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The Elusive Experience of Agency

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Abstract

I here present some doubts about whether Mandik’s (2010) proposed *intermediacy* and *recurrence* constraints are necessary and sufficient for agentive experience. I also argue that in order to vindicate the conclusion that agentive experience is an exclusively perceptual phenomenon (Prinz, 2007), it is not enough to show that the predictions produced by forward models of planned motor actions are conveyed by mock sensory signals. Rather, it must also be shown that the outputs of “comparator” mechanisms that compare these predictions against actual sensory feedback are also coded in a perceptual representational format.

Keywords: Will; Agency; Agentive experience; Motor control; Forward models; Comparators; Action monitoring; Consciousness

Following Bayne and Pacherie (2007), I shall refer to conscious awareness of being the causal author of an action as *agentive experience*.¹ According to a currently influential “comparator-based” model of agentive experience (Bayne & Pacherie, 2007; Frith, Blakemore, & Wolpert, 2000; Grush, 2007), the motor control system exploits forward models of planned actions (also known as “emulators”) in order to predict the sensory consequences of bodily movement, for example, the kinaesthetic, tactile, and/or visual feedback that would result as consequences of reaching for a cup of coffee. When comparator mechanisms detect a sufficiently robust match between predicted and actual sensory reafferences, a registration of agency is generated and the subject may experience her movements as self-generated. If, however, a mismatch is detected, then the subject may experience her movements or aspects thereof as having an external or “alien” cause.

Pete Mandik’s (2010) proposed Allocentric-Egocentric Interface theory of control consciousness (AEICC), like the comparator-based model, focuses on low-level, domain-specific mechanisms of action production and monitoring, as opposed to holistic, domain-general, mechanisms involved in “narrative” self-understanding (Stephens & Graham, 2000;

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Wegner, 2002). AEICC, departs from the comparator-based model, however, in requiring that conscious control states meet two further constraints. First, they must exhibit *intermediacy*, both in the sense that they must be formed at a neuroanatomically intermediate-level in the motor processing hierarchy—identified by Mandik with premotor cortex in the frontal lobe—and in the sense that they must have intermediate-level, egocentric spatial contents. Second, they must be “constituted by pairs of *recurrently interacting* allocentric and egocentric [motor] representations” in a pseudo-closed-loop, that is, forward-model-involving, control architecture.

As this contribution is short, I will uncharitably focus on outlining some difficulties for the elegant AEICC approach.

First, it is not clear that motor representations with abstract, allocentric contents are necessary for agentive experience in the manner suggested by the recurrence constraint. Arguably, agentive experiences may obtain as a consequence of acting so as to fulfill present-directed or “proximal” intentions that have fully *egocentric* spatial contents, for example, the intention to point or turn toward a sudden flash of light at a certain location in (distal) body-relative space.² The transformation of such a present-directed intention into an appropriate set of motor intentions, plausibly involves not the transformation of allocentric motor representations into egocentric motor representations, but rather the transformation of extrinsic, directional motor parameters into intrinsic, kinematic motor parameters.

Second, the restriction of conscious control states to intermediate-level motor representations seems unmotivated. Indeed, many prominent theorists identify high-level, prior intentions such as *Grab a coffee mug* or *Go to the market* as conscious motor representations (Frith et al., 2000; Jacob & Jeannerod 2003; Jeannerod, 2007).

Third, neuropsychological findings do not point to *premotor cortex* as the neural locus of agentive experience. While there is evidence that rostral premotor areas do play an “intermediary” liaison role between executive, prefrontal areas and motor areas that project directly to spinal cord (for a review, see Graziano, 2008, chap. 4), there is also a large body of clinical and neuroimaging evidence that the cerebellum is involved in constructing forward models of bodily actions (Wolpert & Kawato, 1998) and that parietal cortex, also omitted by Mandik’s scheme, plays a major in the comparator matching process (Blakemore & Sirigu, 2003; Frith et al., 2000; Jeannerod, 2007). If the question is *where* the sense of agency arises in the motor control system, then the currently available evidence suggests that we need to look beyond intermediary areas in the frontal lobe.

