Action always involves attention

Wayne Wu

In earlier work, I have argued that action entails solving a *Many–Many Problem*: agents confront many potential actions that can be done at a time, so to do anything, the agent must select one among these many possibilities (Wu 2011b, 2016). The action performed is the solution to the Problem. On the basis of this behavioural structure, I concluded that attention is necessary for action (Wu 2014). Attention then illuminates the notion of *guidance* in the philosophy of action as invoked to solve the problem of deviant causal chains. Specifically, attention, as a necessary part of action, explains agentive guidance (Wu 2016).

Jennings and Nanay (2016) argued that attention is not necessary for action by denying that action entails a Many–Many Problem. As they interpreted my argument, they noted that I derived the Many–Many Problem from the incompatibility of reflex with action. If a behaviour is a reflex, then it is not an action, and a fortiori not an intentional action. Equivalently, a behaviour's being an action means that it is not a reflex. Given that a reflex involves a 'preset one–one mapping between stimulus and response' (Jennings and Nanay 2016: 31 quoting Wu 2011a: 54), then in the canonical case, the absence of a reflex entails a many–many mapping between stimulus and response. To produce behaviour, one of many options must be taken, but which option? This is the Many–Many Problem. I correct their presentation of my argument in what follows.

Let me clarify the technical notion of a *pure reflex* (Wu 2014). Pure reflexes bear a conceptual relation to the biological concept of reflex used to describe certain motor behaviours that exemplify rigid and stereotyped stimulus–response mappings that are not under direct control by the subject. A familiar example is the flexor reflex where a painful stimulus triggers a flexing of muscles that quickly removes the affected body part from the source of pain such as retracting one's hand when touching a burning hot plate.[1] Notably, instances of the biological category of reflexes are not counted as actions in the philosophical sense at issue in the debate with Jennings and Nanay. In my arguments, I abstracted from the empirical details to isolate the concept of a pure reflex whose essence is the rigidity of a one–one stimulus–response mapping where this mapping holds of strong necessity. The stimulus guarantees the response in a way that rules out alternative responses. Having never claimed that pure reflexes are instantiated by creatures in our world, my argument relied not on the biological phenomenon

1 The flexor reflexes are spinal cord reflexes in that the response is triggered without involvement of the central nervous system.

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but on the pure form whose dialectical purpose is to serve as a contrast with action.

Jennings and Nanay object to dividing behaviour between pure reflex and action, arguing that it offers a false dichotomy. There is a third, intermediate category of behaviours which are like reflexes in involving a 'preset one–one mapping between stimulus and response' but are actions in involving 'mental preparation' (Nanay 2013 calls these 'semi-actions'). Here are two of their examples: one's reaching to catch a ball though one knows that a glass partition separates one from the target and Charles Darwin's jumping back from a striking snake located behind glass at the zoo having pressed his face on the glass to provoke it. Because these actions involve preset one–one mappings between input and output, Jennings and Nanay conclude that they do not involve solving a Many–Many Problem. Hence, the Many–Many Problem is not necessary for action.

Jennings and Nanay misinterpret my argument, specifically the concept of a pure reflex. To see that there must be a mistake, note that I understand intentional action in the way that Jennings and Nanay characterize semi-actions. Thus, I noted:

> intention is like a 'prepared reflex' that calibrates specific responses to specific inputs in light of its content. It facilitates identification of the required one-one map (Wu 2008: 1010).[2]

Given the contrast I intended, my invoking the notion of a reflex in describing intentional action is potentially confusing. What I meant to emphasize is that intentional action, through the agent's intention to act, already involves a 'preset one–one mapping between stimulus and response'. That is, the subject's intention is a way of setting a disposition to act which, given the Many–Many Problem, involves being disposed to link a specific stimulus to a response. This is because on my account, an agent's intention provides a canonical way to solve the Many–Many Problem, and the intention's causal role is to prepare a one–one mapping, i.e. an action. In that sense, intending to do something is having a preset one–one mapping between stimulus and response. Since I take intentional actions to arise from solving the Many–Many Problem, the idea of a preset one–one mapping is compatible with that Problem's presence. This means that while 'preset one–one mapping' can apply to pure reflexes, the description also applies to intentional action as well as Nanay's semi-actions. This idea, then, cannot be the basis of my dividing pure reflexes from actions.

