

The Mental Affordance Hypothesis

Dr Tom McClelland

University of Warwick

Introduction

Affordances are opportunities for action. A teapot, for example, has the property of *being grippable*. When a subject grips the teapot, she exploits the teapot's affordance. The concept of affordances, introduced by the ecological psychologist J.J. Gibson (1966), has been applied extensively across a range of disciplines. Throughout the considerable literature on affordances the afforded actions that theorists discuss are, with only a few exceptions, *bodily* actions such as gripping, walking or eating. This paper presents the hypothesis that we are also sensitive to affordances for *mental* actions such as attending, imagining and calculating. Although this Mental Affordance Hypothesis is ultimately answerable to the empirical evidence, a variety of phenomenological and theoretical considerations strongly suggest that we are appropriately sensitive to opportunities for mental action.

Is there already a concept of mental affordances in the literature? In design theory, Hartson (2003) introduces a concept of cognitive affordances, but these are understood as features that aid an agent's understanding of the use of an artefact rather than as opportunities for mental action. Also in design theory, Zhang & Patel (2006) define cognitive affordances as those affordances that depend on background knowledge, such as post-boxes only affording posting to an agent with an understanding of the postal system. Perhaps one could argue that the act of posting a letter is thus mental in some sense, but mental action clearly isn't Zhang & Patel's primary concern here. In artificial intelligence, Raubal & Moratz (2008) present an artificial agent that responds to affordances to perform the mental act of deliberating about which bodily affordance to act upon. Sloman similarly posits 'deliberative affordances' for human subjects (2008). In both cases though, the only mental act considered is deliberation, so there is no real exploration of the broader class of mental affordances. In the philosophical literature on affordances, Proust (2016) posits 'cognitive affordance-sensings' but her concern is specifically with meta-cognitive feelings, and her characterisation of these affordances as non-conceptual appraisals of one's situation diverges from the conception of affordances that I will offer in this paper. Scarantino mentions the possibility of mental affordances in passing (2003, pp. 960-961), and Rietveld & Kiverstein explore affordances for 'high-level' actions that one

might characterise as mental (2014). The concept of mental affordances is given a preliminary treatment by the author (McClelland 2015) but is not developed in any detail. In summation, although there are murmurings about affordances for mental action, nobody has unpacked exactly what it means for there to be mental affordances or made an explicit case for their existence.¹ The current paper is intended to remedy this.

The paper proceeds in four stages. In the first section I explore the somewhat nebulous concept of affordances and identify the key conditions of affordance-possession. In the second section, I use these conditions to offer a precise formulation of the Mental Affordance Hypothesis. In the third section I introduce a series of cases that plausibly satisfy those conditions: affording attention; affording the imagining of a bodily action; and affording counting. In then conclude by sketching a mental affordance research program that would reinforce my case for mental affordances and establish the applications they have to a range of theoretical issues.

1. What are Affordances?

1.1. *Affordances as Opportunities for Action*

Gibson introduced the term ‘affordance’ in his 1966 work *The Senses Considered as Perceptual Systems*. His understanding of the concept evolved throughout his career, and his most fully developed account of affordances can be found in his final work *The Ecological Approach to Visual Perception* (1979). In this book, he introduces the concept as follows:

The *affordances* of the environment are what it *offers* the animal, what it *provides* or *furnishes*, either for good or ill. The verb *to afford* is found in the dictionary, but the noun *affordance* is not. I have made it up. I mean by it something that refers to both the environment and the animal in a way that no existing term does. (1979, p. 127)

Although the notion of affordances remains a key concept in the ecological school of psychology (e.g. Michaels 2003) it has also been taken up across a wide range of other disciplines including: cognitive psychology (e.g. Tucker & Ellis 1998); neuroscience (e.g. Cisek & Kalaska 2010); music (e.g. Krueger 2011); anthropology (e.g. Ingold 2011); design theory (e.g. Norman 1999) and artificial intelligence (e.g. Horton et al. 2012), not to mention

¹ Since there is no real literature in favour of mental affordances, it should be no surprise that there is very little literature against them either. The nearest is perhaps Nanay who holds that we perceive opportunities for bodily action but denies that this can be extended to mental action (2013, p. 18). Although Nanay shows that his own arguments for the perception of bodily action properties do not extend to mental action, he does not present reasons to doubt that arguments for the perception of mental action properties might be developed.

phenomenology (e.g. Dreyfus 2002) and philosophy of perception (e.g. Siegel 2014). Although the proliferation of the concept of affordances gives us a vast and diverse body of research from which to draw, it comes at a cost: the term ‘affordance’ has become unmanageably polysemous, with different theorists using the term in different ways to suit their varied purposes (Hartson 2003; Michaels 2003; and Scarantino 2003). Our first task, then, is to pin down an appropriate conception of affordances.

