On the Necessity of Bodily Awareness for Bodily Action*

Abstract

There appears to be an intimate connection between feeling our limbs ‘from the inside’ and our power to act directly with them. This essay attempts to evaluate the strongest understanding of the connection between bodily awareness and bodily agency: that feeling a body part ‘from the inside’ is necessary for any instance of acting directly with that body part. The most influential defence of this claim is to be found in O'Shaughnessy's work on action. I lay out O'Shaughnessy's arguments and analyse them. It turns out that there are two different strands implicit in O'Shaughnessy's account. I tease these strands apart and evaluate them separately. I then consider three counterexamples against his account: (one) deafferented agents; (two) direct brain control of physical apparatus made possible by brain-machine interface technologies; and (three) the automatic character of the majority of our bodily actions. Each case presents different difficulties for O'Shaughnessy. I end by drawing the upshot of these counterexamples for O'Shaughnessy and explore to what extent he can respond to them.

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1. Introduction

There appears to be an intimate connexion between feeling our limbs ‘from the inside’ and our power to act directly with them. This intimacy can be brought out by the difficulty of conceiving of how one might move a limb that is completely without feeling where one does not have any other forms of perceptual feedback available. Or consider how some intricate task involving complex physical elements – like skiing – would be possible in the absence of any bodily awareness. This connexion between bodily awareness and bodily action is not restricted to the exercise of unusual motor skills but pervades all motor activities. It is hard to see how even a relatively mundane activity like running after a bus is possible in the total absence of bodily awareness. The intimate connexion is reflected in the phenomenology of ordinary agency: in agency as we know it, bodily awareness seems to play a crucial role in the control of actions. Thus there is *prima facie* reason to think that bodily awareness plays some kind of constitutive role in the control of bodily action.

This essay is a partial attempt to clarify the sense in which bodily experiences play this role in the light of various empirical and theoretical considerations. In this essay, I will examine the dominant conception of the connexion between bodily awareness and bodily

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agency in philosophy: that feeling a body part ‘from the inside’ is necessary for every instance of acting directly with that body part. Call this thesis Necessity. One directly acts with a body part when one is able to just perform the action with the body part without performing any other action – as when I just raise my right arm, as opposed to when I use my left arm to raise my right hand.

The most influential defence of Necessity is to be found in Brian O'Shaughnessy’s work on action (1980, 1992, 1995, and 2008). I lay out O'Shaughnessy’s arguments for Necessity and analyse them. It turns out that there are two different strands implicit in O'Shaughnessy’s account. I tease these strands apart and evaluate them separately. I then consider three counterexamples against Necessity: (one) deafferented agents; (two) direct brain control of physical apparatus made possible by brain-machine interface technologies; and (three) the automatic character of the majority of our bodily actions. Each case presents different problems for Necessity. I end by drawing the upshot of these counterexamples for Necessity and explore to what extent a proponent of Necessity can respond to them.

Before we begin it will be useful to specify what I mean by bodily awareness, specifically the forms of bodily awareness at stake when it is claimed that bodily awareness is necessary for bodily agency. There are a large range of internal channels that provide us with information about our bodily state: we receive information about pressure, temperature and friction from receptors at or just below the surface of the skin, information from our muscles about effort and muscular fatigue, static and dynamic information about the state of various body parts relative to each other (proprioception and kinaesthesia), and information about balance and posture from the vestibular system, just to take some major examples. It is important to note that not all these information channels operate at the conscious level. For example, the vestibular system and the postural system are largely unconscious (and hence are not typically forms of bodily experience) even though they are responsible for experiences such as that of feeling upside down. The debate on Necessity focuses on awareness of one’s body and its parts where this awareness is understood to be a form of experience of its objects. In particular, for the purposes of evaluating Necessity, we are interested in those forms of bodily awareness that are conscious experiences of one’s body ‘from the inside’.

2. Necessity

2.1. Necessity as an instance of a general sensorimotor synergy

Necessity can be seen as a particular manifestation of the general cooperation between perception and action. Perception presents the agent with the way things are in his environs, whilst action grants him the means to intervene in this ambient arena as he sees fit. Our concern is with the terms of their alliance when perception comes to the aid of action. Physical action is mostly a distinctive kind of reaction to perceptually registered environmental changes. Two aspects of this encounter merit discussion. In reactive mode, perception is what jolts the agent into action. It is what precipitates the action, as when the sight of a fly wandering into one’s study mobilises one to swat. But more than that, it provides one with the objects that one’s action is directed at. The object of my swatting is not accidentally the fly that I sighted. It is not that seeing the fly occasions my swatting, and

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1 Necessity is the analogue in bodily awareness of a more familiar, but seldom articulated thesis concerning the visual guidance of action: roughly, that in all visuomotor action, control is based on conscious visual experience which directly sets the parameters for action. The visual thesis, too, faces various empirical counterexamples (Milner and Goodale 2006).
the fly that I swat at just happens to be the fly that provoked my action. (There is only one fly around.) Rather, my swatting is directed at that very fly that I saw. Having identified the object of my action, perception now enables me to track my target so as to monitor the success of my campaign as I chase the fly around the study, swatting left and right. To sum up what we have learnt from our little episode: action is “concerned to wreak change in the world, and in consequence one must be aware of its objects, firstly to know where the Will is to strike, secondly to monitor its effects” (O’Shaughnessy 1992, p. 226).

Necessity is an instance of this general sensorimotor synergy. We arrive at Necessity when we retreat from the world back within the limits of the embodied agent. Now the object of the will is the agent’s own body and the objects of awareness are its parts. And thus we have the thesis that without experience of his own body, the agent would have no means to locate his body parts and control his bodily striving.