Pure reflexes involve a strong form of necessitation: the input guarantees a constant response. Jennings and Nanay puzzle about how to interpret pure reflexes, canvassing at one point a strong modal reading where 'the stimulus

2 I borrow the phrase 'prepared reflex' from Hommel (2000) but am not deploying Hommel's account.

necessitates the response: we [the agent] couldn't (in some relevant sense of couldn't) respond differently to this stimulus type' (31). They reject this interpretation because it 'is too strong to capture paradigmatic cases of reflex' (31) by which they mean the biological kinds like the flexor reflex. Yet I never suggested that pure reflexes explain 'paradigmatic cases of reflex'. Rather, I explicitly separated them from the biological varieties (this is seen in the passage that Jennings and Nanay quote from Wu 2014: 89). The concept of pure reflex is to extract an action eliminating property so as to formulate a premiss strong enough to derive a structural condition on action, the Many–Many Problem.

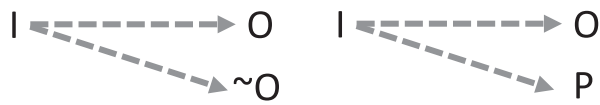
My a priori argument begins with the notion of a *behaviour*, not just as a stimulus–response mapping as in psychology, but specifically a mental state-response mapping where the mental state represents the stimulus in question. An actual behaviour, one where a mental state drives a response as per the mapping, is an *input–output coupling*. We can then define the behavioural possibilities for an agent at a time, what I call a *behaviour space*, by defining all the possible input–output couplings available to the agent at that time. This space is also a *psychological* space in that the inputs are psychological states. A behaviour is produced when a possible coupling is actualized. We can represent this as follows (*I* stands for an input mental state, *O* for some output response capacity; the solid line indicates that the coupling is initiated):

A pure reflex entails no other possibilities for coupling, given the input. This requires a necessitation that corresponds to Jennings and Nanay's modally strong reading, the input guarantees the response. Hence (where 'N' indicates strong modal necessity):

Critically, the necessity rules out any other mapping for *I*. When *I* is coupled to a response, it *must* generate *O*.

We then begin with the claim that any purely reflexive behaviour is not an action. By contraposition, to have action, the behaviour must not be a pure reflex. Since pure reflexes are individuated by the necessity of their input–output mapping, the absence of a pure reflex is just the absence of necessity in coupling. This means that additional behavioural possibilities are available, so there must be the possibility of a different response to which *I* can be mapped. Given that more possibilities are available once reflexive necessity is removed, the behaviour space *branches*. Two basic

possibilities are salient, where an input is mapped to an output or its 'null' or where the input is mapped to two outputs (dotted lines indicate possible behaviours):



Either branched structure is sufficient for a Many–Many Problem for in the minimal case, the subject cannot simultaneously produce *O* and not-*O*. So, to act at all, we must have selection. The many–many mapping that I have emphasized in earlier discussions identifies the most salient case. Typical behaviour spaces are highly branched structures with many inputs and many outputs.

Note that all that has been established is that action entails a branched behaviour space and hence the Many–Many Problem, so only a necessary and not sufficient condition for action (Wu 2011b, 2016). To get a sufficient condition, we return to the canonical case discussed in philosophy of action, the case of intentional action, specifically action that involves an intention. Intentions generate action, but given my argument, this requires that the Many–Many Problem be solved, that at least one among many potential couplings is selected. It is natural to think that intentions solve the problem, so their causal role is to yield appropriate selection. Since an intention's content explains why specific actions are produced, that content must make a difference in solving the Many–Many Problem. In representing an action to be done, the intention generates an input–output coupling (action) that satisfies its content, precisely because of that content. We thus arrive at the claim that intentions effectively impose a one–one mapping, set by its content. It only remains to execute this mapping.

