



Robert Prentner*

Process Metaphysics of Consciousness

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Abstract: In this article, we look at the hard problem of consciousness from the perspective of process metaphysics. We thereby identify three problematic premises of the problem that pertain to the constitution of consciousness and its causal relation to the world. We argue for the necessity of re-thinking the corresponding phenomena in terms of internally-structured processes. The hard problem would then cease to be an insurmountable obstacle to a science of consciousness. Furthermore, this line of reasoning is shown to be continuous with philosophical projects from the early 20th century that preceded the contemporary philosophy of mind. Specifically, we investigate the relationship of parts and wholes, and translate metaphysical problems of consciousness into mereological language. Despite this being a philosophical project, we frequently note and discuss links to the empirical sciences, in particular those of quantum mechanics, systems theory and the embodied cognition framework.

Keywords: Process Thought, Consciousness, Mereology, Mereological Structure, Hard Problem, Embodiment, Constitution, Causation, Cognition, Systems Theory

1 The hard problem

The “hard problem of consciousness”¹ is tantamount to the question how the phenomenal character of consciousness could be accounted for in terms of physical, chemical or biological facts. It underlies the nagging doubt that arises in the scientist’s mind who is confronted with the task of explaining phenomenal consciousness. It could be dissected into a definition and a subsequent question:

Definition: Phenomenal consciousness is the “way-it-is-like” to undergo a particular experience. Often, the term “qualia” is used to refer to the phenomenal properties of consciousness.

Question: Will it ever be possible to describe or even explain phenomenal consciousness in purely physical (functional) terms?

Answered negatively, the hard problem is not only hard, but impossibly hard: Whatever scientists will find out, this will not be the full story. There will always be *something left unexplained* which constitutes the phenomenal aspect of the mind, and the hard problem could be called “the impossible problem” of consciousness. Answered positively, however, it is tempting to think of the hard problem to be just another problem for science, similar to questions about radioactivity, genes or thunderstorms.

While we are skeptical regarding any *a-priori* arguments for or against its (dis-)solvability, we content that the problem is ill-conceived. True, it points to a peculiar natural phenomenon – the phenomenal character of experience – that needs to be taken more seriously. However, calling it a “problem” is in itself problematic; at this stage, it still resembles a philosophical puzzle, rather than a scientific problem. In other words, while it did serve the purpose of waking scientists from their physicalist slumber, the hard problem should be handled with care. We believe, there are at least three reasons for this:

1 Chalmers, “Facing up to the Problem of Consciousness,” 200.

*Corresponding author: Robert Prentner, ETH Zürich, Switzerland; E-mail: robert.prentner@phil.gess.ethz.ch

1. The first pertains to the definition of phenomenal consciousness in terms of qualia which are often conceived of as intrinsic, non-structural and immediately given properties of conscious experience. Although this presentation is quite standard throughout the philosophically-inclined community, it is hard to precisely say, in intersubjective terms, what qualia designate; one always ends up referring to one's own subjective experience. The philosopher Ned Block once famously wrote that if you have to ask what this means, you will never understand². This alone makes the hard problem very different from scientific problems such as, say, determining the carrier of heritable information or explaining the cause of radioactivity. Everyone can circumscribe the latter in terms of objects and their behaviour (e.g. in terms of genes or radiation), given that he has acquired the right kind of vocabulary. This is very different in the case of qualia. Of course, hardly any scientific discovery was ever made with a full definition of the target already in mind (or on paper). Nevertheless, to paraphrase Ludwig Wittgenstein, it seems strange that one can only point at phenomenality (captured in Tom Nagel's phrase of the "what-it-is-likeness"³), but has to stay shamefully silent when asked what it (objectively) amounts to. This seems to suggest that there is something about the "way-it-is-like" that cannot be expressed in terms of something else. Phenomenal consciousness is thus conceptually different from whatever could be said in terms of the behaviour of physical objects.⁴ There is, it seems, more which could be said about the mind than about the neuronal patterns in the brain.
2. A negative answer to the question of explicability crucially rests on the distinction between qualia that stand for everything phenomenal and cognition that stands for everything functional. We do not doubt the conceptual usefulness of making this distinction, but does it also translate to what we empirically find? Empirically, this distinction seems at least questionable. If we look at humans some of the behaviours that are typically called "cognitive" are encountered together with phenomenal consciousness. In most real-world situations, these aspects seem hard to separate. This worry becomes even more pertinent, when we try to think about concepts such as meaning, intentionality, subjectivity etc. Are they referring to something purely phenomenal? Don't we need some functional characterization to address them? Could one even think of an empirical way to test whether phenomenology were indeed separable from all (cognitive or overt) behaviours?⁵
3. The idea of assigning matters of cognition to the brain (body) and qualia to the mind (consciousness) and keeping them separate is undermined by recent findings coming under the heading of "embodiment" and related concepts⁶. The mind, accordingly, is embodied, enactive and extended: The body is not just the contingent carrier of the soul but truly "shapes the mind"⁷. This could be understood, for example, in terms of dynamical systems theory where brain, body and environment are viewed as parts of a system comprising (a nested hierarchy of) various interconnected feedback loops⁸. One might be skeptical and ask whether this paradigm also applies to consciousness⁹. The answer relies on whether the proposed mechanisms that lead to extended/embedded/enactive cognition have a constitutive role for the experience of the agent in question. Phenomenologically, consciousness seems to crucially involve an "intrinsic core" comprising the experience of being centered and directed toward one's environment. The hard (but no more impossibly hard) problem in this setting would then amount to showing how the experience of an agent correlates to its situatedness; one thus needs to be able to consistently relate the "first-personal" and "third-personal" perspectives on the dynamics of the full system.

