Representation-hunger reconsidered

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Abstract

According to a standard representationalist view cognitive capacities depend on internal content-carrying states. Recent alternatives to this view have been met with the reaction that they have, at best, limited scope, because a large range of cognitive phenomena —those involving absent and abstract features— require representational explanations. Here we challenge the idea that the consideration of cognition regarding the absent and the abstract can move the debate about representationalism along. Whether or not cognition involving the absent and the abstract requires the positing of representations depends upon whether more basic forms of cognition require the positing of representations.

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1. Introduction

Does intelligent behaviour require an explanation involving mental representations, understood as inner vehicles of specific contents? The standard position in philosophy and the science of cognition subscribes to a representational framework, based on "the fundamental idea of inner computational states acting as the vehicles of specific contents – that is to say (…) the very idea of internal representation" (Clark & Toribio 1994: 401), even if there are different opinions about the form representations take, and about what kind of content they carry. Indeed, representationalism has become so ingrained that representational assumptions have acquired an axiomatic status, as if "representational attributions are not the result of, but the prerequisite for, theoretical development. Representations are invoked even before the theory starts" (Tonneau 2011/2012: 338).

Recently, representationalism has come under sustained scrutiny. According to one contemporary line of anti-representationalist argument, the explanatory posits used by many successful scientific approaches to cognition—such as those provided by connectionist or dynamical systems approaches— are not in any substantive sense representational (Ramsey 2007). Hutto and Myin (2013) single out problems for the ways representational content is standardly grounded in naturally available 'information.' They point out that prominent attempts to bridge the gap between natural information and (semantic) content run into severe problems, and describe the heavy prize, such as abandoning explanatory naturalism, that may have to be paid when one tries to account for content in that way. Chemero (2009) argues that a fully non-representational dynamical systems approach, enriched by insights from Gibsonian ecological psychology, might prove to be a more successful research program for the study of cognition. Acting upon his statement that "(t)he true test of any approach in any science is how well it answers the questions we want answered with empirical results" (Chemero 2009, p. xii), he provides examples of nonrepresentational explanations for behavior which accomplishes a broad range of tasks.

Representationalists can, and do, counter the critique regarding the lack of substance, or grounding of their foundational notion of representational content, by considering it as a problem whose solution can be postponed, perhaps even indefinitely (Sprevak 2013; Colombo in press b). Moreover, they can, and do, argue that the problem of finding a satisfactory account for content dwindles in the light of principled barriers to the reach of non-representational cognition

(Shapiro 2011; Colombo in press a). Such a principled barrier, defending representational accounts of the mind against intrusions from non-representationalism, is widely believed to have been identified in a paper by Clark and Toribio (1994), in which the case was made for the existence of 'representation-hungry' problems. These problems arise in 'representation-hungry domains', which are characterized as involving 'the absent', or 'the abstract.' They are "cases in which ambient environmental information is (prima facie) insufficient to guide behaviour" (Clark & Toribio 1994: 402), or "cases requiring sensitivity to distal, non-existent or highly abstract properties" (Clark & Toribio 1994: 412). Capacities to intelligently deal with the absent and the abstract are 'representation-hungry' in the sense that these capacities depend on mental 'stand-ins' for the environment or intermediating representations of abstract properties (e.g. Clark & Toribio 1994; Clark 1997: 166-170).

The notion of 'representation-hunger' was originally used to lay to rest challenges to representationalism coming from an earlier wave of nonrepresentationalist theorizing, which was inspired by developments in behavior-based robotics and dynamical systems theory approaches to behaviour and action (Brooks 1991; Beer 1995; Van Gelder 1995; Keijzer 2001). Granting that the kinds of nonrepresentational approach proposed by the challengers might apply to some phenomena, such as the behaviour of (simulated) insect-like agents, it was taken to be beyond serious doubt that the very nature of a large domain of cognitive phenomena calls for representations as explanantia (Clark & Toribio 1994; Clark 1997).