At the heart of the concept of affordances is the notion of *opportunities for action*. An opportunity to perform an action is a situation in which it is possible for a subject to deploy some ability they possess. Consider a tree’s property of *being climbable* by me. Affordances are relativised to particular subjects, thus what is climbable *for me* will differ from what is climbable *for you*, which will in turn differ from what is climbable *for a squirrel*. For a tree to be climbable for me is for it to stand in a certain relation to my ability to climb: it must be something toward which I can successfully deploy that ability (see Nanay 2010, pp. 430-432). Some trees will stand in this relation to my climbing ability (e.g. sturdy trees with plenty of branches) and other trees will not (e.g. weak trees with too few branches). The tree’s climbability and my ability to climb it are *complementary dispositions*: they are a mutually dependent pair of dispositional properties, much like a sugar cube’s disposition to dissolve in my tea and my tea’s disposition to dissolve the sugar cube (Turvey 1992). The foregoing suggests the following condition on some object or situation x affording φ -ing for S:

The Opportunity Condition: x affords φ -ing for S only if x constitutes an opportunity for S to φ .

A couple of clarificatory remarks are in order. First, the entity x that constitutes an opportunity for action needn’t be an object. A scenario on the street might present an opportunity for me to cross the road, but here it is the overall *situation* that presents the opportunity to φ rather than some particular object (see Siegel 2014). Also, an entity constitutes an opportunity for action for a subject independently of how the subject takes it to be (Gibson 1979, p. 139). A tree might be climbable by me even if I fail to notice its climbability, and might be unclimbable by me even when I mistakenly take it to be climbable (see Gaver 1991).

The Opportunity Condition is almost universally treated as a necessary condition of affordance-possession.² It should not, however, be regarded as a sufficient condition. Positing affordances

² Some adopt a more liberal conception of affordances on which the thing afforded need not be an action. Gibson (1979 p. 39) talks about a fire affording warmth, for example, even though warmth is not an action. However, Michaels (2003) argues convincingly against such a liberal conception.

is meant to tell us something substantive about how agents successfully engage with their environment, yet positing opportunities to act tells us nothing at all. After all, it is hardly an insight that there are situations in which it is possible for creatures to exercise their abilities. Any theoretically informative conception of affordances must supplement the Opportunity Condition with a more demanding condition (or conditions) on affordance-possession. There are two overlapping strands in the affordance literature that introduce conditions concerning the way in which subjects are *sensitive* to opportunities for action. In the first strand, the further condition of affordance-possession is that affordances are *perceptible*. In the second strand, the further condition of affordance-possession is that perception of the object or situation *potentiates* the afforded action i.e. automatically readies S to perform that action. I will use the term ‘sensitivity’ to encompass both of these ways in which a subject might be responsive to an affordance. I now turn to consider each of these possible conditions in turn.

1.2. Affordances as Perceptible Opportunities for Action

Affordances are commonly characterised as *perceptible* opportunities for action (see Gibson 1979; Michaels 2003; Dotov et al. 2012). On this view, recognising the climbability of a tree is not a matter of seeing a set of qualities then inferring that an object with those qualities is climbable by us. Instead, we can simply *see* its climbability. This gives us the following condition:

The Perceptibility Condition: x affords φ -ing for S only if x 's property of constituting an opportunity for S to φ is perceptible by S.

This condition does not bring with it any commitments regarding the nature of our perceptual relation to affordances. Gibson's understanding of affordances is bound up with a number of claims about affordance perception, including the claims that: affordances are perceived directly rather than represented; affordances are perceived through ‘optic flow’ information without any need for internal processing, and; that in ordinary perception we are aware exclusively of affordances. The Perceptibility Condition, however, should be read in a way that is compatible with views that oppose Gibson on these matters. It is consistent with: a representational view of affordance perception (e.g. Prosser, 2011; Siegel 2014); with affordance perception involving internal processes that disambiguate ambiguous sensory inputs (Christensen & Bicknell forthcoming); and with ordinary perceptual awareness being characterised not just by affordances but by objects and qualities (Nanay 2010; Christensen & Bicknell forthcoming). The condition is also neutral on whether our perception of affordances

is visual or some other mode of perception (though for convenience I will often talk of *seeing* affordances).

Why think we perceive opportunities for action? This is a thesis that should be judged on its explanatory value. Although the explanatory applications of this thesis are too numerous to explore here, there are some that should be highlighted. One application concerns the adaptive value of such perceptual capacities: if opportunities for action had to be inferred using our capacity-limited cognitive resources, our responsiveness to salient opportunities would be impeded in situations where our cognitive resources are over-stretched. Another key application concerns skill acquisition. The transition from unskilled to skilled action plausibly involves the acquisition of certain perceptual capacities. For example, where a novice driver has to *infer* that a situation requires braking, a skilled driver can simply *see* this feature of her situation.³ Finally and, for my purposes, most importantly, the thesis that we perceive opportunities is often motivated phenomenologically. Many report, for instance, that they perceptually experience the teapot not just as white and as smooth but as *grippable*. Some of the most vivid experiences are those in which we are presented with a particularly strong affordance, such as a frosted cake strongly affording eating (Siegel 2014). This important aspect of our phenomenology is best explained in terms of our perceiving opportunities for action.

