Non-Computational Functionalism: Computation and the Function of Consciousness

Gualtiero Piccinini (piccininig@umsl.edu)
University of Missouri – St. Louis, 1 University Blvd., St. Louis, MO 63121

Abstract: The view that the mind, including phenomenal consciousness, has a functional nature (functionalism) does not entail that the mind has a wholly computational nature (computational functionalism). An unappreciated option is that the mind has a functional yet non-computational nature. This latter option, *non-computational functionalism*, is not a type-identity theory either, because it posits that phenomenal consciousness is constituted by higher-level properties that are not identical to lower-level physical states.

Keywords: functionalism; computation; consciousness.

Functionalism about the mind is the view that the mind has a functional nature (Putnam, 1967). In other words, according to functionalism, the mind is (an aspect of) the functional organization of the organ of cognition. Functional organization is the plurality of components, functions, and organizational relations that make up a mechanism and explain its capacities (Piccinini, 2010). The main organ of the mind is the brain.[1] Therefore, according to functionalism, the mind is (an aspect of) the functional organization of the brain.

Functionalism is often assumed to *entail* that the mind has a *computational* nature—that the mind is the software of the brain (Putnam, 1967). This is a bad mistake (Piccinini, 2010). Instead, the view that the mind is the software of the brain is a stronger thesis: *computational* functionalism. Computational functionalism entails functionalism but not vice versa.

I argue elsewhere that computation is a special kind of mechanistic process among others. Therefore, computational states are a special subset of functional states. Conversely, not all functional states are computational. In the interesting sense of 'computation'—the sense that matters for explaining mental capacities—computing mechanisms are a relatively small subset of all functional mechanisms. They are those mechanisms whose teleological function is manipulating medium-independent vehicles in accordance with a rule (Piccinini, 2015). Therefore, having a functional nature by no means entails having a computational nature. This makes room for a new theory of phenomenal consciousness that does not require conscious states to be (entirely) computational in nature.

According to the Computational Theory of Cognition (CTC), cognition has a computational explanation—or, more strongly, cognition has a computational nature. There are two powerful reasons for CTC: those aspects of neural processes that are most functionally relevant—spike frequency and timing—are medium independent, and information processing in the relevant sense requires computation (Piccinini and Bahar, 2013). Yet, even if cognition is computational, it doesn't follow that everything about the mind is computational.

For present purposes, the mind can be divided into cognition and phenomenal consciousness. By 'phenomenal consciousness' I mean the qualitative aspect of subjective experience. The relationship between cognition and consciousness is complicated and controversial, and I cannot do it justice here. What I do need to say is that much of cognition does not require phenomenal consciousness—that is, much of cognition can occur and often does occur in the absence of any phenomenal consciousness. Thus, much of cognition can be explained without worrying about phenomenal consciousness.

What about those aspects of cognition that are phenomenally conscious? Is phenomenal consciousness required for them to take place, for them to take place in biological organisms, or at least for them to function correctly in biological organisms? And what about phenomenal consciousness itself? How does that work? This paper clarifies the relation between computation and consciousness, in the service of clarifying what does and does not follow from both functionalism and computational approaches to cognition.

One possibility is that phenomenal consciousness is reducible to cognition, which according to CTC boils down to computation and information processing. This gives rise to the view that the whole mind is reducible to computation and information processing. I call this the Computational Theory of Mind (CTM). CTM says that the whole mind—including phenomenal consciousness—can be explained in terms of computation and information processing or, more strongly, that the nature of the whole mind—including phenomenal consciousness—is computational and informational (Lycan, 1987; Dennett, 1991; Rey, 2005).[2] The standardly acknowledged

[1] Plus, perhaps, aspects of other parts of the nervous system as well as the body and environment. I'm ignoring the possibility of extended mind to simplify the exposition.