The idea that the range for nonrepresentational cognitive approaches is seriously restricted, because of the existence of 'representation-hungry' problems, remains at the core of current thinking about cognition. A clear and recent expression of it can be found in Wilson and Foglia (2011):

> Formulating an empirically adequate theory of intelligent behavior without appealing to representations at all (...) faces insuperable difficulties, and the idea that it is a relatively trivial matter to scale up from existing dynamic models to explain all of cognition remains wishful thinking and subject to just the problems that motivated the shift from behaviorism to cognitive science in the first place. (...) Domains raising a representation-hungry problem (A. Clark 1997) are those involving reasoning about absent, non-existent or counterfactual states of affairs, planning, imaging and interacting. (Wilson & Foglia 2011, section 4.2)

Clearly, then, the concept of representation-hungry problems continues to carry a lot of weight in the current debate regarding representationalism. Whenever a cognitive domain involves problems of such type, the very idea of dispensing

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with representational explanantia allegedly can be dismissed as 'wishful thinking', 'facing insuperable problems.' Clark and Toribio's notion has become iconic, arguably because it expresses key commitments of philosophical and scientific thinking about the mind ever since the 'cognitive revolution.' In variation on the quote of Wilson and Foglia above, the notion identifies 'just the problems that motivated the shift from nonrepresentational to representational cognitive science.'

One way to answer the attempt to restrict the reach of nonrepresentationalism by invoking the existence of 'representation-hungry' problems, is by moving against it on a case by case basis, by providing examples of nonrepresentational accounts of allegedly representation-hungry problems. Such a strategy is pursued by Chemero (2009), who points for example to the nonrepresentational model for imagined action described by Van Rooj, Bongers and Haselager (2002). In the present paper, we will question in a more general way the validity of trying to restrict the reach of anti-representationalism by invoking a domain of 'representation-hungry' problems. We will do so by challenging the widely accepted theses that cognitive domains which involve 'the absent' or 'the abstract', necessitate representationalist accounts *because* they involve the absent and the abstract.

More specifically, we will investigate two theses:

[ABSENT]: cognitive activity in domains involving the absent necessitates mental representations as explanantia;

and

[ABSTRACT]: cognitive activity in domains involving the abstract necessitates mental representations as explanantia.

We will consider these theses in isolation from other reasons for or against mental representations as explanantia. That is, the explanation of intelligence might necessitate mental representations for other reasons than those having to do with the absent and the abstract. In this paper, we will remain neutral about whether representationalism holds for such other reasons. In other words, we will investigate whether the absent and the abstract offer independent, sufficient reasons to justify positing representations and embracing representationalism in these domains.

As a consequence, we will just consider the question whether there is an important difference in explanatory demands between cognitive activities in the presence versus the absence of stimuli, or in relation to cognition of the concrete versus the abstract. It is important to keep in mind that our treatment is

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focussed on the question of how to explain cognitive activities. One might be tempted, for example, to think that cognition which involves the absent is *by definition* representational. Though we will not attempt to refute that claim, we will come to reject that it forms a good basis for committing to representational explanantia (section 4).

2. The absent

Clark and Toribio define cognition involving the absent as "reasoning about absent, non-existent, or counterfactual states of affairs" (1994: 419). We will initially follow Clark and Toribio in understanding reasoning in a broad sense here, so that 'keeping track of' or 'behaviourally anticipating something not (yet) present', count as manifestations of 'reasoning about the absent' (both examples are from Clark and Toribio 1994: 419, see also Wilson & Foglia 2011). We will return to a more high level interpretation of reasoning as sophisticated thinking, which might become possible only with the use of language, in section 4.

Let us first focus on behaviour in absence of clear environmental cues driving the behaviour. Does the agent's responsiveness to absent or not presently sensed states of affairs necessitate an appeal to representational stand-ins?

2.1. Going through the same motions

As a warm-up, consider the following example. Someone is living in a house with a kitchen in the hallway, such that she has to walk around a sideboard to get to the other side. Suppose that at some point the sideboard gets removed, but that the person still takes the same curve to get to the other side of the hall. In the new situation, the person is going through the same old motions in absence of the environmental basis for these motions. Over the years, a behavioural pattern has emerged: the person tends to take a particular trajectory when walking through the hallway. This might involve representations, or it might not. In the latter case, the person responded to the environmental situation in a particular way, without representing it.

According to the absence thesis, however, the mere removal of the sideboard would necessitate representation. Merely because of the freshly created absence of the sideboard, the person's behaviour would have to be representational in the sense of involving a representational state. This seems problematic, however, given that the person might be doing exactly the same before and after the removal of the sideboard. Indeed, the person might not even notice that the thing has been removed, because the lights are off, or because she is distracted, and still make the curve. That is, the removal of the sideboard doesn't change the nature of the person's capacities: If they were representational before, they stay representational after; if they were nonrepresentational, they remain nonrepresentational. Presence or absence of the environmental stimulus does

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not have to bring about a fundamental change in the nature of the behaviour, or the capacity displayed in it, and therefore seems not sufficient to render it representational.