1.3. Affordances as Potentiating Opportunities for Action

The Perceptibility Condition is present – whether explicitly or implicitly – in a great deal of the affordance literature. There is, however, a different condition on affordance-possession that underwrites a substantial body of research in cognitive neuroscience. Here what matters is a kind of motoric sensitivity to opportunities for action. On this conception, an object or situation x affords ϕ -ing for S only if S perceiving x potentiates S actually ϕ -ing.⁴

A range of studies suggest that when we see an item that presents an opportunity to perform a particular action, the motor pathways responsible for performing that action (or parts of that action) are potentiated. In a study by Tucker & Ellis (1998), subjects were required to identify the orientation of a presented object by pushing a button with their left hand to indicate that the object is upside-down or pushing a button with their right hand to indicate that it is the correct way up (or vice versa in other trials). This study revealed an ‘interference effect’. Where the

³ Here I stop short of the thesis that skilled actions are wholly automatic and ‘mindless’ (for discussion, see Christensen et al. 2016).

⁴ Confusingly, this literature sometimes uses the term ‘affordance’ to refer to the motor state triggered by the perceived entity rather than to the entity’s property of triggering that state. I will maintain the latter use.

presented item is a teapot, if the handle of the teapot is facing toward the subject's right-hand, this slows down their response time when the trial requires a left-handed button-push and improves their response time when the trial requires a right-handed button-push.⁵ Ellis & Tucker explain this interference in terms of the perception of the teapot potentiating a right-hand grasp. The readying of this right-handed movement makes a right-handed button push faster, but impedes a left-handed button push. Crucially, they propose that perceiving the teapot potentiates the appropriate grip *automatically*: since gripping the teapot is irrelevant to the task, the potentiation of the gripping motion must occur independently of the agent's intentions. They interpret this phenomenon as manifestation of the intimate connection between perceptual and motor systems in the brain. They explain that '[t]he visual system is highly integrated with the motor system to the extent that no clear divide exists between what one could call purely visual processing and purely motor processing.' (1998, p. 830) Consequently, such motoric responses to perceived stimuli should be unsurprising.

We gain an interesting clue into how potentiation works from the phenomenon of utilization behaviour (Brazzelli & Spinnler, 1998). This is a condition, caused by brain damage to the frontal lobe (Besnard et al. 2011), in which subjects are compelled to 'utilize' items that they see. When presented with an apple, subjects eat the apple regardless of whether they are hungry. When presented with a toothbrush, they brush their teeth even in inappropriate contexts such as a doctor's office. When presented with pens, they draw with them even if there's no paper to draw on. This condition has been interpreted in terms of subjects being unable to suppress the motor processes automatically triggered by their environment (e.g. Rietveld 2012; Cisek & Kalaska 2010). Perception of an apple automatically potentiates the motor process responsible for eating. In a typical subject, if eating the apple is an unsuitable response then that motor process is suppressed (whether consciously or unconsciously). But for subjects with relevant frontal lobe damage, such suppression is not possible so they are compelled to eat. These considerations point us toward the following condition on affordance-possession:

The Potentiation Condition: x affords φ -ing for S only if S 's perception of x potentiates the process responsible for S φ -ing.

In order to apply this condition fruitfully, we must be specific about what it means for an action to be potentiated. The foregoing discussion highlights four key features of potentiation. I suggest that these features should be encoded in an operationalised definition of potentiation.

⁵ The precise character of such interference has been mapped more recently by Bub (2015).

S's perception of x potentiates S φ -ing just in case S's perception of x causes S to be in a state such that: if S does not suppress φ -ing then S will actually φ ; if S actually φ s in response to x then S's response time will be more rapid than it would have been had S not been in that state; if S performs an act relevantly congruent with φ -ing then their performance of that act will be more rapid than it would have been if they were not in that state; if S performs an act relevantly incongruent with φ -ing then their performance of that act will be more slow than it would have been had S not been in that state.

Why think that stimuli automatically potentiate actions? Although the experimental and pathological data discussed offer considerable support for this thesis, it gains further support from its wider explanatory applications. As with the thesis that opportunities for action are perceptible, it has explanatory applications regarding the adaptive value of potentiation and regarding the role of potentiation in skill acquisition. It also has important applications to our agential phenomenology. The agential experience of catching an on-coming ball is best characterised as one of *permitting* an action to occur rather than of *initiating* an action spontaneously. The notion of potentiation helps explain this phenomenology: the on-coming ball potentiates the act of catching the ball, so in order to catch the ball the subject need only allow this process to unfold rather than having to initiate the act of catching.

2. What Are Mental Affordances?

In light of the foregoing, how should we frame the hypothesis that there are affordances for mental action? At the very least, we need the condition that x affords a mental action only if it constitutes an opportunity for mental action. Given our discussion of the thinness of the Opportunity Condition, it should be no surprise that it can be satisfied fairly straightforwardly. Mental actions include (though are by no means limited to) attending, imagining, remembering, expecting, evaluating, deciding, calculating and judging. There is considerable debate over the extent to which we have agency over our mental processes (see Soteriou & O'Brien 2009). Although this debate has important implications for what does and does not count as a mental act, it is worth noting that the view that there are *no* mental actions does not have a serious following. As such I will help myself to the claim that there are such things as mental actions. The division between mental and bodily actions is likely to be blurry. The mental act of deliberating about something may involve the overt bodily act of talking to yourself or (as we will touch on later) perhaps a covert 'off-line' bodily act of talking in your head. Nevertheless, such fuzziness should not lead us to doubt that there are such things as mental acts.