[2] This terminology may be confusing because 'Computational Theory of Mind' is often used for what I call Computational Theory of Cognition. I'm sorry about that.

alternative to CTM is that phenomenal consciousness is identical to lower level physical properties—this is the type-identity theory of mind (e.g., Place, 1956; Feigl, 1958; Smart, 1959). The type-identity theory of mind is consistent with CTC, though not with CTM.[3]

The dialectic between CTM and the type-identity theory misses one plausible account of phenomenal consciousness. That's the view that phenomenal consciousness is due to higher-level properties that are functional yet non-computational—properties that are neither identical to lower-level physical properties nor computational. I will refer to this as *non-computational functionalism*. This is an option worth exploring because both CTM and the type-identity theory face serious objections.[4]

Non-computational functionalism combines what is appealing about functionalism—that it fits within the multilevel mechanistic framework of cognitive neuroscience and allows for the multiple realizability of mental states (Piccinini, unpublished)—with what is appealing about the critique of computational functionalism about consciousness—that computation alone is too extrinsic to account for consciousness.

The central idea is that phenomenal consciousness is a kind of macroscopic physical state brought about by certain types of physical mechanisms, of which human brains are an instance. When the right type of physical system is in the relevant macroscopic state, phenomenal consciousness ensues. Brains are capable of bringing that state about, and other physical systems may be able to do it too if they have the right causal powers. (Whether other physical systems have the relevant causal powers is unknown because we do not know exactly what physical macrostates constitute phenomenal consciousness.)

According to this non-computational functionalism, consciousness has a functional nature in the sense of being an aspect of the functional organization of the brain, but it is not (entirely) computational in nature. This is still consistent with consciousness being physical, because the functional organization of the brain is still physical. The view I propose is consistent with the multiple realizability of consciousness, although multiple realizability is not guaranteed because there may be only a unique kind of structure that supports the relevant kind of functional organization.

The important difference between this view and computational functionalism is that no amount of computation is sufficient for phenomenal consciousness. Thus, consciousness is not medium independent, which means that consciousness is not a state whose sole function is processing variables based on differences between different portions of the variables. On the contrary, consciousness is a global brain state whose function includes processing specific physical variables (conscious ones) in ways that are sensitive to some of their specific macroscopic physical properties (namely, their phenomenal character).

This account does not solve all the problems about phenomenal consciousness but it does constitute genuine progress on this most intractable of philosophical problems, because it identifies a non-computational and hence more plausible version of functionalism than those previously available. The progress is afforded by combining functionalism with the important yet generally unheeded distinction between computational and functional states. By relying on the functional organization of the brain, this non-computational functionalism can address some classic objections to computational functionalism coming from the physicalist and biological camps (e.g., Block, 2007) and incorporate the insights of such views.

There is a whole space of possibilities worth exploring. For ease of reference, I have dubbed these views *non-computational functionalism*. This label is slightly misleading because the theories I'm referring to can combine functions with qualities, where qualities may or may not reduce to functions. According to these theories, the nature of consciousness is a combination of qualities and not-entirely-computational functions.

Qualities are categorical properties intrinsic to an object, like being round or triangular. They come in levels of being, where each higher-level quality is a part of its lower-level realizers. Functional properties are causal powers that also come in levels of being, where each higher-level causal power is a part of its lower-level realizers. Typically, higher-level qualities and functions are multiply realizable—they can be parts of many different lower-level realizers.

The functions invoked here are not (entirely) medium-independent. Therefore, they are not (entirely) computational. This does not mean that they are identical to lower-level properties. Again, they are higher-level

[3] A third option is property dualism, the view that phenomenal consciousness is due to non-physical properties (Chalmers, 1996). Property dualism poses a distinct set of problems that I have no room to discuss here. I discuss some of those problems in more detail in (Piccinini, 2017).

[4] Type-identity theories are implausible largely because consciousness seems to arise from the organization of a very complex system, which makes it a higher-level functional property. For recent arguments against computational accounts of consciousness, see (Piper, 2012; Bartlett, 2012).

properties, which means they are probably multiply realizable.