Suppose we think about the situations with and without the sideboard in terms of 'the adaptive functional role' of 'inner states and processes' with respect to 'extra-neural states of affairs' (Clark & Grush 1999). It then remains to be decided whether the adaptive functional role of inner states and processes are best described either as 'responding to' or as 'standing in' for those extra-neural states of affairs when one is in direct contact with them. In case the adaptive role of the inner process should be described as a role of 'responding to' an aspect of the environmental situation without representing it, it is not necessary to suppose that this adaptive role must be one of 'standing in' for that aspect when the environmental aspect is remote. After all, it may be the very same processes that are involved in both situations, responsive to an environmental situation that may not be presently sensible (e.g. in the dark), or that may no longer be present. Other considerations might be invoked to prefer a description in terms of 'standing in' instead of in terms of 'responding to', but they do not hinge on the difference between behaviour in the presence or absence of the stimulus.

One might protest that the sideboard scenario does not allow to draw conclusions about ABSENT, because it does not concern a cognitive task that normally involves something that is absent: avoiding a sideboard normally comes down to avoiding a genuine, live sideboard – a real one, that will hurt if one accidentally hits it. It is only in abnormal, somewhat contrived situations, that the same avoiding behaviour occurs in the absence of the sideboard. Perhaps ABSENT applies only to capacities or tasks that relate to the absent more essentially. Let us therefore turn to an example of exactly such a task, in which dealing with the absent belongs to its standard conditions, to see if reasoning along the lines exemplified in the sideboard example does apply to it.

2.2. Mental imagery
Consider the ability to imagine absent states of affairs. Take, in particular, visual imagery. Does the fact that what is imagined is absent necessitate a representational explanation?

As in the context of the sideboard example, one can question whether absence versus presence makes a significant difference regarding the need for representations. For suppose one holds a view of visual imagery as *virtual perception*: when one visually imagines some object or situation, one is in the conditions one would be in *if* one were perceptually confronted with that object or situation. In its simplest form, imagery could then be a form of re-enactment, or the (partial) re-creation of conditions one has been in while perceiving. If one

is a representationalist about perception, imagery, understood as virtual perception, will obviously involve representation too. If, however, one combines a virtual perception take on mental imagery with a view of perception as nonrepresentational, one will be led to a nonrepresentational view of imagery (Hutto 2008: 80). Crucially, if an account of perception in the presence of a stimulus is nonrepresentational, the account of imagery as a kind of perception in the absence of the stimulus, may be so too. As in our example in the previous section, the absence of the stimulus may not warrant a representational interpretation of the processes involved in the cognitive behaviour or capacities at issue.

Virtual perception accounts, irrespective of whether they are representational or nonrepresentational, build on the continuity between perception and imagery. In a recent philosophical treatment of imagery and perception, it is stated that "contemporary cognitive science of mental imagery is very largely predicated upon the truth of the continuum theory" (Thomas 2014: 135). The continuum theory finds empirical support in neuroscience, as it has been established that many of the brain areas involved in perception are so too in mental imagery (Thomas 2010, section 4.4.2). The standard ways to develop a continuum approach to imagery is representational. For example, one considers perception to consist in the build-up of a mental representation, which then can be re-activated in imagery (Kosslyn (1980) and Pylyshyn (1981) are classics, see Nanay (2014) for a recent version). But nonrepresentational continuum approaches are possible too, which hold neither a representational view of perception, nor a representational view of imagery. On such views, perception does not consist in a relation of a perceiver and a representational percept, but rather in a relation or interaction of a perceiver and an environment that is unmediated by a representation. One can flesh out such an approach by conceiving of perception as the enactment of 'visual routines' (Thomas 1999) or patterns of 'sensorimotor contingencies' (O'Regan & Noë 2001a,b), sequences in which exploratory actions are coupled to specific environmental responses, or changes in stimulation. On the sensorimotor contingency approach, one then sees a red patch, for example, because one engages in a pattern of active exploration, in which certain movements of the eye and head with respect to the red patch, cause very specific changes in the visual situation received from that red patch (O'Regan & Noë 2001b: 83). In terms of perceptual routines, "perceptual experience (experience of perceivables) (…) arises from specific sequences of exploratory perceptual actions (…) through which the identity of specific types of perceivables in the environment is determined" (Thomas 2014: 136). Such views lead to construing imagery in an equally nonrepresentational way, for example, as "the (partial, abortive, and largely covert) enactment of the perceptual routine through which the identity of its object (i.e., the thing