Opportunities for mental action are situations in which it is possible for an agent to exercise a particular mental capacity. I take it to be uncontroversial that there are opportunities for mental action. A stimulating documentary presents an opportunity to reflect, an old photo album presents an opportunity to reminisce, a place of worship presents an opportunity to contemplate and a fantasy novel presents an opportunity to imagine.⁶ With a little work, a wealth of such examples could be provided. This leads me to conclude that the Opportunity Condition is easily satisfied. However, we have seen already that the Opportunity Condition is not plausibly a sufficient condition of affordance-possession. It seems we must adopt at least one of the further conditions that specify the way in which subjects are sensitive to these opportunities for action, but which one? I propose adopting *both* further conditions. If difficulties emerge for the claim that opportunities for mental action are both perceptible and potentiate the afforded mental action, we are free to retreat to the more moderate position that we are only sensitive to such opportunities in one of these respects. However, until such difficulties emerge we should aspire to find mental affordances that satisfy both extra conditions. Another reason for adopting both further conditions is that there is an attractive position according to which potentiation and affordance perception are two sides of the same coin. On this view, when gripping is potentiated by a grippable object, that motor-state itself constitutes a perceptual representation of the object's grippability. This view is motivated by the thought that the state in question is assessable for accuracy: it is veridical when the stimulus is grippable and non-veridical when the object is not. Although it would be inappropriate to assume such a view without further argument, it does give us further reason not to pick one condition at the expense of the other. The foregoing yields the following account of mental affordance-possession. An object or situation x affords a mental act φ iff:

- I) The Opportunity Condition:** x constitutes an opportunity for S to perform the mental act of φ -ing.
- II) The Perceptibility Condition:** x 's property of constituting an opportunity for S to φ is perceptible by S.
- III) The Potentiation Condition:** S's perception of x potentiates S φ -ing.

⁶ Just as a teapot does not present an opportunity to grip *as such*, but rather presents an opportunity to grip *that very teapot*, so too a documentary does not present an opportunity to reflect *as such*, but rather an opportunity to reflect *on that very documentary*. It would be a mistake, however, to assume that all mental affordances are such that the mental act is performed *on* the affording object. A space might afford contemplation without affording contemplation *of that very space* and perhaps without affording contemplation of anything in particular. This is explored more closely in McClelland (2015).

The Mental Affordance Hypothesis is simply the claim that there exist at least some mental affordances satisfying all three of the conditions above.⁷

A number of *a priori* considerations obstruct the case for the Mental Affordance Hypothesis. The first worry is that the Mental Affordance Hypothesis predicts an implausible proliferation of affordances. Opportunities to grip are constrained by the presence of grippable objects in your perceptual environment. Opportunities to attend, in contrast, are ubiquitous. Being *attendable* is a far less demanding property than being grippable, so any perceptual environment will be saturated with attending-affordances. The same goes for opportunities to imagine, to count or to reflect upon. The Mental Affordance Hypothesis predicts we are sensitive to this plethora of affordances: our perceptual experiences would be shot through with myriad mental affordances, and each of these mental acts will be potentiated. The implausibility of such a commitment casts doubt on the hypothesis.

I suggest that there is a parallel problem regarding bodily affordances, and that the solution to this problem can be imported to address the challenge to mental affordances. Although opportunities for mental action are ubiquitous, this does not mean that all those opportunities are perceived, or that all those opportunities potentiate the relevant mental act. Our sensitivity to opportunities is tuned to *relevant* opportunities. In a field full of footballs, we might perceive the kickability of a particularly well-placed football, and the kicking of that ball could be potentiated, but that won't be the case for *all* the footballs we perceive. Similarly, we will only be sensitive to those opportunities to perform a mental act that are particularly relevant. An aptness-filter is built into affordance sensitivity, so responding to an affordance is limited only to those cases where action is likely to be apt. This is not to say that our responses to affordances are *wholly* sensitive to aptness. Recall, teapot gripping is potentiated even though it is irrelevant to Tucker & Ellis's task, and utilization behaviour patients characteristically perform inappropriate actions. Nevertheless, an aptness-filter is still evident in both cases: not *every* opportunity for left- or right-handed actions in the subjects' perceptual environment interferes with their performance, and not *every* opportunity for action in the perceptual environment is acted on by the utilization behaviour patient.⁸

⁷ Although I am attempting to offer a conception of affordances that encompasses major strands in the literature, I do not claim to offer a conception free from theoretical biases. I am offering a conception that allows us to offer a plausible and theoretically interesting formulation of the Mental Affordance Hypothesis, meaning that some strands of the affordance literature have been disregarded.

⁸ One might go further and suggest that we *represent* the aptness of the affordance: that the ball is represented as *good-to-kick*. My proposal stops short of this. Aptness is key to the aetiology of affordance sensitivity, and this is enough to assuage worries of proliferation without making a further claim about normative content.