2.2. The case for Necessity

We can also argue for Necessity directly. The argument involves three interrelated strands: The deep reason for Necessity is that conscious experience plays an essential role in explaining action; in particular, it is experience that rationalises action. The first strand of argument thus consists in showing how bodily awareness is crucial in rationalising bodily action. The question then arises as to how bodily awareness manages to do this, which is what the second and third strands of argument concern. The answer is that it provides necessary feedback for the control of bodily actions as they unfold and provides the bodily will with its ‘target-object’.

2.2.1. The rational role of bodily experience

Earlier, when we busied ourselves with the fly in the study, our little episode hinted at the rational links between experience and action. Our common sense picture of the link between experience and action is committed to the idea that experience plays a direct role in guiding one’s action. Experience supplies reasons for an agent acting in the way he does and thus rationalises one’s actions.

One way to tease out the rational commitments of our picture of the connexion between perception and action is by looking at the phenomena of blindsight and blindtouch. Blindsight patients are ‘functionally blind’ in certain areas of their visual field due to damage to the visual cortex. These patients do not respond spontaneously either in action or judgement to stimuli presented in their blind field. However, when pressed by experimenters, they are able to guess (for a certain range of properties) what is presented in these blind areas with some accuracy – despite denying that they have any visual experience of the properties they are making guesses about (Weiskrantz 1986). Blindsight patients have also been shown to be capable of acting on objects in their blind field. Amazingly, patients are able to accomplish these pointing and grasping tasks, when compelled by experimenters to do so, with remarkable accuracy whilst denying that they have any experience of things in their blind field.

Closer to home is the pathology of ‘blindtouch’, the somatosensory analogue to blindsight (Paillard 1999, Rossetti et al. 2001). This is a lesser known phenomena first documented by Paillard and colleagues (Paillard et al. 1983) and more recently studied by Rossetti and colleagues (Rossetti et al. 1995, 2001). Rossetti’s patient had a left parietal thalamo-subcortical lesion and was unaware of any tactile stimulation to the skin of his right (centrally) deafferented arm. The patient was blindfolded during the experiments and
his motor and verbal responses to stimuli were compared. He failed to show significant performance when induced to verbally guess where stimulation was applied or when asked to indicate the stimulus location on a drawing of an arm. However, he performed above chance when pointing at stimulus locations on his arm. Interestingly, the patient was unable to verbally report the position of his right index finger when it was positioned passively on a horizontal plane, but could accurately point to this finger with his left hand. Thus the kind of dissociation that we see in blindtouch also seems to be possible for proprioception. In both blindsight and blindtouch we have subjects who have the ability to localize targets of action and act whilst seeming to lack any sensory experience. Our bewilderment - also shared by the patients - points to our commitment to experience rationalising one’s actions. Paillard’s blindtouch patient, e.g., interrupted the experiment on her own to express her astonishment: “But, I don’t understand that. You put something there; I do not feel anything and yet I got there with my finger. How does that happen?” (Paillard 1999). In both pathologies, though the agent is able to acquire information about the location of his targets and the development of his actions through his sense organs, this information is not presented to the agent in a way where it might be exploited to allow for conscious guidance of action. Rather, the role that perceptual information plays in these pathological cases is ‘brutely causal’. Perhaps this also is manifest in the blindsighted patients’ behaviour where action and judgement are not spontaneous but elicited by compulsion on the experimenter’s part. This makes sense from the blindsighted agent’s point of view: for if he is not presented with anything in his blind field then *a fortiori* he is not presented with anything affording action in his blind field. Thus there is no reason for him to spontaneously make judgements or act, for it would strike him as manifestly irrational.

Now that we have shown how deep seated our commitment to action being rationalised by experience is, and have seen the force of the claim in the specific case of bodily awareness, we can turn to the second and third strands of argument for Necessity. These strands of the argument are concerned with the specific implementations of the rational role of bodily experience. The second strand has to do with the requisite feedback required for control and fine-tuning of actions and the third strand has to do with a phenomenological tie between bodily agency and awareness.

### 2.2.2 Bodily awareness as an ineliminable source of feedback

The second and more straightforward strand of the argument is that bodily awareness provides the requisite feedback required for control and fine-tuning of actions. It is easy to discern this strand of the argument. The proponent of Necessity argues for his position by posing questions such as: How could one reach out and grab something if one did not have proprioception and kinaesthetic sensations to tell one about the position of one’s arm and the way it is moving? Without the feedback that we receive from bodily awareness, how might we correct for mistakes in the direction of movement?

It is clear the thrust behind these challenges to explain how bodily agency is possible is that bodily awareness provides us with crucial feedback on the state of one’s arm – feedback that allows for one to control one’s actions. Within this strand of the argument we can discern two ideas:

(One) acting requires one to know the state of one’s limbs, and bodily awareness puts us in a position to know the state of one’s limbs.

(Two) actions – unlike reflexes, e.g. – are robust in that agents in action can achieve the desired goal state in a very large number of ways. (E.g., if you are reaching for the salt and there are bottles blocking a direct approach to the salt, one can reach around them.) Changes in one’s environment (obstacles changing position, say) and changes in one’s
bodily state (fatigue in the arm, say) thus require that one gets feedback that allows for fine-
tuning so that the agent can be sensitive to conditions affecting the performance of his
task.