imagined) would be recognized if actually present" (Thomas 2014: 136). Sensorimotor and perceptual routine approaches, beyond sharing the empirical evidence common to all continuum views, can rely on additional lines of support, such as the fact that imagining a particular object involves the spontaneous, but covert, making of the same eye movements "that (at least partially) enact the stimulus-specific pattern of such movements that they would make if actually looking at the equivalent visual stimulus" (Thomas 2010, section 4.5.1), and that the making of random eye movements disrupts visual imagery (ibid.).

Clearly then, on a continuum view, and *a fortiori* on a virtual perception view, whether or not imagery is representational or not is determined by prior theoretical commitment, and not by the absence of the stimulus. The cognitive science of imagery, by endorsing a continuum theory of perception and imagination, does not support ABSENT.

Of course accounts of imagery should acknowledge that there are also important *differences*, phenomenological and other, between vision and visual imagery. An obvious difference between perception and imagery is that one is often well aware of the imaginary character of imagery. But note that this difference does not necessarily introduce a representation-implying asymmetry between imagery and perception, for one's awareness of the imaginary character of what one imagines may very well be due to nonrepresentational differences in bodily engagement with the environment rather than being based in any representational differences.

A nonrepresentational account of differences between perception and imagination might build on the observation that perception, but not imagery, is characterized by a high degree of 'bodiliness' and 'grabbiness' (O'Regan, Myin & Noë 2005a,b; O'Regan 2011). 'Bodiliness' (or 'corporality') refers to the fact that perception is systematically sensitive to the changes brought about by bodily movements. 'Grabbiness' (or 'alerting capacity') refers to the fact that certain changes in the environment (such as a flash of light or a sudden loud sound) will incontrovertibly attract perceptual attention, as well as perceptual re-orientation. Arguably, such differences in 'bodiliness' and 'grabbiness' can explain the difference in awareness between situations in which the stimulus is present (perception) versus situations in which the stimulus is absent (e.g. imagery). These differences would be differences in bodily engagement rather than any representational ones.

Another difference between perception and imagery might lie in the fact that only imagery is 'creative', or 'under the subject's control.' It might then be argued that this forms a basis for claiming that imagery is representational, even if perception need not be. However, such a conclusion can only be drawn if an

independent argument is given for the idea that creativity or being under the subject's control requires representations. We will not discuss such a line of argument here, because of its independence from ABSENT.

In short, if we suppose that perceptual experience of the environment need not involve the inner representation of the environment, then behaviour and experience concerning the absent need not involve inner representations either. Imagery and other capacities going beyond response to the immediately sensed environment provide no particular support for positing representations. The thesis we've labelled ABSENT in the previous section, remains unsupported.

3. The abstract

The second condition that is often thought to necessitate the invoking of representations as explanantia is when a problem requires that the agent is "selectively sensitive to parameters whose ambient physical manifestations are complex and unruly (for example, open-endedly disjunctive)" (Clark & Toribio 1994: 419). Or, as Clark puts it, this condition involves response to "states of affairs that are unified at some rather abstract level, but whose physical correlates have little in common" (Clark 1997: 167). According to Clark:

> It is very hard to see how to get a system to reason about such thing without setting it up so that all the various superficially different processes are first assimilated to a common inner state or process such that further processing can then be defined over the inner correlate: an inner item, pattern, or process whose content then corresponds to the abstract property. (Clark 1997: 167)

On this view, the domain of cognition with respect to abstract properties invites a representational analysis because these abstract properties involve different physical manifestations, which physically have little in common. A 'unitary' versus 'diverse' contrast is what drives the line of reasoning: if properties have unitary physical manifestations, they may be 'cognized' non-representationally, but not so if those physical manifestations are variegated. In the latter case, for the sake of 'further processing', some internal correlate has to be constructed, which would stand in for the abstract property it is meant to represent.