Other *a priori* obstacles to mental affordances target particular conditions. Regarding the Perceptibility Condition, one might worry that opportunities for mental action are too sophisticated to be represented perceptually (Nanay 2010, p. 432). It is one thing to perceive a ball as to-be-caught but quite another to perceive a situation as to-be-deliberated-about. This parallels worries in wider debates about perceptual content: one might accept that a perceptual state can represent a tree *as green*, and perhaps even represent it as having a certain characteristic Gestalt, but be resistant to the claim that it represents the tree *as a pine tree*. Perhaps perceptual content is too basic to encompass opportunities for mental action. Regarding the Potentiation Condition, one might worry that only motor processes are the kind of process that can be potentiated by stimuli. To the extent that mental action is non-motoric, it cannot be potentiated. Although I was careful not to *define* potentiation motorically, it might still be suggested that only motoric states could satisfy the operationalised conditions that I presented. Neither of these worries are knock-down objections to the Mental Affordance Hypothesis. They do, however, highlight the kind of challenge we will face when trying to find well-supported cases of mental affordance-possession.

What method should be used to establish whether some candidate satisfies the three conditions? I will use phenomenological observations as a point of departure. Although such observations have often played a key role in supporting claims about our sensitivity to affordances, I will endeavour not to rely on phenomenological observations too heavily. The first reason for this is that phenomenological observations are too easily disputed, and such disputes are notoriously difficult to resolve. The second reason is that phenomenology is an imperfect reflection of our underlying mental processes: one can perceive an opportunity to grip and have a gripping response potentiated without it showing up in one's experience, and one can have an experience as of grippability and the potentiation of gripping without the relevant underlying psychological states. Despite these limitations, it would be a mistake to disregard phenomenological considerations entirely (see Koffka 1935). Defeasible evidence is still evidence, and I will supplement these observations with theoretical and empirical considerations. That said, the claim that there are mental affordances is ultimately answerable to the empirical data, so my argument constitutes only a preliminary case for mental affordances that, I hope, will motivate the relevant empirical investigation.

3. Are There Mental Affordances?

Case I: Affording Attention

Consider the following situation. You are working at your desk but outside a builder has a radio on too loud. Although you successfully keep your attention trained on your work, the music outside is a continual distraction. I suggest that this scenario is best described in terms of the noise *affording focal attention*.

Phenomenologically, the music is experienced as *demanding* our attention. The music invites us to perform a certain act, namely that of focally attending to it. Crucially though, this is an invitation we are free to ignore, and it is possible to succeed in keeping our focal attention trained on our work. This is not to say that we don't attend to the music *at all* (indeed, a case could be made for thinking that wholly unattended stimuli are unexperienced, which would be at odds with the phenomenology of the scenario). Rather, we attend to the music only peripherally and resist the invitation to direct our focal attention toward it.

Does the music satisfy the three conditions of affordance-possession? The music presents an opportunity for us to perform a certain action – the act of focally attending to it – so the Opportunity Condition is plausibly satisfied. Furthermore, our representation of the music as *to-be-attended* is more plausibly construed as perceptual than non-perceptual. Although there are no uncontroversial criteria for distinguishing perceptual from non-perceptual states, two features strongly associated with perceptual processes are that they are non-inferential and doxastically impenetrable. One's representation of the noise as *to-be-attended* certainly seems to be non-inferential – it is something we recognise directly rather than with the help of mediating premises. Furthermore, one's representation of the noise as *to-be-attended* seems to be doxastically impenetrable. If it were doxastically penetrable, the belief that our attention is better directed at our work would stop us from representing the music as *to-be-attended*. What we find, however, is that the noise continues to make a demand on our focal attention regardless of our beliefs.

Our auditory perception of the music also plausibly potentiates the act of focally attending. This is not a situation in which attending to the stimulus is obligatory – in the scenario described, we succeed in keeping our focal attention directed on our work. But nor is it a situation in which our focal attention is unaffected by the stimulus – we are in a state such that we *would* focally attend to the music if we stopped deliberately directing our attention at our work. This situation is plausibly understood in terms of the stimulus *potentiating* our focal

attention. The stimulus automatically readies our focal attention to be directed toward it, but we are able to suppress this automatic signal and direct our focal attention elsewhere.

We have initial reasons to believe that the music satisfies all three conditions of affordance-possession. The only remaining question is whether attending is a mental act. Attention has both an overt aspect and a covert aspect. Overt attention is the *bodily* activity of directing one's sense organs toward a particular stimulus, property or region. Covert attention is the *mental* activity of concentrating on a particular perceived stimulus, property or region. These two activities are *dissociable*: one can direct one's covert attention toward things other than the target of one's overt attention. That said, the two activities typically coincide. The focus of our gaze, for instance, is normally the focus of our concentration. Crucially, when we deliberately attend to a stimulus we don't typically perform two acts – one bodily and one mental. Rather, attending involves a single act of will, albeit an act that has both bodily and mental results. I suggest that attention should be regarded as a hybrid act that is both bodily *and* mental in nature. Insofar as it is partly mental, affordances to attend will thus qualify as mental affordances.