Last, the “raw,” initial output of hypothesized comparator mechanisms, when predicted and actual reafferences match, is not itself a conscious agentive experience, but rather a nonconscious registration of agency (Synofzik, Vosgerau, & Newen, 2008).³ Whether a nonconscious registration of agency gives rises to a conscious agentive experience depends on a variety of factors, including temporal dynamics (rapidly performed actions may be completed before consciousness can “catch up” with them) and, importantly, allocation of *attention*. Notably, this is the case even when the agent is acting so as to fulfill a future-directed, prior intention. For example, I may form the intention to walk to the store and then go on to perform some of the subsidiary actions necessary to fulfill that intention on “auto-

pilot” if my attention is elsewhere focused. The important point is that in such autopilot cases comparator mechanisms are involved in the formation, implementation, and monitoring of motor intentions, but the subpersonal registrations of agency that they produce do not rise to the level of conscious awareness. This suggests that intermediacy and recurrence are not jointly sufficient for agentive experience and that certain further attentional constraints must be met.

I turn now to the question of whether conscious agentive experience is an exclusively perceptual phenomenon. According to Jesse Prinz (2007), the answer is *yes*. Like other proponents of the comparator approach, Prinz assumes that the prediction produced by the forward model is a *sensory signal*: It functions as an “anticipatory somatosensory image” or, as Rick Grush (2007) puts its, “mock sensory information.” Although Mandik centrally disputes this assumption, he agrees with Prinz that it entails “an account of control consciousness wherein control consciousness turns out to be a form of sensory consciousness after all.”

As I see it, however, the assumption that forward models generate mock sensory information does not *by itself* entail the conclusion that agentive experience is exclusively perceptual in nature. Rather, in order to motivate this conclusion, it would *also* have to be shown that the registrations of agency produced by comparator mechanisms, when conscious, make a sensory contribution to the phenomenology of acting. That is, even if the comparator matching process does involve the comparison of mock sensory information with incoming sensory feedback, the *output* of the matching process need not, in turn, be a signal coded in a perceptual representational format. In general, mechanisms that receive sensory signals as inputs need not produce sensory signals as outputs. Sensorimotor transformation—the mapping of perceptual inputs onto motoric outputs—is a clear case in point.

The question, then, is not whether comparator inputs are exclusively sensory, but rather whether comparator *outputs* are exclusively sensory. Do the registrations of agency produced by the putative comparator matching process make an exclusively sensory contribution to the phenomenology of intentional acting?

There are a number of different possibilities. Here are but two. First, the output produced by comparator mechanisms, when consciously accessible, could take the form of a *sui generis*, nonperceptual “feeling of agency.” Mandik suggests that the relevant output channel might have a very low bandwidth, making the signal it conveys hard to discriminate against a high-bandwidth sensory background. Moreover, the act of introspection itself might blur the image in the Humean microscope, “given that introspection itself puts a load on control processes.” Phenomenological disputes are indeed notoriously difficult to adjudicate, but without proposed experimental measures the nonperceptual signal hypothesis does not seem to be adequately motivated.⁴

A second possibility, consistent rather with Prinz’s position, is that when predicted and actual reafferences match, the comparator’s primary contribution to conscious awareness is a *negative* one: It attenuates or cancels out actual reafferences so as to accentuate the salience of externally caused sensory inputs (Blakemore & Frith, 2003).⁵ On this view—presented here in extremely abbreviated form—there is no distinct, *sui generis* experience of acting.