The need for continuous feedback comes out clearly in cases of learning complex
motor skills. Consider a violinist who is trying to learn how to play a staccato
passage. The staccato passage is a difficult bowing technique where a series of notes are
played in rapid succession with a single stroke of the bow, where the bow flies repeatedly
on and then just off the string. If the violinist exerts too much pressure on the bow, then it
will not bounce; but if he exerts too little pressure, then the stroke will be out of control.
The bow stroke requires the violinist to maintain a delicate equilibrium – applying just
enough pressure on the bow to achieve a staccato, yet exploiting the natural bounce of the
bow so that it flies. In order to do this, he needs to feel the pressure of his index finger
against his bow and the weight of his arm, correcting his motions if the pressure is either
insufficient or overly strong. The violinist cannot rely solely on visual or auditory feedback
(or their combination) to do this, but can only learn how to play the bow stroke by ‘feeling’
how to do it. Similar points can be made about the acquisition of other motor skills, such
as riding a bicycle or skiing.

The upshot of these two points is that without the requisite feedback from bodily
awareness we would have no ability to control our actions. Call this the Feedback for Control
Argument, or Feedback for short.

2.2.3. A phenomenological tie

The third strand of thought in O'Shaughnessy’s argument is that there is a phenomenological
tie between bodily action and bodily awareness. It is difficult to articulate what is exactly
behind this thought, but the idea is that the phenomenology of bodily action necessarily
involves bodily awareness such that we could not conceive of acting directly with a certain
body part without feeling it ‘from the inside’. The very way we understand bodily action
requires that bodily action is accompanied by bodily awareness.

J. J. Valberg, who follows O'Shaughnessy on this point, gives voice to this idea:

… It is an important fact about the phenomenology of [agency] that will is not independent
of feeling. Where feeling is completely absent here there is no sense of my body at all—the
possibility of the movements of my body occurring within my experience as willed is absent
as well. There can be bodily feeling without will, but not will without feeling.

Note, we are not talking here about numbness—the sort of thing you get, say, with
local anaesthesia. Numbness itself is (or involves) a kind of feeling. We are talking about the
more extreme possibility of a total loss, a sheer absence, of feeling. If this happened to your
arm, could you move it (in the normal way)? It is not that if you tried to move it you would
fail. You could not even try to move it. Without feeling, there is, so to speak, nothing at
which the will might aim. Feeling is what makes the body “visible” to the will. And if
something is not visible, you cannot aim at it. (Valberg 2007, p. 272)

The key move is in the last three sentences. Call this the Target-Object Argument.

Although the Feedback and Target-Object strands of argument are distinct, they are
not unrelated. The first idea we introduced in analysing the feedback strand of
O'Shaughnessy’s argument was that acting with one’s limbs requires one to know the state
of one’s limbs, and that bodily awareness puts us in a position to know this. The putative
phenomenological tie consists – at least – in this basic informational link and beyond this
claims that we cannot even make sense of directly acting with a body part that one does not
feel ‘from the inside’.
The key claim is that if there was nothing it is like to feel a body part from the inside, we could not even ‘aim’ at them – the idea being that if they were not phenomenally given, so to speak, then an agent’s body parts would not be presented to the agent as parts that he might act directly with at all. Bodily sensation is our (only?) method of ‘latching on’ to the body part. And if we can’t ‘latch onto’ a certain body part, we cannot act with that part. We can’t conceive of acting directly with a body part that we can’t feel ‘from the inside’, because we would have no way of singling out that body part to act with – as opposed to other parts of the body – and exertion involving it. Bodily awareness presents certain body parts to the agent as ‘affording’ action. Bodily awareness is thus the mode through which we apprehend parts of our body which allows for the possibility of acting with these parts – as opposed to say vision, which might present one with the body part but not present it as a body part that the agent can act with.

Let us sum up the argument for Necessity. We began by seeing Necessity as an instance of the general coordination between perception and action when the limits of perception and action are pushed back within the agent’s body. There, by considering the contrast with blindsight and blindtouch, we saw that if perceptual information is to make rational sense of an agent’s actions, this perceptual information has to be conscious. We then considered just how this rational link was secured. We saw reason to think that bodily awareness plays an essential role both in providing a ‘target-object’ for the bodily will and supplying feedback to the agent for control of his actions. Thus we appear to have a powerful case for Necessity.

3. Counterexamples

The attractions of Necessity are obvious, but trouble looms for the thesis. In this section, I consider three counterexamples against Necessity: (one) the case of deafferented agents, who appear to be able to directly act with parts of their body that they have no sensation in; (two) the case of direct brain control of physical apparatus that has been made possible by various brain-machine interface technologies; and (three) the majority of our bodily actions seem to be accomplished without conscious attention to or awareness of the body parts involved. These probe the Necessity thesis in different but related ways. They unite in opposing any claim that the contribution of bodily awareness to bodily agency is indispensable.

3.1. Deafferented agents

Deafferented agents who retain a capacity to act with parts of their body that they no longer have sensation in pose a direct threat to Necessity. I am not saying that physical action is possible in the complete absence of bodily awareness – a definitive answer to that question would require further empirical investigation than has previously been carried out. There is the much discussed case of Jonathan Cole’s patient IW, who is able to dress himself, walk, write, and even drive, despite being deafferented from the neck down (Cole 1991, Cole and Paillard 1995). Thus physical action is possible even if one’s bodily awareness is drastically reduced. But more importantly, IW appears to be able to act with many body parts that he has no sense of touch or of movement in. This seems to be a direct counterexample to Necessity.2

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2 IW retains some bodily awareness in parts of his body where he has no touch, proprioception or kinesthesia, but his possession of these forms of awareness, such as pain, temperature, and some sense of
I do not doubt that what it is like for IW to act is radically different from the phenomenology of agency of normal human beings. But that is not our question. Unless we can show that IW cannot be understood as capable of bodily agency at all with those parts of his body that he doesn’t have sensation in, this constitutes a powerful counterexample to Necessity. There are no grounds for denying that IW is capable of acting directly with certain parts of his body just because he lacks proprioception and kinaesthesia in those parts; IW is clearly able to do various things with those parts of his body. For IW, it is not the case that he has occurrent awareness of many body parts that he acts directly with. It is not even the case that he sometimes has awareness of those parts of the body below his neck, when, e.g., he is not acting with them.