The relationship between qualities and causal powers is a complex issue that I cannot resolve here. Options include that qualities reduce to powers (dispositionalism), powers to qualities (categoricalism), qualities and powers are the same thing (identity theory, not to be confused with type-identity reductionism), properties are a combination of qualities and powers (hybrid view), or there is some more complicated relationship between the two. Different versions of non-computational functionalism are generated by different views about the relationship between qualities and powers. Only the theory that combines non-computational functionalism and dispositionalism is a functionalist view in the strictest sense.

More precisely, there are two types of theory according to which consciousness is due to non-computational, higher-level properties. Type 1 theories assert that consciousness is due to purely functional yet non-computational higher-level properties. According to Type 1 theories, consciousness has a purely functional yet not-wholly-computational and not-wholly-informational nature. Type 2 theories assert that consciousness is due to higher-level properties that are not wholly functional in nature because they have qualitative aspects that are not entirely reducible to functional properties. According to Type 2 theories, consciousness is a higher-level property not wholly functional in nature. Which type of theory is correct depends not only on the nature of consciousness but also on the metaphysics of properties—specifically, the relationship between qualities and causal powers. (I assume that functions are a kind of causal power [Maley and Piccinini, 2017].)

I will not address the metaphysics of properties any further. The connection between the theory of consciousness and the metaphysics of properties is an area ripe for exploration. To keep matters simple, in what follows I will elide the distinction between Type 1 and Type 2 theories and refer to both as non-computational functionalism, even though, strictly speaking, Type 2 theories are not purely functionalist theories.

I want to reiterate that non-computational functionalism is neither computationalist nor reductive in the sense of the type-identity theory. It is not computationalist because the functions involved in producing phenomenal consciousness are *not* (wholly) computational functions. They are medium-*dependent* functions, whereas computational functions are medium-*independent*. At the same time, the functions involved in producing phenomenal consciousness *are* functions, so they are higher-level properties, which are proper parts of their realizers (Piccinini and Maley, 2014; Piccinini, unpublished). Since they are proper parts of their realizers, they are *not* identical to their realizers. Therefore, the type-identity theory does not hold. (Even the token-identity theory does not hold.) Notice that phenomenal consciousness is qualitative, so there may be more to phenomenal consciousness than functions. Whether that is the case depends on the exact relationship between qualities and functions (i.e., causal powers), which is a matter that I will not investigate here.

Non-computational functionalism is neutral on whether the functions that are involved in phenomenal consciousness are teleological. If phenomenal consciousness is tied to the performance of teleological functions (in the sense of [Maley and Piccinini, 2017]), then phenomenal consciousness provides a regular contribution to the goals of organisms. Since phenomenal consciousness occurs spontaneously and is not under intentional control, the goals in question must be biological—that is, goals such as survival, reproduction, development, and helping others. Thus, if phenomenal consciousness is tied to teleological functions being performed, then phenomenal consciousness plays a valuable biological role—presumably to facilitate certain cognitive functions.

There are two kinds of role that phenomenal consciousness could play with respect to cognition. The first kind of possible role is to enable aspects of cognition that would otherwise not occur within biological organisms. For example, nervous systems might be so constituted that without being phenomenally conscious, they cannot integrate different sources of information into a unified percept. This is consistent with the hypothesis that those same cognitive functions can be performed unconsciously, although doing so may require other, non-biological forms of cognition.

The second kind of possible role is to enable aspects of cognition that could not occur at all without phenomenal consciousness—either within biological organisms or any other cognitive systems. For example, some forms of creative thought may be such that they can only take place within a phenomenally conscious system. If this were the case, then an artificially intelligent agent could replicate those forms of cognition only if it possessed phenomenal consciousness. So much for the possible teleological functions of consciousness.

It's also possible that phenomenal consciousness is produced by functions that are not teleological. In that case, phenomenal consciousness would be either a byproduct of other teleological functions—a so-called spandrel—or a frozen evolutionary accident (Zack, Maley, and Piccinini, 2015). Biological traits fall into two

classes: functions with a teleological function, which are typically adaptations, and functions without a teleological functions, which are typically either byproducts of other traits or frozen biological accidents due to genetic drift. If consciousness fell into the second class, then phenomenal consciousness would not enhance cognition in any way. It might be either epiphenomenal or, more likely, have physical effects that play no useful biological role.