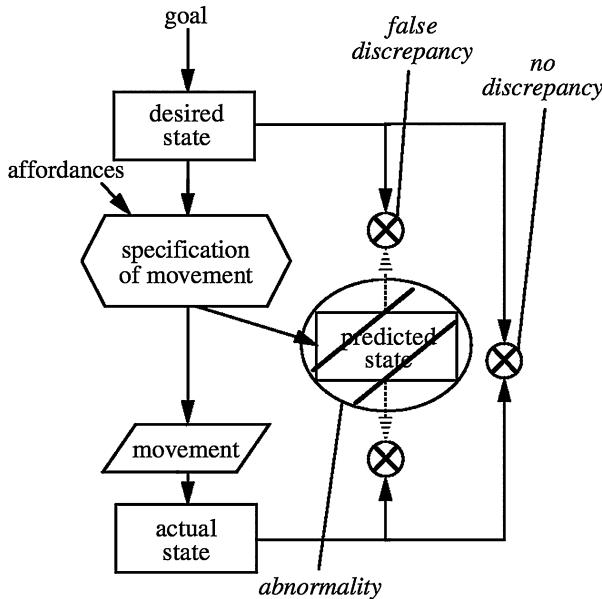


Fig. 1. The underlying disorder in schizophrenic delusions of control. The patient is aware that her movement (actual state) matches her intention (desired state) but lacks awareness of the change in state predicted by the forward model. The patient feels as though her intentions are being monitored and her actions controlled by some external force. Adapted from Frith et al. (2000) with permission of the Royal Society.

Rather, as Elisabeth Pacherie (2001, p. 174) suggests, “our ordinary experience of agency may simply be a rather diffuse sense of a coherent ongoing flow of anticipations and sensory feedback.” This possibility is also consistent with the influential model of passivity phenomena in schizophrenia proposed by Frith et al. (2000) (Fig. 1). Missing from the schizophrenic’s experience, on this model, is not a “distinctively nonsensory component,” but rather conscious awareness of the predicted sensory consequences of action. The schizophrenic has the intention to grasp a cup; she is able successfully to plan and control the requisite movements; and she is moreover aware that the movements she actually makes match her intention; but she lacks awareness of the prediction produced by the forward model and, thus, lacks awareness of *initiating* her grasping action. Prinz’s account is consistent with this model because it assumes that actions that are not preceded by anticipatory somatosensory images will not be experienced as self-generated. By contrast, it is not evident that AEICC has the resources to explain what is amiss here because the schizophrenic’s deficit does not seem to reside either in the absence of intermediate-level motor representations or in the absence of recurrent processing—in particular, in the absence of a pseudo-closed-loop control architecture.⁶

In conclusion, AEICC is a compact and elegant theory of agentive experience, but more work needs to be done in order, first, to clarify and justify its intermediacy and recurrence constraints and, second, to show that there is a distinctively nonsensory, but nonetheless introspectible component in control consciousness.⁷

Notes

1. There are good reasons to suppose that this experience has a number of distinguishable components. For fine-grained examination, see Pacherie, 2008.
2. See Gallagher, in press for relevant discussion.
3. To use the language of Grush, 2007, this registration only amounts to an “implicit representation” of agency.
4. Which is not to say that the hypothesis is merely conjectural: Mandik argues that positing nonperceptual control signals accounts for our ability to distinguish internally generated sensory images from sensory perceptions with similar contents. For alternative explanations of this ability that are compatible with Prinz’s sensory account of agentive experience, however, see the contribution by Mylopoulos in this issue.
5. This may not be its only contribution, however. There is evidence that self-generated actions and their sensory effects exhibit “intentional binding,” that is, are perceived as being closer together in time than are non-self-generated actions and their sensory effects (Haggard, Clark, & Kalogeras, 2002).
6. Frith et al. write: “There is nothing obviously abnormal in the motor control of these patients. This suggests that accurate representations of predicted states are available and used by the motor system. However, these representations are not available to awareness” (p. 1784).
7. I am grateful to Rick Cooper, Lisa Mosier, and an anonymous referee for helpful comments on this paper.

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