3.2. Brain-machine interface (BMI) technology

The second putative counterexample to Necessity consists of cases in which direct recording from the motor cortex of experimental subjects is exploited to control external physical systems, such as a computer cursor. Call these BMI actions. Miguel Nicolelis and colleagues have trained macaque monkeys to operate a computer cursor with visual feedback to chase a moving target on a screen initially by manual manipulation of a joystick and later by directly issuing motor commands without overt behaviour (Carmena et al. 2003). An even more dramatic demonstration of the potential of BMI technology involves monkeys using cortical control of a robot arm to feed themselves (Velliste et al. 2008). As with the previous case, the monkeys were initially trained to operate the robot arm with a joystick. Afterwards, their own arms were restrained and they learnt to use their motor cortical activity to control the robot arm. The monkeys were able to learn how to feed themselves using the robot arm with fluent movements in a matter of days. The movements of the robot arm displayed features characteristic of skilled motor activity: the monkeys were able to learn how to use alternate trajectories to avoid obstacles and also make rapid corrections to the trajectory of the arm when experimenters unexpectedly changed the location of the food item. The robot arm effectively functioned as a surrogate arm for the monkey.

The basic idea is that by recording directly from an agent’s cortex, with the appropriate equipment (implanted electrodes, channels for information transfer, computers), an agent may learn to exert direct control over arbitrary physical systems that are appropriately connected to him. What subjects are doing in these cases is learning how to use their brainwaves to directly cause changes in some external system. It has been shown that given adequate feedback (often visual), subjects are able to latch onto statistical correlations and learn to control their brainwaves such that these can directly cause changes in an external system – e.g., guide movement of computer cursors. Moreover, there is nothing mysterious about the set-up. It is not a form of telekinesis since we can provide a complete story of how ‘BMI actions’ are possible in terms of electric circuitry hooked up to equipment sensitive to brainwaves.

‘BMI actions’ are naturally thought of as actions since moving the computer cursor with one’s brainwaves is prima facie something that one does. Moreover, it appears to be something active that one does, unlike sleeping. I shall not attempt to set down conditions such that we can conclusively decide whether ‘BMI actions’ qualify as actions, but insofar as we have reason to think that they do, we also have reason to think that they appear to be a species of basic action. Subjects appear to directly effect changes on the state of the

fatigue and effort, are insufficient by themselves to explain his capacities for bodily action, since they do not provide essential information about limb location and movement.

computer cursor rather than doing so by performing some distinct act that produces the
events of cursor movement. But these subjects do not feel the apparatus that they can act
on ‘from the inside’, since there are no bodily sensations associated with the apparatus at
all. Rather, the only feedback these subjects have is seeing the cursor move.

We have, as yet, no counterexample to Necessity, since the ‘BMI actions’ discussed
above involve control of physical systems external to the body. Necessity makes a claim
only about bodily action and not physical action at large. A counterexample is not far away,
however. As one of the pioneers of BMI technology, J. P. Donoghue, puts it, the barriers
are ‘merely technological’.

Scientific interest in BMI technology is in large part due to its medical potential. BMI
technology may allow scientists to construct devices that enable patients suffering from
severe motor disabilities or paralysis to regain some measure of motor functioning. This
may consist either in building systems that bypass the central nervous system entirely and
go directly from the cortex to nerves in the limb in cases where the patient’s muscles
remain intact or direct cortical control of external devices. Whilst the technology is as yet
unavailable, we can envisage neuroprosthetic devices which exploit BMI technology for
agents who have lost both sensation and motor function in their limbs to regain mobility.
The agent’s afferent nerves within and efferent nerves to his limbs have been destroyed,
but now we engineer a direct cortical link to his original limbs (with the appropriate
transducers, etc.). If the muscles and the efferent nerves in the agent’s limbs are intact, then
the agent can learn how to control and move his limbs without feeling his limbs ‘from the
inside’ – since he has no afferent nerves in his limbs and no substitute proprioceptive
system has been provided for. This would give us another case of basic bodily action with a
body part without feeling it ‘from the inside’.

‘BMI actions’ and deafferented agents constitute the same kind of counterexample
against Necessity. In both, we have agents who act with parts of their body that they don’t
feel ‘from the inside’. However, O’Shaughnessy might respond that Necessity concerns the
normal or non-pathological (where by this he means the conceptually central and
paradigmatic cases, as opposed to whatever is statistical predominant) cases of physical
agency, and we have not shown that Necessity fails there. The next counterexample
attempts to undermine this.

3.3. Automaticity: sub-personal mechanisms of control

Perhaps Necessity fails when we consider more outré cases like deafferented agents and
BMI technology, but surely the requirement on bodily awareness is binding for normal
agents engaged in mundane bodily acts, such as reaching to scratch an itch? O’Shaughnessy
is willing to concede that there may be extreme cases even in the repertoire of normal
agents that require an alternative treatment, but, he stresses, “the normal acts of reaching
are scarcely on a par with sudden high-speed duckings from what shows as a mere blur in
one’s visual field!” (O’Shaughnessy 1995, p. 201).