² Block, "Troubles with Functionalism," 281.

³ Nagel, "What Is It Like to Be a Bat?"

⁴ Pace Daniel Dennett who seemingly argued for the non-existence of phenomenal consciousness, where, in fact, he illustrated the ill-foundedness of the term "qualia" to account for phenomenal consciousness. Dennett, "Quining Qualia."

⁵ To relate this to a contemporary discussion from cognitive psychology: Even if we found that "perceptual consciousness overflows cognitive access" (Block, "Perceptual Consciousness Overflows Access Consciousness"), this does not imply that phenomenal consciousness could ever be "pure." Consciousness might not be identical to a "global-access related" function, but it might still be intricately related to the behaviour of an agent embedded in its environment.

⁶ Menary, "Introduction."

⁷ Gallagher, "How the Body Shapes the Mind."

⁸ Silberstein and Chemero, "Complexity and Extended Phenomenological-Cognitive Systems."

⁹ See, for example, the various contributions in Silberstein and Chemero, "Consciousness Unbound."

In what follows we shall try to convince the reader that consciousness could (i) be taken seriously, which excludes both mysterianism and scientism; and (ii) is open to logical and scientific investigation, highlighting the conceptual queries that make philosophy still relevant today. To make progress on this, we shall look at the hard problem from the angle of process metaphysics, and we propose that metaphysical problems surrounding particular phenomena could be re-conceptualized in terms of the processes that gave rise to these phenomena in the first place. The hard problem understood in terms of process thought stops being an insurmountable obstacle to the science of consciousness, although it would still leave philosophers and scientists much to think about: For example, according to one hypothesis, qualia should be conceived of not as properties of certain objects (physical ones or representations thereof) but as abstractions that Derive from processes of meaningful interaction between and agent and its environment that led to genesis of those objects. Or, to give another example to which we shall return later, wondering how it could be that consciousness has any effect in the physical world would translate into the question of how certain phenomena arise in circular causal networks, and how consciousness could be correlated to this circular structure.

2 Metaphysics: historical remarks and a re-conception

The German Idealist philosopher G.W.F. Hegel once remarked that metaphysics is the tendency towards substance, which means that metaphysical speculations usually end up in discussions of the nature or essence of things. Metaphysics, being an important part of philosophy since antiquity, received a backlash in the 20th century. Scientists, as well as many philosophers, were (perhaps naively) conveying an anti-metaphysical attitude. Yet, when pondering about the human mind and in particular about phenomenal experience, it seems hard to evade metaphysical thought. As a consequence, some circles ceased to regard consciousness as a respectable scientific topic best left to dinner conversation. This was the mainstream view until late in the 20th century. Others, however, did try to take the scientific study of consciousness more seriously with Nobel laureate Francis Crick¹⁰ being, perhaps, the most prominent scientist spearheading this field. Yet, the proposed models were deeply rooted in a non-processual and physicalist framework¹¹.

What about the many philosophical considerations that emerged from traditional (and continental) philosophy throughout the last centuries? Too often, these were discarded, and, judging from a brief look into almost every textbook on analytic philosophy, one gets the wrong impression that serious and scientifically plausible philosophy of mind really only started with analytic behaviourism and the identity theory in the 1950s. In addition to process thinkers such as William James and Alfred North Whitehead, we also wish to mention some other projects: Rudolf Carnap and his *Aufbau*¹², Edmund Husserl and his early writings on *Phenomenology*¹³ and Gustav Theodor Fechner and his *Psychophysics*¹⁴. These projects deserve more recognition when addressing the structure of phenomenal experience. The following discussion tries to keep some of these authors' philosophical insights in mind while adopting a scientific attitude that regards consciousness as empirically accessible phenomenon. A first step would be to replace (parts of) old metaphysical problems, such as the question of the *nature* of the mental and the physical, with questions concerning the *relations* between naturally occurring processes. Metaphysics, if conceived along these lines, would be more open to a dialogue with the empirical sciences.