The crucial idea is that convergence of many variegated stimuli upon one neural correlate with physical integrity is key to conveying representational status. But why would convergence upon an internal item with physical integrity confer representational status? Clearly, one can imagine, or simply observe, lots of non-cognitive processes whereby causes with various physical manifestations converge upon a common effect. It does not follow that the common effect thereby comes to represent its causes. Consider the simple example of causing a

small piece of iron to move by pushing it with one's hand, by blowing it away, or by attracting it with a magnet. There's no reason at all to draw the conclusion that the iron's movement represents its causes.

If one *would* claim it did, it would not suffice to point to the convergence of the causes on a common effect *per se,* but an additional and independent argument would be needed. Some theory of representation applying to physical causal processes would be called for. Without further reasons, the case is not different when the processes under consideration are cognitive.[2] Also then, a theory of representation is required to justify why the occurrence of convergence does confer representational status. Therefore, in the cognitive case as well, merely pointing out that a domain of cognition involves abstract properties with unruly physical manifestations is not sufficient to justify the need for representational explanations.

Moreover, it is not clear what is the basis for assuming that there is a relevant asymmetry between simple properties and complex properties. Why assume, that is, that the complex case is particularly supportive of a representational interpretation, if the simple case is not? Recall that such an asymmetry is needed, if the domain involving abstract properties is to provide particular reasons for invoking a representational analysis. This worry about the lack of an asymmetry between the simple and the complex is aggravated by the fact that the line of reasoning under discussion tries to *assimilate* cognition in the abstract case to cognition in the concrete case: the common inner state in the abstract case functions precisely like the simple stimulus in the simple case. Once such an assimilation between the kinds of cognition have taken place, the assumption that the one is still different in nature from the other seems to stand in need of justification.

In conclusion, we have not found a valid reason to suppose there is a representation-supporting dis-analogy between capacities to respond to abstract and non-abstract properties. Parallel to the conclusion reached in the previous sections, we conclude that no good reasons have yet been supplied to hold that the thesis we've labelled ABSTRACT is true.

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[2] Of course, such further arguments exist. For example, one might hold that it is the wider role played by cognitive processes which makes them properly representational. We do not deny such an argument can be held, nor do we challenge here its validity. We just point out that this way of arguing for the need for representation is different from arguing from ABSTRACT.

4. Conclusion

We are aware that it is possible to make a two-step move in response to the above. A first step would consist in stipulating that capacities for dealing with the absent and the abstract are representational *because* they involve the absent and the abstract. As a result any capacity involving the absent and the abstract, including anticipating, tracking and imagining would be representational capacities. A second step would then consist in stipulating that any inner state that plays a role in the exercise of that capacity is representational, *because* of the representational nature of the capacity. We think such a move would be an attempt to 'win an argument by redefining terms' (Chemero 2009: 66), which comes at considerable costs. First, it deprives the notion of inner representation of substantive content. No further investigations, for example neuroscientific, could favour or disfavour a representational interpretation, resulting in a notion of representation unconstrained by empirical findings. Second, this move implies surrendering the ambition that the representational nature of internal states would play any role in explaining the representational status of the capacities, because these internal states would derive their representational status from the representational status of the capacities at play, rather than the other way round.

We have up to now taken 'reasoning' in the broad sense specified at the beginning of section 2. One might wonder whether our conclusion that the domains of the absent and the abstract do not necessitate inner representational states as explanantia might only apply to low-level cognitive phenomena. Whenever more sophisticated thinking is involved, 'thought' and 'reasoning', understood in the sense in which these refer to capacities which are standardly assumed not to be shared with animals, the invocation of inner representational states might be necessary after all. As such thinking typically involves the absent and the abstract, ABSENT and ABSTRACT might hold for cognitive phenomena that involve thinking.

Note that, even if such were true, our conclusions reached thus far would remain important, and contrary to much current work in the philosophy and science of cognition. Still, our challenge to ABSTRACT and ABSENT would have considerably more reach if it also applied to 'higher-level' thought and reasoning. In closing, and without developing the matter to the extent it deserves, we just want to point out that it does not seem contradictory to assume that higher-level thinking, such as might only be the privilege of language-users, might not involve inner representational states. It seems possible to hold that such thinking *only* involves public symbols. Such thinking skills would then be acquired by being exposed, in the appropriate ways, to public symbols, but once established, these skills might be exercised in the absence of external *and* internal representations.