4 This is not to deny that ‘BMI actions’ may be non-basic actions for the subject during the learning phase;
e.g., he may be acting on the external device by conjuring a certain image. My point is rather that practised
behaviour exploiting BMI technology is such that one can have direct cortical control of external devices
where one performs actions with these devices not by performing some distinct action.

5 By the term ‘automatic’ I mean to pick out those instances of actions that appear not to be performed under
conscious feedback control but rather by dedicated sub-personal action systems (such as Milner and Goodale’s
vision-for-action system; see Milner and Goodale 2006). These differ from reflexes and conditioned
responses (other phenomena often referred to as ‘automatic’) in that they are teleologically robust in the sense
alluded to earlier: they are sensitive to changes in the environment and effector and can tailor the specific
means employed according to these changes.
Unfortunately, O'Shaughnessy’s contention is open to empirical counterexamples. Psychologists have studied the question of whether sensory feedback concerning the progress of an action is necessary for online control of an action for more than a century. There is now overwhelming evidence that even if we restrict ourselves to central cases of ordinary bodily action, such as mundane arm raisings and the like, it appears that (one) most instances of these are accomplished automatically and without constant bodily awareness, (two) even when movement involves bodily awareness, the online control involved in fine-tuning actions is mostly non-conscious. This, unsurprisingly, is due to the workings of various sub-personal mechanisms which monitor the state of our body and underwrite our ability to act.

The first claim that most instances of our ordinary bodily actions are accomplished automatically and without constant bodily awareness can be established by comparing execution times of actions with the time required for sensory feedback to arrive from the periphery. Karl Lashley (1951) observed that the frequency at which finger alternations take place whilst a subject is playing a fast musical passage can reach up to sixteen strokes per second. The speed at which finger movements take place during these passages precludes the possibility of any sensory feedback influencing the command system.

This example also bears on our second claim concerning the role of sensory feedback for online fine-tuning of many ordinary bodily actions, which are often very quick and accurate: sensory feedback is delayed. Proprioceptive information is delayed because of the time it takes for neural signals to propagate from the limbs to the brain. Therefore, if motor control relied on sensory feedback for online control of fast actions, the reafferent information would be inevitably out of date. This has the consequence that:

Relying on feedback information during fast movements will not increase accuracy, and will lead to instability. Keele and Posner (1968) found that vision of the target and moving hand only improved the accuracy of aimed movements if these lasted more than 200ms. The motor system thus faces a bandwidth problem in needing to use detailed information about ongoing movement as fast as possible. (Haggard 2001, p. 123)

So far our argument against the need for occurrent bodily awareness of a body part in order to act directly with the body part in question has been a purely negative one: (one) the timescales of certain actions are so short that sensory feedback – which takes time to propagate from the periphery to the brain – is too slow to make any impact and (two) because of the inevitable delay of sensory feedback, use of feedback during fast actions is counterproductive as these delays may lead to instability when attempts are made to bring fast movements under feedback control (Miall et al., 1993). Since these fast actions form a large and important part of an agent’s repertoire, Necessity cannot hold. However, recent empirical work testing for dissociations between motor awareness and action seem to allow us to make a strong positive case that there are scenarios where the sensory information fed back cannot be what the agent exploits in acting, and so cannot be necessary for online fine-tuning of actions.

Fourneret and Jeannerod (1998) conducted a series of stylus experiments where subjects were asked to draw straight lines with a stylus on a digital tablet in the sagittal direction with their drawing hand hidden from sight. During some trials, the experimenters introduced a bias of up to $10^\circ$ in the visual feedback – on a computer screen reflected in a mirror where the subjects saw the lines they were producing – which was inconsistent with the proprioceptive and kinaesthetic information subjects received. Effectively, subjects had to draw a tilted line in the opposite direction of the bias in order to produce a straight line on the screen.

Subjects performed experimental trials in two sessions. The trials in the two sessions differed only in the response required of the subject at the end of the trial. At the end of
the first session, subjects were asked to give a verbal report of their action. They were shown a card with lines at different angles from a single point of origin (between -10° to -2° to the left and 2° to 10° to the right, with six lines each side of the line running straight up from the origin), and asked to pick out which line most closely approximated how they moved their hand. At the end of the second session, the experimenter placed the subject’s hand holding the stylus at the starting point and subjects were asked to draw a line in the direction corresponding to what they had perceived during the trial with their eyes shut.

The results were as follows: Firstly, subjects were consistently able to trace out lines that appeared sagittal. This means that they were able to correct for the bias on trials when it was present. Secondly, subjects gave responses for both sessions that indicated that they thought their hand had moved straight even on perturbed trials. During the verbal reports, subjects tended to report a direction approximating to the sagittal. The mean direction of the motor responses also showed a tendency on the part of the subjects to draw lines close to the sagittal direction. Since both the verbal and motor responses indicated that the subjects were under the impression that they moved their arms straight during perturbed trials, it is plausible to think that conscious bodily awareness provided erroneous information about the actual task parameters in these cases. Given that the subjects were systematically successful, we may infer that they could not have been exploiting the false information to accomplish the task, but rather that some automatic sub-personal mechanisms were at work.⁶

⁶ Fourneret and Jeannerod note that there are two conflicts generated during the perturbed trials: (one) a visual-kinesthetic conflict, since the visual and kinesthetic signals indicated different directions of movement, and (two) a conflict between the motor command sent to the arm to trace a line straight ahead and kinesthetic signals generated by that action.
We may conclude from the foregoing that: (one) occurrent conscious awareness can’t be playing the role that Necessity requires, because the subject can accomplish the experimental task without veridical awareness of information from conscious bodily experience, and (two) since the subject was systematically successful, online control and fine-tuning must have been due to non-conscious processes.\(^7\)

\(^7\) There are numerous other experiments showing similar results which we might have drawn on to illustrate our point, but see Marcel (2003) for landmark experiments exploiting vibrotactile proprioceptive illusions to elicit striking dissociations between motor awareness and action.
These points appear to indicate that our claim that continuous conscious bodily awareness is required for feedback such that action is possible is not true for even central cases of ordinary basic bodily action since in many cases online correction takes place only at non-conscious sub-personal levels.