Some remarks are in order at this stage. First, "structure" shall be understood as the relation into which entities enter to give rise to some (empirically accessible) phenomenon. This has two immediate consequences: (i) a deflation of the notion of "substance"; and consequently (ii) the replacement of thinking in terms of "intrinsic properties" (mass, charge, position, but also redness, sourness or what-it-is-likeness). Substances are nothing but sophisticated (philosophical) abstractions from a multitude of different structural relations encountered in an ever-changing world; and properties subsequently designate the regularities

¹⁰ Crick, "The Astonishing Hypotheses."

¹¹ Prentner, "A Framework for Critical Materialists."

¹² Carnap, "Aufbau."

¹³ Husserl, "Logische Untersuchungen."

¹⁴ Fechner, "Psychophysik."

that supervene on these relations.¹⁵ Ignoring our tendency to abstract and reify what is in constant flux, and thereby speaking of substances and properties as if they were immutably given, has been called the “fallacy of misplaced concreteness” by Alfred North Whitehead¹⁶. Note, that this stands in sharp contrast to a view sometimes ascribed to self-declared “qualia freaks”¹⁷, namely that phenomenology is essentially extra-structural. In contrast, we believe that the hard problem – and not just the “easy problems” – in fact is about the structure of consciousness. The structure we are mostly interested in throughout the remainder of this article is mereological structure. Many metaphysical problems revolve around issues of parthood, and we therefore wish to give a short, non-technical introduction into mereology, the logic of part-whole relations.

3 Mereology

3.1 Conceptual basis of mereology

In both science and philosophy, one encounters situations where the relation between parts and wholes lies at the center of interest. There are various examples of exotic and non-standard part-whole-relations, found within micro- as well as macroscopic domains of investigation. For example, in quantum physics we encounter the phenomenon of entanglement, where the part-whole relation is different from what we are familiar with: In terms of the quantum mechanical formalism only the total state of a system is at any time well-defined, whereas the state of some of its parts (say, of a single electron) might not be. Such a state is usually recovered by making a “projection” on the state of the total system, but in cases of entanglement such projections do not always lead to a pure quantum state. Accordingly, some properties of the part (say, its spin or its position) are well-defined only with respect to the total quantum system. But there are also instances of non-standard part-whole relations that are important in sciences other than fundamental physics, for example in chemistry¹⁸: The chemical bond relates atoms and molecules; molecules enter into chemical reactions that lead to qualitative changes; chemical reaction networks embed different reactions in a single system that constrains its own structure; and groups of chemical reaction networks, modeled as set of ordinary or partial differential equations, often serve as prototypes for systems on the ecological scale. Considering the mereology of chemistry, and then also biology, thus naturally leads to illuminating insights about phenomena from the macroscopic domain. Contrary to what some might intuitively expect, the assumption of “unrestricted composition” – i.e. that any collection of well-defined parts is constituting a “system” – holds only up to a point. More often than not, the situation is more complicated and draws on different ideas involving symmetry breaking or (self-) organization. The notion of an “organism” already indicates that the relations between (material) components are of paramount importance to individuate biological systems – something quite different from a mere collection of things. Very intricate notions of parthood are also found in ecology and the social sciences where organisms (individuals) stand in a complex relation to their environment (society).

Interestingly, one could often observe that something that needs to be conceived of as system-whole from one perspective has to be conceived of as part of a bigger system from a different perspective. For example, a molecule could be conceived of as system-whole with respect to its electrons and nuclei but also as being part of a chemical reaction network; cells are system-wholes on a macromolecular level but also parts that constitute the organic tissue in our body; persons are individuals on the scale of psychology but parts of a

¹⁵ Certainly not every problem in philosophy could be dissolved in a structuralist re-conceptualization. But some might, and illuminating this class of problems would help to make clear which philosophical issues lie beyond structural considerations. It will eventually become necessary to think about the entities that enter these structures, or phrased differently: to think about the ontology of process itself. This straightforwardly follows from the fact that in order to speak of relations, one needs to conceive of entities that enter into these relations. By making statements only about the structure of these relations, we have ipso facto said not much about these entities. However, to what extent this metaphysical problem is relevant to the understanding of consciousness is still an open question.