Let us return to Jennings and Nanay's examples. It should now be clear that the presence of a preset one–one mapping is consistent with the behaviour being an intentional action, for every intentional action involves a preset mapping *but against the context of a Many–Many Problem*, i.e. a branched behaviour space (similarly for semi-actions). Since their examples do not instantiate pure reflexes, it follows that other behavioural possibilities exist, and a Many–Many Problem obtains. It is just that given the posited 'mental preparation' the agent is disposed to act in a pre-set way, just like with intentions, the agent is also disposed to act in the intended way.

Jennings and Nanay's examples illustrate that coupling is often *automatic* as in habitual or 'thoughtless' actions that are not driven by intentions. The behaviour space poses a Problem, but how we solve it varies. Sometimes, the action that arises is due to a prior intention, occasionally it is stimulus driven, and sometimes it is by force of habit. The power of the notion of a behaviour

space is that it gives us an explanatory framework to characterize different forms of behaviour within a uniform structure. The basic psychological thread for action is revealed: the input mental state guides the response.

Guidance grounds a conception of attention in the input state that anchors agentive guidance. This claim about attention effectively follows from the Many–Many Problem. Attention is seemingly controversial as over the past century, theorists routinely bemoaned the absence of a clear analysis. Yet, William James correctly captured attention in his well-known gloss:

> It is the taking possession by the mind, in clear and vivid form, of one out of what seem several simultaneously possible objects or trains of thought. Focalization, concentration, of consciousness are of its essence. It implies withdrawal from some things in order to deal effectively with others. (James 1890: 403)

Interestingly, the description James provided ties attention to action, namely to dealing effectively with the attended target, selected among many possible targets. This echoes the structure of the Many–Many Problem. If we think of a typical structure as identifying a plethora of mental states as potential inputs, then selecting a target to deal effectively with it is embodied in the specific coupling where one mental input informs response. This input mental state then reflects the mind's taking one out of many possible targets. Moreover, withdrawal from other potential targets is entailed because in coupling, we eliminate other possibilities at that time.

If we wish to speak about states of attention, then the state of attention can be identified with the mental state that provides the basic input for guiding action (Wu 2011a: 104ff, 2014: 95ff). This leads to what is called the *selection for action* conception of attention, one that has Jamesian roots (Allport 1987, Neumann 1987). Drawing on James, we can see how attention is located in the Many–Many Problem, namely in the selectivity inherent in one input mental state among many guiding a specific response among many when the Problem is solved. If the Many–Many Problem is entailed by every action, then so is attention (for detailed discussions of this issue, see Wu 2014).

I have noted that empirical methodology in the study of attention draws on selection for action in the following sense: to study attention, the experimenter must control how the subject attends. To do so, the experimenter carefully designs a task so that to correctly perform the task, the subject must select some target X to guide performance. In doing so, the subject is presumed to be attending to X. This task guidance captures James' idea of dealing effectively with things. Note that while there are questions whether the types of behaviour studied in the lab adequately replicate natural behaviours (Krakauer et al. 2017), the presumption in designing these experiments is that the behaviours tap into the basic capacities that are deployed in

mundane situations. Attentional paradigms such as those involving cueing, visual search, discrimination and detection, dichotic listening (selecting one of two verbal streams), remembering, making decisions and so forth are presumed to capture corresponding natural behavioural capacities.

That action always involves attention strikes many as too strong, for it seems that there are actions that do not involve attention even if there is selection that informs the action. This is partly what Jennings and Nanay's examples attempt to demonstrate, but arguably, their cases involve attention: when the subject reaches for the ball automatically, despite knowing about the intervening glass, the subject visually attends to the ball to control his movement. When Darwin presses his nose on the glass separating him from the snake, he did not do so with his eyes closed but tested himself by fixating on the adder whose movement then captured his attention driving a fleeing response.[3] Attention is present in these cases. If my argument is right, it must be.