4. Upshot: bodily awareness and bodily agency

What is the upshot of these counterexamples for Necessity? The issues here are complicated. As we have seen, Necessity is buttressed by two distinct lines of thought: that bodily awareness provides an ineliminable source of feedback for bodily action and that bodily awareness provides the will with a ‘target-object’ so that body parts are given as affording action. To assess the consequences of the above counterexamples, it is best to consider their consequences for the two distinct lines of thought supporting Necessity individually.

4.1. On the ineliminability of feedback from bodily awareness

The idea that feedback from bodily awareness is ineliminable falls prey to two problems:

(One) We can substitute feedback from bodily awareness with visual information. In fact, this is IW’s strategy (Cole 1991). IW was only able to perform many mundane tasks, such as walking and even sitting, by painstakingly relearning them, for he now has to be able to perform them without the benefit of bodily awareness. He has to compensate for lack of immediate bodily awareness by paying close visual attention to the state of his body and needs to constantly anticipate his next moves so as to deal with obstacles that the environment turns up. Similarly, we suggest that our hypothetical BMI-aided patient – who exerts direct cortical control over his limbs through the BMI but has no proprioceptive information – can employ feedback strategies like IW’s for motor learning and online control.

Notice that part of our earlier motivation for the feedback line of thought was that, in contrast to visual awareness, bodily awareness appears to be ineliminable for bodily action. Sighted agents can often act perfectly well in total darkness and unsighted agents can be perfectly good at acting with their bodies. This, at best, shows that when agents lack visual feedback, proprioceptive feedback becomes crucial. However, as the case of IW demonstrates, this fails to establish that bodily awareness is an ineliminable source of feedback.

(Two) Our discussion of automatic mechanisms shows that feedback for fine-tuning actions is not necessarily from conscious experiences of one’s body. We saw that (a) the timescales of certain actions are so short that sensory feedback – which takes time to propagate from the periphery to the brain – is too slow to make any impact; (b) because of the inevitable delay of sensory feedback, use of feedback during fast actions is counterproductive; and (c) there are scenarios where subjects are successful at performing a task despite illusory information from bodily awareness.

The upshot of our discussion here is that there is no obvious necessity on this score. This is neither to rule out conscious online control, nor to deny that there are complex actions that we are only able to accomplish with bodily awareness. The point is that contemporaneous conscious bodily awareness of a body part is not necessary for acting with that body part – where the claimed necessity holds because bodily awareness provides an indispensable source of feedback. Thus, the dialectical burden of defending Necessity falls on the alleged phenomenological tie between bodily awareness and agency.
4.2. On the phenomenological tie

Remember that the second strand of thought in O'Shaughnessy’s argument for Necessity is that there is a *phenomenological* tie between bodily action and bodily awareness. We found it difficult to articulate the content of this strand of thought, but it seemed to involve a number of ideas that were related but not obviously the same. The first is that the phenomenology of bodily action necessarily involves bodily awareness such that we could not conceive of acting directly with a certain body part without feeling it ‘from the inside’. The second was captured by talk of bodily awareness ‘making the body “visible” to the will’. The idea there being that if body parts were not phenomenally given, so to speak, then an agent’s body parts would not be presented to the agent as parts that he might act directly with at all.

Given that we have cases like that of deafferented agents and ‘BMI actions’ before us, the first way – where acting with a body part that one doesn’t feel ‘from the inside’ is *inconceivable* – of unpacking the phenomenological tie is clearly too strong. The latter idea about bodily awareness providing the ‘target-object’ of the will is the appropriate claim to engage with. But we have to guard against a certain misunderstanding of it. The thought is that in sensing the limb, the agent is thereby presented with it as affording action. The ‘thereby’ here cannot be read as indicating a sufficient condition, for we experience bodily sensations in body parts that we do not and cannot directly act with. For example, we experience pangs of hunger in the stomach and pain associated with heartburn in the central area of one’s chest. Bodily sensations in these parts do not signal that these body parts afford acting with, since these are body parts that we cannot directly act with, but rather that one’s body is in a certain kind of state. We often act on these experiences – cook some noodles, or swallow some antacids – but we don’t act with the body part ‘made visible’ by the sensations in question.

Let us narrow our focus to a more minimal conception of how bodily awareness affords action with the body part one is currently aware of: if body parts were not phenomenally given, then an agent’s body parts would not be presented to the agent as parts that he might act directly with at all. However, on this understanding of how bodily awareness affords bodily action, it becomes unclear why occurring bodily awareness needs to be contemporaneous with the bodily action – unclear why we need, as O'Shaughnessy puts it, an “immediate concrete seeming presence” (1995, p. 202). The grounds for requiring that feeling a body part ‘from the inside’ is necessary for every instance of acting directly with that body part becomes obscure. Why is it not enough that we are often but not always aware of our body and its various parts ‘from the inside’ and, on this basis, have some practical grasp of bodily potential which allows one to act with these parts even when they are anaesthetised?

