform this task he has to respond to the presence or property of the target in addition to the cue and spatial location. Strikingly, he does so with better than chance accuracy and with a

³⁶ A further feature worth noting is what is usually called *stimulus onset asynchrony* (SOA), namely the gap between presentation of the cue and the presentation of the target. This feature is not critical in what follows.

³⁷ See Chris Mole's critical discussion of this work in his (2008). He has indicated (personal communication) that his thinking on this issue has shifted. For a discussion, see his (forthcoming).

reaction time that is consistent with deployment of spatial attention. It is plausible then to say that he is intentionally reporting on the presence or orientation of a target stimulus, as required by the task instructions.

Spatial attention as deployed in Posner's cuing paradigm is itself selection of spatial location for action. The task requires that GY select a specific spatial location, either the valid or invalid location depending on the trial, and respond to what is present at that location. In other words, a specific location is salient to GY's performance of the task, and his response must reflect his perceptual attunement to that location, his selecting it rather than other locations. It is hard to see why his action oriented attunement fails to count as one way of orienting attention since in normal cases, the same ability tested for by Posner's paradigm counts as attention. Moreover, once we hold that this initial selection for action is a form of attention, it is hard to see why the subsequent selection of an object within that location for action would also fail to count as a form of attention. In both cases, we have a way that the subject is attuned to certain features of the world so as to respond to it. We would miss capturing a unified perceptual capacity if we failed to take the subject's attunement to objects or properties as also of the same kind as the initial attunement to space. Thus, while the Posner paradigm is generally taken as an index for the deployment of spatial attention, we must see that the tasks required in the paradigm also involve attention to the relevant stimuli. In both cases, we have selection for action as a way of attending to the world. This suggests to me that any view that implies that consciousness of x is a necessary condition on attention to x is false whether x is space, property or object. Rather, the view over-generalizes from salient cases of conscious selection for action.

Nevertheless, when we think of attention, we typically think of its conscious forms, the forms that motivate talk of spotlighting, highlighting, focusing or accentuating the items

attended. While these forms raise their own interests, we would fail to fully capture an essential psychological capacity were we to restrict talk of attention to just these conscious forms. For the very capacity for action requires that the agent exhibit a striking form of attunement to the world so as to guide her behavior, and much of this attunement is in a way subterranean to consciousness even if it is not subpersonal. Responsiveness to the world, in action, precisely involves a way of attending to the world, more often unconscious than not.³⁹

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