While Jennings and Nanay's examples do not present actions without attention, their aim is clear, so let me consider recent counterexamples congenial to their stance. Watzl (2017) attempts to show that selection for action is not sufficient for attention. He writes:

> While engaged in a conversation over dinner while your (perceptual) attention is focused on your conversational partner you might reach for your glass to drink ... you are selecting the glass as the target of a bodily action. Yet you can do this *without* focusing your attention on the glass. (Watzl 2017: 111, emphasis in original)

Similarly, he considers flicking on a light automatically as one enters the room. One selects the light for action but one does not attend to it. Often, the case of driving on autopilot is raised. While conversing with one's travel partner, one can shift gears, signal and stay on the road without attending to the relevant targets. Given that they claim that there are actions without attention, Jennings and Nanay will be sympathetic to such cases.

There is an issue, however, about the evidential standing of these descriptions which are offered as uncontroversial data points. Philosophers often claim that these judgements about attention are 'intuitive' or 'plausible'. Thus, Buehler (forthcoming) cites the following example:

> We can imagine [an agent] exiting the metro, his attention entirely devoted to reading a newspaper. He has the intention to walk home. Unless he encounters obstacles, the individual need not attend to what he is doing. Yet he acts, and exercises agential control over his

3 I do not consider Jennings and Nanay's discussion of anarchic hand because either it is a form of agency and receives the same response as I give to the other examples, or it is not, in which case I make no commitments about the involvement of attention.

> movements [including selection for action]. These points seem intuitively obvious. (Buehler forthcoming: 12)

The descriptions of these cases where it is said that attention's absence is obvious seem to me to be perilously close to begging the question. At best, the data are presented without showing that they are reliably generated. What is at issue is whether a form of mental processing, attending, is occurring. Mere intuition or plausibility is not a good way of doing psychology, especially when assessing the presence or character of mental processing to adjudicate theories.

For the intuitions to do any work in constraining psychological theory about mental processing, they must have a firm epistemic foundation, but based on what? Introspection? Not likely as introspection is widely held to be an unreliable way to uncover mental causal structure. Further, once we allow that attention can be unconscious or that it can be automatic as in the putative counterexamples under consideration, we should be suspicious of claims that aim to establish the absence of mental processing solely based on pretheoretical intuition, obviousness, prima facie plausibility or introspection. Consider the rapid saccades (ballistic eye movements) that occur about two to four times a second during normal vision. Psychologists speak of such eye movements as forms of overt attention, and these shifts in fixation are thought to often be programmed by covert attention (Kowler et al. 1995, Deubel and Schneider 1996, Wright and Ward 2008). I conjecture that laypersons would report no prior act of covert attention before each eye movement, were they to even notice those movements. Further, laypersons might find intuitive, plausible and obvious the claim that one moves one's eye *without* a prior act of covert attention to the target of movement. Such intuitions about the absence of attention do not track psychological reality as we empirically understand it. I suspect the same holds for the cases raised by my critics and their claims that automatic attention is not present.

There are cases where we are reliable in detecting attention, namely where we intentionally deploy attention. This follows from our capacity for reliable agentive awareness (here I agree with Watzl 2017; see also Wu 2010). This reliability, however, does not simply carry over to the automatic (perhaps unconscious) forms of attention invoked in examples such as those of Watzl, Buehler or Jennings and Nanay. Indeed, focusing on attention in the cases where it is agentively accessible to us distorts matters. Watzl talks about the absence of 'focused' attention and in the visual domain, this typically involves fixating the object that we are attending to with the eyes. In his example, the focus of attention is on the conversation which we are intentionally undertaking, and given knowledge of what we are doing intentionally, we can authoritatively affirm that we are conversing intentionally and not intentionally doing anything else. It does not, however, follow that one is not *automatically* attending in other ways outside the focus of one's attention nor

does it follow that one would be authoritative regarding automatic attention.[4] Thus, I do not have any confidence that taking the offered cases as intuitive, plausible or obvious cuts any theoretical ice in the current context.