The bottom line is that functionalism does not entail that phenomenal consciousness has a wholly computational or informational explanation, or that computation and information processing are sufficient for phenomenal consciousness. Contrary to what many assume, functionalism is consistent with the possibility that phenomenal consciousness has a functional yet non-computational and non-informational nature.

References

Bartlett, G. C. (2012). Computational theories of conscious experience: between and rock and a hard place. *Erkenntnis* 76: 195-209.

Block, N. (1978). "Troubles with Functionalism." In C. W. Savage, ed., *Perception and Cognition: Issues in the Foundations of Psychology*. Minneapolis, University of Minnesota Press, pp. 261-325.

Block, N. (2007). *Consciousness, Function, and Representation.* Cambridge, MA, MIT Press.

Block, N. and J. A. Fodor (1972). "What Psychological States Are Not." *Philosophical Review* **81**(2): 159-181.

Chalmers, D. J. (1996). *The Conscious Mind: In Search of a Fundamental Theory*. Oxford University Press.

Chalmers, D. J. (2011). "A Computational Foundation for the Study of Cognition," *Journal of Cognitive Science* 12 (4): 323-357.

Dennett, D. C. (1991). *Consciousness Explained*. Bonston: Brown and Company.

Dretske, F. (1995). *Naturalizing the Mind*. MIT Press.

Feigl, H. (1958). 'The "Mental" and the "Physical"', in H. Feigl, M. Scriven and G. Maxwell (eds.), *Concepts, Theories and the Mind-Body Problem*, Minneapolis: University of Minnesota Press.

Harman, G., 1990. 'The Intrinsic Quality of Experience', in Tomberlin (1990).

Lycan, W. (1987). *Consciousness*. MIT Press.

Maley, C.J. and Piccinini, G. (2017). "A Unified Mechanistic Account of Teleological Functions for Psychology and Neuroscience," in D. Kaplan (ed.), *Explanation and Integration in Mind and Brain Science*, Oxford: Oxford University Press, pp. 236-256.

Piccinini, G. (2010). "The Mind as Neural Software? Understanding Functionalism, Computationalism, and Computational Functionalism." *Philosophy and Phenomenological Research*, 81.2: 269-311.

Piccinini, G. (2015). *Physical Computation: A Mechanistic Account*, Oxford: Oxford University Press.

Piccinini, G. (2017). "Access Denied to Zombies," *Topoi* 36.1: 81-93.

Piccinini, G. (unpublished). *Neurocognitive Mechanisms*.

Piccinini, G. and Bahar, S. (2013). "Neural Computation and the Computational Theory of Cognition," *Cognitive Science* 34: 453–488.

Piccinini, G. and Maley, C.J. (2014). "The Metaphysics of Mind and the Multiple Sources of Multiple Realizability," in M. Sprevak and J. Kallestrup, eds., *New Waves in the Philosophy of Mind*, Palgrave Macmillan, pp. 125-152.

Piper, M. (2012). "You Can't Eat Causal Cake with an Abstract Fork." *Journal of Consciousness Studies* 19 (11–12): 154–90.

Place, U. T. (1956). 'Is Consciousness a Brain Process?' *British Journal of Psychology* 47: 44–50.

Putnam, H. (1967). Psychological Predicates. *Art, Philosophy, and Religion*. University of Pittsburgh Press.

Rey, G. (2005). "Mind, Intentionality and Inexistence: an Overview of My Work," *Croatian Journal of Philosophy* V(15): 389-415.

Robinson, Z., Maley, C. J., and Piccinini, G. (2015). "Is Consciousness a Spandrel?" *Journal of the American Philosophical Association*, 1.2: 365-383.

Rosenthal, D. M. (2005). *Consciousness and Mind*. Oxford: Clarendon Press.

Smart, J. J. C. (1959) 'Sensations and Brain Processes.' *Philosophical Review* 68: 141–156.

Tye, M. (1995). *Ten Problems of Consciousness*. Cambridge, MA: MIT Press.