In that case, ABSENT and ABSTRACT might not hold for sophisticated thinking either.

References

Beer, R. D. (1995). A dynamical systems perspective on agent-environment interaction. *Artificial Intelligence* 72(1–2), 173–215.

Brooks, R. (1991). Intelligence without representation. *Artificial Intelligence* 47, 139–159.

Chemero, A. (2009). *Radical Embodied Cognitive Science*. Cambridge, Mass.: MIT Press.

Clark, A. (1997). *Being There: Putting Brain, Body, and World Together Again*. Cambridge, Mass.: MIT Press.

Clark, A., & Grush, R. (1999). Towards a cognitive robotics. *Adaptive Behavior* 7(1), 5-16.

Clark, A., & Toribio, J. (1994). Doing without representing. *Synthese* 101, 401-31.

Colombo, M. (in press a). Explaining social norm compliance. A plea for neural representations. *Phenomenology and the Cognitive Sciences*.

Colombo, M. (in press b). Neural representationalism, the Hard Problem of Content and vitiated verdicts. A reply to Hutto & Myin. *Phenomenology and the Cognitive Sciences*.

Hutto, D. D. (2008) *Folk Psychological Narratives: The Socio-Cultural Basis of Understanding Reasons*. Cambridge, Mass.: MIT Press.

Hutto, D. D., & Myin, E. (2013). *Radicalizing Enactivism: Basic Minds Without Content*. Cambridge, Mass.: MIT Press.

Keijzer, F. (2001). *Representation and Behavior*. Cambridge, Mass.: MIT Press.

Kosslyn, S.M. (1980). *Image and Mind*. Cambridge, Mass.: Harvard University Press.

Nanay, B. (2014). *Between Perception and Action*. Oxford: Oxford University Press

O'Regan, J. K. (2011). *Why Red Doesn't Sound Like a Bell: Understanding the Feel of Consciousness*. New York: Oxford University Press.

O'Regan, J. K., Myin, E., & Noë, A. (2005a). Sensory consciousness explained (better) in terms of "corporality" and "alerting capacity." *Phenomenology and the Cognitive Sciences* 4(4), 369–387.

O'Regan, J. K., Myin, E., & Noë, A. (2005b). Skill, corporality and alerting capacity in an account of sensory consciousness. *Progress in Brain Research* 150, 55–68.

O'Regan, J. K., & Noë, A. (2001a). A sensorimotor account of vision and visual consciousness. *Behavioral and Brain Sciences* 24(5), 883–917.

O'Regan, J. K., & Noë, A. (2001b). What it is like to see: a sensorimotor theory of perceptual experience. *Synthese* 129(1), 79–103.

Pylyshyn, Z.W. (1981). The imagery debate: analogue media versus tacit knowledge. *Psychological Review* 88, 16-45.

Sprevak, M. (2013). Fictionalism about neural representations. *The Monist*, 96(4), 539–560.

Shapiro, L. (2011). *Embodied Cognition*. Abingdon: Routledge.

Ramsey, W. M. (2007). *Representation Reconsidered*. Cambridge: Cambridge University Press.

Thomas, N. J. T. (1999). Are theories of imagery theories of imagination? An active perception account of conscious mental content. *Cognitive Science* 23, 207-245.

Thomas, N. J. T. (2010). Mental imagery. *The Stanford Encyclopedia of Philosophy*. E. N. Zalta (ed.), URL = <http://plato.stanford.edu/archives/spr2014/entries/mental-imagery/>.

Thomas, N. J. T. (2014). The multidimensional spectrum of imagination: images, dreams, hallucinations, and active, imaginative perception. *Humanities* 3(2), 132-184.

Tonneau, F. (2011/2012). Metaphor and truth: a review of representation reconsidered by W. M. Ramsey. *Behavior & Philosophy* 39/40, 331-343.

Van Gelder, T. (1995). What Might Cognition Be, If Not Computation? *The Journal of Philosophy* 92(7), 345–381.

Van Rooij, I., Bongers, R. M., & Haselager, W. (Pim) F. G. (2002). A non-representational approach to imagined action. *Cognitive Science*, 26(3), 345–375.

Wilson, R. A., & Foglia, L. (2011). Embodied Cognition. *The Stanford Encyclopedia of Philosophy*. E. N. Zalta (ed.), URL = <http://plato.stanford.edu/archives/fall2011/entries/embodied-cognition/>.