The most straightforward answer relies on leaning back on the feedback line of thought. We need occurring awareness of body parts to directly act with them because bodily awareness contemporaneous with bodily action allows one to monitor and control one’s action. As we have seen, in the case of ordinary bodily actions which are fast, bodily awareness appears to play little role in online control. Furthermore, since the Feedback and Target-object lines of thought are distinct – neither entails the other – we cannot assume that we have argued for one of them by arguing for the other.

But even with this more minimal conception of how bodily awareness affords action, the Target-Object line of thought is open to counterexamples. Both the case of deafferented agents and our hypothetical BMI-aided patient involve cases where agents are able to directly strive with body parts that they do not feel ‘from the inside’. Thus, these
agents have no need for sensation in body parts in order that these body parts can be
‘target-objects’ for the agents’ wills to engage. IW lacks bodily awareness in his body parts
below his collarline and thus lacks such a target mechanism but can still act directly with
many of these parts.

But how then is bodily action possible in IW in the absence of this ‘target
mechanism’? As our earlier discussion of ‘BMI actions’ seems to indicate, if agents are
given a suitable training environment where they receive appropriate feedback (which may
be purely visual) about the success of their strivings, agents appear to be able to learn to
directly act with objects that they have no sensation in. In a sense this is no surprise, since
in the case of IW, whilst his afferent nerves have largely been destroyed, his efferent nerves
are completely intact. Since motor commands to the periphery are sent via the efferent
nerves, there is no bar to motor commands reaching the periphery. And since the
peripheral biomechanical structures were undamaged, there is no reason why they could
not, in principle, respond to motor commands issued by the central system.\(^8\)

O'Shaughnessy and Valberg, however, claim to be able to rule this out by reflection on the
phenomenological tie between bodily awareness and agency.

At this point, O'Shaughnessy may insist that these cases fail to represent
paradigmatic cases of agency and so fail to dent his conceptual claim. However, once we
understand how sub-personal mechanisms take over much of the processing for various
actions that agents undertake, the role for occurring conscious awareness appears to be
diminished, and this would naturally lead us to be sceptical about the phenomenological tie
embodied in Necessity. At this point, O'Shaughnessy is likely to respond that even in these
automatic cases the agent is, strictly speaking, aware of that part of his body, but that this
awareness is very peripheral. This claim, however, is open to empirical counterexamples as
we have seen.

In section 3.3 we discussed Fourneret and Jeannerod’s (1998) stylus experiments.
There the visual feedback which subjects received was inconsistent with the proprioceptive
and kinaesthetic information subjects received. However, after effectively drawing tilted
lines to produce a straight line on the screen subjects reported that they had moved their
arms straight. The conclusion we drew there was that since conscious bodily awareness in
this case was inaccurate about the actual task parameters but subjects were successful at
their task, we should infer that subjects could not have been exploiting false information
received from non-visual sensory feedback to accomplish the task, since this would have
led them to draw a line in the sagittal direction, producing an angled line on the screen.
Rather, some automatic sub-personal mechanism was responsible for online correction of
the drawing.

Remember that part of the Target-Object line of thought trades on the idea that
acting with one’s limbs requires one to know the state of one’s limbs, and that bodily
awareness puts us in a position to know the state of one’s limbs. This basic informational
link is a minimal commitment of the position. But if conscious bodily awareness sometimes
fails to provide veridical information about one’s limbs, how can conscious bodily
awareness be always ‘putting one in a position to know the state of one’s limbs’ – and
hence providing the will with its ‘target-object’? Might O'Shaughnessy respond by asking
why bodily awareness cannot still be making body parts ‘visible’ to the will even though it

\(^8\) My remarks concerning the availability of other sources of sensory feedback and statistical learning
strategies in this and the previous section should not be taken as a sketch of a complete answer to how action
is possible for IW (or how ‘BMI actions’ are possible). (For further discussion of how action is possible for
IW, see chapter 11 “The Physiology of Cheating” of Cole 1991.) In particular, I don't wish to deny that a
complete story will require an account on which actions are coded not only in terms of body movements but
also in terms of the distal perceptual effects that these actions aim to generate (Prinz 1997) and that we also
need to consider the contribution of distal goal representations in understanding action.
provides false information about the target object in this case? Perhaps. But what can be the point of that? As O'Shaughnessy (1995, p. 202) himself writes: “Then if some esthesia is a necessary condition of the normal [tennis] stroke, why so? It can scarcely be that one needs intellectual reassurance that the limb still exists!” However, the response highlights that once we retreat from aspects of the Target-Object line of thought that trade on its providing a ‘target’ for action and control of action – which require information to be accurate – then it is unclear why we would still want to hold on to Necessity.

A further problem with the Target-Object line of thought is that it appears to be committed to a slight temporal priority for events of awareness of body parts, since these have to precede (or at the very least be simultaneous with) acting with these body parts, otherwise there will be no ‘target-object’ for the will to engage with. However, the circuits responsible for conscious awareness of motor performance appear to be far slower than the circuits involved in online fine tuning of actions (Castiello et al. 1991; see also Jeannerod 2006, chapter 3). If so, then, for an important class of ordinary actions which are fast, conscious bodily awareness cannot be temporally prior in a way that the priority is what the will exploits to know what to latch on to and how to control it.