The fact that attention has this hybrid nature suggests an interesting argument for mental affordances. If one is on board with the idea of affordances for bodily action, then there's no principled reason to resist affordances for the bodily action of overtly attending. But if one is going to countenance affordances to attend, one should posit affordances for the hybrid act of (overtly and covertly) attending rather than just for the bodily act of overtly attending. After all, the two aspects of attention have deep functional interconnections, and rarely come apart. As such, the case of attention makes it uncomfortable for someone to countenance affordances for bodily action whilst rejecting affordances for actions that are at least partly mental.

The result that there are affordances to attend is valuable as it shows that there is at least one kind of mental affordance. What it does not do, however, is give us reason to posit affordances for a wider set of mental acts relevantly similar to attending. Attending is a *sui generis* act so there are no mental actions of the same genus that we can infer are also afforded. Our next target should be a mental act that is plausibly representative of a wider class of mental actions.

Case II: Affording the Imagining of a Bodily Action

Consider the following scenario. You are traversing a series of stepping stones across a river. The first dozen stones are fairly easy to deal with, and you perform the appropriate hops and steps without having to reflect on your actions. You then get to a trickier stone. You pause,

mentally rehearse the required leaping manoeuvre, perform the rehearsed leap then continue on your way. I suggest that each of the actions involved in this scenario is best described in terms of affordance perception, and that when you reach the tricky stone the act afforded is the *mental* act of rehearsing your leap in imagination. The phenomenology of this scenario is plausibly captured in terms of our sensitivity to affordances.

Regarding perceptibility, as you traverse the easy stones, there is no need to *infer* what kind of step can be performed on the next stone. Rather, you *perceive* the specific stepping action afforded by the stone. I suggest that exactly the same applies to your experience of the tricky stone – that you perceive the stone as affording a certain mental act viz. the act of mental rehearsal. And this appearance seems to be cognitively impenetrable. If you're convinced by a friend that the best strategy is *to not think and to just keep going*, then pausing and rehearsing your leap will be at odds with your beliefs. But since the appearance that the tricky stone affords this act is perceptual, it is relatively insensitive to your background beliefs.

Regarding potentiation, as you traverse the easy stones your experience is not of *initiating* the appropriate stepping action but is rather one of *permitting* yourself to perform steps potentiated by the perceived stone. Again, I suggest the same applies to your experience when you act on the tricky stone – you do not deliberately initiate the act of mentally rehearsing your jump but rather permit a potentiated mental action to unfold. Moving beyond phenomenological considerations, there is also indirect empirical evidence that imaginings of bodily acts can be potentiated. A wealth of data suggests that the neural underpinnings of an imagined bodily act overlap extensively with the neural underpinnings of the actual performance of that act (Jeannerod 1995; Kessler & Thomson 2010). This drives a convincing account of imagined bodily acts as 'off-line' performances of bodily acts. If we grant, as I think we must, that the processes responsible for bodily acts are automatically potentiated by stimuli, then we should also accept that the processes responsible for imagined acts can also be automatically potentiated by stimuli. After all, if they are to a significant extent *the very same process*, then if one can be potentiated it is plausible that the other can be potentiated too. Even those who claim that only motoric processes can be potentiated have nothing to object to here.

We are thus led to the defeasible conclusion that there are affordances to mentally rehearse bodily actions. As with the case of attention, if one accepts affordances for bodily actions it is hard to resist the conclusion that there are at least some affordances for mental action. Unlike the case of attention, we have opened up a large class of mental actions for which there are plausibly affordances. If we can perceive affordances to mentally rehearse a certain kind of leap,

we can presumably perceive affordances to mentally rehearse a host of other bodily actions. The space of perceptible affordances for bodily actions might even be duplicated in a space of perceptible affordances for the imaginative performance of those same bodily actions.

By considering mental acts with an intimate connection to bodily action, we put ourselves in a good position to argue that those who countenance affordances for bodily action ought also to countenance affordances for these mental actions. A limitation of this strategy, however, is that one might object that *only* those mental acts with a close connection to bodily action can be afforded. It might be objected that opportunities to perform abstract mental acts detached from the bodily are too complex to be perceived, or that the wholly non-motoric nature of such acts precludes them from being potentiated. This leads us to our third and final candidate mental affordance.

Case III: Affording Counting

Counting is a mental act. Sometimes we count in a way that involves the bodily act of pointing to items and numbering them out loud. Sometimes we count in a way that involves doing those bodily acts off-line i.e. by pointing and numbering in our heads. It is implausible, however, that the act of counting is exhausted by such overt or covert bodily action. We can count things without performing either of these acts, and we have a brain area – the intraparietal sulcus – that is directly associated with arithmetic without being directly implicated in those bodily acts (Dehaene et al. 2004). My target here is what you might call unassisted counting: a way of counting that depends on neither covert nor overt bodily action. Our environment can present opportunities for counting. Consider a jar full of marbles, a pile of pennies, or the leaves on a clover. The question is whether we perceive the marble jar as affording counting, and whether perceiving the marbles potentiates the act of counting. I trust that readers will be able to imagine the kind of phenomenological case I would make for this conclusion. For this case though, I will instead focus on some pathological data that suggests we are relevantly sensitive to opportunities to count.