As we cannot appeal to a specific theory of attention to adjudicate disagreements about cases since the correct theory of attention is what is in dispute, how can we make progress? Let's consider the actions in the offered examples as exemplifying capacities that the agent has acquired over time. Consider when you enter an unfamiliar room for the first time where the light switch is not where you think it should be based on the layout of other rooms with which you are familiar. You must first visually search for the switch, a well-studied form of visual attention. Unfortunately, not being a quick learner for trivial matters, you might not remember the switch's location the next time you enter the room, and so for the second time, you look for it. This might happen frequently, but after you learn where the switch is, you can turn on the light without searching for or indeed thinking about the switch's location. You simply flick it on, automatically, eventually habitually. You can turn on the light while deep in thought or having an intense conversation as you enter the room.[5]

The point is that the selection for action with which you began when first learning to correctly turn on the light in this room, namely visual attention, does not disappear as you progress, but changes its character. It becomes less controlled and more automatic in the acquisition of a simple skill, one that is based on learning and experience. The acquisition of automaticity is an empirical phenomenon that is well studied. Thus, various features empirically associated with automatization appear on the scene such as the reduction of dual task interference (you can have a conversation with someone as you enter the room and merely flick on the light), an increase in efficiency (you find the light faster), the absence of an explicit intention to turn on the light (you don't need to think about the light) and so forth (for features of automaticity, see Palmeri 2006; for a philosophical analysis of automaticity and control, see Wu 2013). The same shift applies to reaching for other objects while talking intensely with a friend, driving on autopilot while deep in thought or exiting a familiar metro station. We aren't magically blessed with an ability to multitask efficiently in these cases. As we all know from experience, we must learn to do so, and in this process of acquiring skill,

4 This is clear from studies of patterns of automatic overt attention in cricket batters in Land and McLeod 2000, Mann et al. 2013. Professional batters were surprised by the results regarding how they visually attend to the ball during batting, and indeed, many denied the results. The old adage of keeping one's eye on the ball is not substantiated except in special cases.

5 At some point, this behaviour might involve a transition from being visually guided to being memory-guided. In that case, attention will be memory-based. In the text, I focus on actions where the flicking remains visually guided albeit automatically so.

attention changes its character. What dissipates is not attention, but the need for explicit control of it.

My critics might object, emphasizing their description of the putative counterexamples as the correct ones. But they are not obviously correct, and in a sense, their reading of how we act is impoverished in not take into account the learning and skill that is part of dealing effectively with the world, something that applies to attending as well as to moving. Attending in a certain way is something that one gets better at doing over time, and when it does, the salient development is not its abolition but its change of character. The dimension that is left out of the opposing account of attention in agency is precisely its skilled shape.

I have argued that Jennings and Nanay's criticisms against my position fail. Their objection depends on misunderstanding the role of the pure reflex in the argument from the Many–Many Problem. It is necessitation and not 'prepared one–one mapping' in pure reflexes that exclude actions. Where actions are present, the necessary one–one structure entailed by a pure reflex is absent, and we arrive at the Many–Many Problem, the branching of behavioural possibilities. Within that structure, we locate attention along the lines that James conceived of it. Moreover, the examples that Jennings and Nanay present, along with similar examples by Watzl and Buehler, do not illustrate action without attention, but rather reflect a shift from controlled to automatic attention. Attention, like many other aspects of action, changes over time with learning and practice, but it is an ever-present component of action.[6]

Center for the Neural Basis of Cognition
Carnegie Mellon University
4400 Fifth Avenue, Pittsburgh, PA 15213, USA
waynewu@andrew.cmu.edu

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Abstract

Jennings and Nanay (this journal, 2016) argue against my claim that action entails attention by providing putative counterexamples to the claim that action entails a Many–Many Problem. This reply demonstrates that they have misunderstood the central notion of a pure reflex on which my argument depends. A simplified form of the argument from pure reflex to the Many–Many Problem as a necessary feature of agency is given, and putative counterexamples of action without attention are addressed. Attention is present in every action. In passing, the reply discusses how we should assess intuitive claims about attention and mental processing, with emphasis on learning and the automatization of attention in its development as a skill.

Keywords: attention, action, intention, control, automaticity