This leads us to a final wrinkle in the debate with O'Shaughnessy to do with his two notions of body image. Theorists of the body image, where the relevant kind of body image is that which is exploited in direct action control, have typically distinguished between (at least) two senses of body image: a long-term body image and a short-term or here-and-now body image (O'Shaughnessy 1980, vol. 1, p. 241-248, Lackner 1988).

The long-term body image is, roughly, a settled picture of one’s own physical dimensions, which may change (slowly) depending on development of the body (grafts, amputations, growth). This describes the structure of one’s body – how it is shaped, sized and hinged – and thus what possibilities of movement are open to one. This tells us what basic actions the body can afford. However, the long-term body image only tells us what range of actions are possible for one given the structure of one’s body. It tells us nothing about the current state of one’s body, including its current position and spatial dispositions. One’s long-term body image remains the same whether one is upside down or downside up, whether one is in loving embrace or tearing down a piste. What we need, then, is a body image which gives us a sense of what range of actions are currently possible for one. And this requires an image that describes one’s current posture and dispositions of body parts. This is what O'Shaughnessy calls the short-term body image. It is “given by the description or drawing or model one would assemble in order to say how the body seems to one at a certain instant. For example: torso straight, right cylindrical arm stretched out from body, crooked at right angles, etc.” (O'Shaughnessy 1980, vol. 1, p. 241).

The debate regarding Necessity is concerned only with the short-term body image as these are the occurrent, but usually recessive experiences of the body that Necessity claims are essential to bodily action. However, why not retreat to the claim that all we really need is the long-term body image, which contains information about possible sites of sensation, bodily structure and bodily dispositions, but is not a form of occurrent experience of one’s body? Conceding this much is already to concede that Necessity is false as it stands. This indicates that the connexion between bodily awareness and agency is more complicated than the model embodied in Necessity suggests and may involve different factors contributing in complex ways.

Whilst we agree with O'Shaughnessy that “a necessary condition of willing bodily events is that an epistemological contact should be set up between the putative agent and his body” (1980, vol. 1, p. 137), we disagree on the nature of the epistemological contact. O'Shaughnessy’s contention is that “the body must be ‘there’ for [the agent], more or less come what may and as it were through the thick and thin of the mind’s vicissitudes, and in an immediate mode, if he is to be in a position to act” (1980, vol. 1, p. 137). As we have
seen from the various counterexamples we have considered, this is false. The intimate connexion between bodily awareness and bodily agency cannot be as strong a link as Necessity.

5. Conclusion

We began this essay by reflecting on the phenomenology of bodily agency, where there appears to be an intimate connexion between feeling our limbs ‘from the inside’ and our power to act directly with them. It might appear that despite the intuitive plausibility of the claim that bodily awareness plays a crucial role in our physical agency, given the range of counterexamples that can be mustered against a dependency claim between feeling and ability to act, we should submit that bodily awareness can at best play a peripheral role in physical agency. This, however, is too pessimistic a reading of the situation. Whilst the counterexamples canvassed above from cognitive psychology show that occurrent awareness ‘from the inside’ of a particular body part cannot be necessary for striving with the body part in question, they do not deny the presence of some intimate connexion between bodily awareness and agency.

The need to articulate a rational connexion between conscious experience and agency still remains. Our common sense picture of the link between experience and action is committed to the idea that experience plays some role in guiding one’s action. If we go with the counterexamples from cognitive psychology and forsake the intimate connexion between bodily awareness and agency that reflection on our experience of agency suggests, we are threatened with the loss of any understanding of how bodily action is possible. What now rationalises bodily actions? What now presents one’s moveable body parts as parts that afford action? Without occurrent bodily experience, we lack any conception of how the bodily will can target parts of one’s body and how the agent can guide his actions. No matter how impressive subpersonal action systems are, we appear to be forced into the predicament of blindtouch patients with the rejection of this dependence relation. Yet the testimony of experience is that normal agents are not cast in this unfortunate predicament.

The considerations we have marshalled from deafferented agents, BMI-actions and the automatic character of much of our everyday actions show that the intimate connexion between bodily awareness and bodily agency cannot be as strong a link as Necessity. Thus we should reject Necessity as the correct account of the relation between bodily awareness and agency, but, at the same time, we need to tease out the insight behind Necessity while allowing room for the cases from cognitive psychology. In rough outline, this will involve relaxing the link between bodily awareness and agency from the very direct connexion that Necessity claims. If we properly restrict the scope of our claim, we can perhaps discern the role that bodily awareness plays, which may be at a remove from a direct role in online control.

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9 We might even worry that this requires us to accept that conscious bodily awareness is epiphenomenal, but we can safely set this aside. First of all, it is fallacious to think that if a certain factor is not necessary for a certain phenomenon, then it cannot play some causal role when it is present. To take a simple example, not all patients afflicted with lung cancer are or were smokers, yet there is strong evidence that smoking is a cause of lung cancer. Secondly, it is clear that loss of bodily awareness does have an impact on one’s ability to act with one’s body, as is clear from the loss of various motor capacities and the ability to acquire certain new motor skills even in the case of the most able deafferented agents (Cole 1991). Furthermore, even though there are experimental situations where sub-personal mechanisms can take over action execution entirely, under certain novel situations or unexpected situations where there are huge margins of error, conscious guidance can kick back in (Slachevsky et al. 2001, Jeannerod 2003). Thus even though bodily awareness is not always required it is not epiphenomenal.
In this essay, I have shown that acting directly with a certain body part does not require *occurrent* awareness of the body part in question. But this is not to deny that there is a deep connexion between bodily awareness and bodily agency that is less straightforward than what our naive picture of the connexion between experience and action might lead us to expect.

**References**