The manifestations of utilization behaviour we have discussed so far are all bodily acts: eating an apple, brushing with a toothbrush and writing with a pen. Interestingly though, the patient discussed by Brazzelli & Spinnler also showed a ‘compulsion to count’ (1998, p. 350).⁹ This

⁹ A complication here is that the cases of counting observed by Brazzelli & Spinnler are, of course, cases of overt counting. One might claim that it is this bodily act that is afforded rather than the mental act of counting. However, the burden of proof would be on the objector to say why this is so. Ordinary subjects perform these bodily acts to *assist* a mental act of determining how many of something there are, and there is no obvious

indicates that the act of counting is potentiated by our perception of opportunities to count. Where neurotypical subjects naturally suppress this signal to act the patient is unable to do so, hence her atypical behaviour. It is worth noting that the patient's symptoms are not naturally explained in terms of atypical behavioural urges: the characteristic feature of the disorder is that the patient's behaviour is *environment led*, meaning that she acts on perceived opportunities for actions regardless of whether she has a desire to perform those actions. Consequently, the fact that she performs the act of counting on certain stimuli indicates that she *perceives* those stimuli as constituting an opportunity to count. This case again puts pressure on those who accept affordances for bodily action to countenance affordances for certain mental actions. If the compulsive bodily actions of Brazzelli & Spinnler's patient are to be understood in terms of affordance perception then, other things being equal, the same treatment ought to be given to her compulsive mental actions.

We are thus led to the defeasible conclusion that there are affordances to count. Where does this leave us? Counting is part of a wider class of arithmetical actions, so to the extent that one finds it plausible that there are affordances to count one should also grant the possibility of affordances for other arithmetical actions. A pile of sweets, for example, might present an opportunity for division. And stimuli in the language of mathematics can present opportunities for far more sophisticated arithmetical actions. Moving beyond arithmetical actions, one might take the existence of counting-affordances as evidence that the scope of mental affordances is unlimited. We've moved beyond affordances for off-line bodily activity to mental acts more detached from bodily action, and if we can perceive opportunities to perform one act of this kind, why not all such acts?

Those convinced that we cannot perceptually represent complex properties like opportunities for abstract mental action will be resistant to this conclusion. Those convinced that potentiation is limited to motoric processes will be similarly resistant. The burden of proof will be on them, however, to demonstrate how cases like the countable marble jar are relevantly different to accepted cases of affordance-possession. Of course, the dispute here may well fragment, with objections to the perception of opportunities for abstract action differing in force from objections to the potentiation of mental action by stimuli. We should thus be open to the possibility that some opportunities for mental action will only qualify as mental affordances if

reason to doubt that the patient is doing the same. Put another way, the patient is most likely compelled to make bodily gestures that aid counting precisely because she is compelled to perform the mental act of counting.

we soften our conditions of affordance-possession so as not to require both perceptibility *and* potentiation.

5. Conclusion: The Mental Affordance Research Program

My preliminary case in favour of the Mental Affordance Hypothesis is by no means conclusive. It should, however, be enough to motivate the pursuit of a mental affordance research program. It will be worthwhile to explore whether there are cases in which the perception of a task-irrelevant opportunity to perform a mental act interferes with our behaviour in the same way as Ellis & Tucker's grippable teapot. It will also be worth exploring whether pathological conditions associated with affordance perception can lend further support to the conclusion that we are sensitive to opportunities for mental action. Besides these direct investigations into mental affordances, we should also explore the theoretical applications of mental affordances. Recall the explanatory considerations that motivate the claims about perceptibility and potentiation for bodily affordances. Can mental affordances be put to the same explanatory use? Perhaps we need to posit mental affordances to properly capture our perceptual and agentive phenomenology. Perhaps sensitivity to mental affordances has an adaptive value of minimising cognitive load and enhancing response time. And perhaps we must cite a subject's sensitivity to mental affordances to explain her transition from unskilled to skilled mental performance. Though we are not in a position to predict the answers to these questions with any certainty we are, I hope, in a position to recognise their value.

REFERENCES

- Besnard, J., Allain, P., Aubin, G., Chauvire, V., Etcharry-Bouyx, F., & Le Gall, D. (2011). A Contribution to the Study of Environmental Dependency Phenomena: The Social Hypothesis. *Neuropsychologia* (49), 3279-3294.
- Brazzelli, M., & Spinnler, H. (1998). An Example of Lack of Frontal Inhibition: the 'Utilization Behaviour'. *European Journal of Neurology* (5), 347-353.
- Bub, D. (2016). tdlc.ucsd.edu/events/boot_camp_2015/DBubTDLCTalk2015.pdf. Retrieved from tdlc.ucsd.edu/events/boot_camp_2015/DBubTDLCTalk2015.pdf
- Christensen, W., & Bicknell, K. (forthcoming). Affordances and the Anticipatory Control of Action.
- Christensen, W.; Sutton, J.; McIlwain, D.J.F. (2008) Cognition in Skilled Action. *Mind & Language* (31), 37-66.
- Cisek, P. (2007). Cortical Mechanisms of Action Selection: The Affordance Competition Hypothesis. *Philosophical Transactions of the Royal Society* (362), 1585-1599.

- Cisek, P., & Kalaska, J. F. (2010). Neural Mechanisms for Interacting with a World Full of Action Choices. *Annual Review of Neuroscience* (33), 269-98.
- Dehaene, S., Molko, N., Cohen, L., & Wilson, A. J. (2004). Arithmetic and the Brain. *Current Opinion in Neurobiology* (14), 218-224.
- Dotov, D.G., Nie, L. & Wit, d. M.M. (2012). Understanding affordances. *Avant*, 3(2), 28-39.
- Dreyfus, Hubert L. (2002). Intelligence without representation. *Phenomenology and the Cognitive Sciences* 1(4): 367-383.
- Gaver, W. W. (1991). Technology Affordances. Proceedings of the SIGHI conference on Human factors in computing systems.
- Gibson, J.J. (1966). *The senses considered as perceptual systems*. Boston: Houghton-Mifflin.
- Gibson, J. (1979). *The Ecological Approach to Visual Perception*. New York: Psychology Press
- Hartson, R. (2003). Cognitive, physical, sensory, and functional affordances in interaction design. *Behaviour and Information Technology*, 22(5), 315-338.
- Heft, H. (2001). *Ecological Psychology in Context: James Gibson, Roger Barker and the Legacy of William James's Radical Empiricism*. New York: Psychology Press.
- Horton, T., Chakraborty, A., & St. Amant, R. (2012). Affordances for robots: a brief survey. *Avant*, 3(2), 70-86.
- Ingold, T. (2011). *The Perception of the Environment: Essays on livelihood, dwelling and skill*. London: Routledge.
- Jeannerod, M. (1995). Mental Imagery in the Motor Context. *Neuropsychologia*, 33(11), 1419-1432.
- Jenkins, H. (2008). Gibson's "Affordances": Evolution of a Pivotal Concept. *Journal of Scientific Psychology*, 34-45.
- Kessler, K., & Thomson, L. A. (2010). The Embodied Nature of Spatial Perspective Taking: Embodied Transformation versus Sensorimotor Interference. *Cognition*, 114(1), 72-88.
- Krueger, J. (2011). Doing Things With Music. *Phenomenology and Cognitive Science*, (10), 1-22.
- Koffka, K. (1935). *Principles of Gestalt Psychology*, Oxford: Routledge.
- McClelland, T. (2015) Affording Introspection: An Alternative Model of Inner Awareness, *Philosophical Studies*, 172(9), 2469-2492.kreme
- Michaels, C. (1988). S-R Compatibility Between Response Position and Destination of Apparent Motion: Evidence of the Detection of Affordances. *Journal of Experimental Psychology: Human Perception and Performance*, 14(2), 231-240.
- Nanay, B. (2010). Action Oriented Perception. *European Journal of Philosophy*, 20(3), 430-446.
- Nanay, B. (2013). *Between Perception and Action*. Oxford: OUP.
- Norman, D. A. (1999). Affordance, conventions and designs. *Interactions*, 38-43.
- Prinz, J. (2012) *The Conscious Mind*, Oxford: OUP.
- Prosser, S. (2011). Affordances and Phenomenal Character in Spatial Perception. *Philosophical Review*, 120(4), 475-513.

- Proust, J. (2016). The Evolution of Primate Communication and Metacommunication. *Mind and Language*, 31(2), 177-203.
- Raubal, M., & Moratz, R. (2008). A Functional Model for Affordance Based Agents. In E. Rome, *Affordance-based robotic control* (pp. 91-105). Berlin: Springer.
- Rietveld, P. (2012). Bodily Intentionality and Social Affordances in Context. In F. Paglieri, *Consciousness in Interaction*. Benjamins.
- Rietveld, E., & Kiverstein, J. (2014). A Rich Landscape of Affordances. *Ecological Psychology*, 26(4), 325-352.
- Scarantino, A. (2003). Affordances Explained. *Philosophy of Science*, 70(5), 949-961.
- Siegel, S. (2014). Affordances and the contents of perception. In B. Brogaard, *Does perception have content?* Oxford: Oxford University Press.
- Soteriou, M. & O'Brien, L. (eds.) (2009). *Mental Actions*. Oxford: OUP.
- Slovan, A. (2008) The Well Designed Young Mathematician. *Artificial Intelligence*, 172, 2015–2034.
- Tucker, M., & Ellis, R. (1998). On the Relations Between Seen Objects and Components of Potential Action. *Journal of Experimental Psychology*, 24(3), 830-846.
- Turvey, M. T. (1992). *Affordances and Prospective Control: An Outline of the Ontology*, *Ecological Psychology*, 4(3), 173-187.
- Zhang, J., & Patel, V. L. (2006). Distributed cognition, representation and affordance. *Pragmatics & Cognition*, 14(2), 333-341.