¹⁶ Whitehead, “Science and the Modern World,” 52.

¹⁷ Jackson, “Epiphenomenal Qualia,” 127.

¹⁸ Harré and Llored, “Mereologies as Grammars”; Prentner, “Chemistry, Context and the Objects of Thought,” 31-33.

larger social group. Whether something needs to be conceived of as part or as system-whole is thus relative to our cognitive interest. However, such “cognitive interests” too have to be accounted for in the end. This creates a hierarchy of nested part-whole structures, each depending on what’s above and influencing what’s below. Thus, every complex dynamical system affords a multitude of descriptions in terms of causation and mutual constraints, along different scales of time and energy. The most adequate and parsimonious descriptions that corresponds to this situation is that of an internally (mereologically) structured process.

3.2 Mereological models

Before we look more closely at the claim that the relation of mind and body is in part mereological, we shall probe the part-whole relation a little deeper. Mereology is the *logic* of the part-whole relation. As formal system, it conceives of two primitive entities that stand in a basic relation to each other. These entities are called part and whole respectively.¹⁹ One could furthermore distinguish between various approaches:

- Most classical accounts of mereology are concerned with questions regarding composition. The “compositional approach” takes a whole to be the (mereological) sum of its parts. The basic task of mereological inquiry is to elaborate on conditions of summation: When is it the case that parts give rise to comprising wholes? Is summation unrestricted, i.e., always possible, or should we expect some principles to exist that distinguish objects that sum from others that do not? According to the compositional approach, parts are prior to wholes (– logically or ontologically, depending on the interpretation).
- The “decompositional approach”, on the other hand, conceives of wholes to be prior to their parts (logically or ontologically, again depending on the interpretation). Accordingly, the main goal is not to find conditions of summation but conditions of differentiation. Such mereologies are suggesting themselves as soon as one is investigating natural domains in which wholes are prior to their parts: Whenever we believe that objects could not be individuated without recourse to their comprising whole, this could indicate that their mereological structure is decompositional.
- Instead of focusing on entities, one could also examine the basic operation of mereology, that is, the relation of parthood. Parthood could be thought of as a generic relation that holds between any two entities which intuitively correspond to part and whole. So, “being part of something else” has a very general scope: My arm is part of my body; I am part of the office but also part of my university’s faculty; a lecture is part of a curriculum etc. In contrast, parthood might also be considered as highly relative notion, depending on the context of use. Mereology, then, is about distinguishing between different senses of parthood by application of further constraints on the syntax of the calculus.

The rough classification given above might be illustrated using “mereological models”. More precisely, models could be understood as interpretations of a formal system. In order to give a more thorough account of mereological models, one would need to specify the formal system in more detail.²⁰ For the sake of this introduction, however, we shall limit ourselves to a less formal discussion, where “models” roughly correspond to schematic representations of relational structures.

In a “classical mereological model”, which is compositional and features a generic sense of parthood,

¹⁹ As reference for mereology, we refer the reader to the comprehensive book “Parts” by Peter Simons.

²⁰ For example: $x < y$, means that x is part of y , where variables x, y refer to objects, and parthood $<$ is a general relation that holds between them. Note, that x and y might also be identical. In many situations, this is not the case; and one would thus introduce the relation of “proper parthood”, $x \ll y$. From there, one could proceed with stating axioms of mereology such as *asymmetry* – if x is a proper part of y , this excludes the possibility of y being part of x –; *irreflexivity* – something cannot be a proper part of itself –; or *transitivity* – if x is part of y and y is part of z , then x is part of z . Transitivity is already disputed among mereologists, for example, when considering different senses of parthood: my little finger is part of my body, and my body is part of the person that I am, but it would seem odd to conclude that my little finger would also be part of the person I am. Of course, if I were a famous magician performing tricks with my little finger, my little finger would probably count as part of the person that I am. This example is somewhat trivial, but it illustrates some of the issues logicians are faced with. Things get more complicated as soon as we think about constraints on the composition or decomposition of parts (wholes).

“atomicity” is one possibility to enrich the calculus. By definition a (logical) atom has no part other than itself (it is indivisible). Most classical formulations of mereologies are further assumed to be “extensional”. This indicates that two entities that are made up of the same set of parts are identical. If one combines extensionality with the core thesis of atomism (that any entity is either an atom or has an atomic part other than itself), one can prove the theorem that the world is fully made out of atoms, and any two things that are made of the same atoms are identical. (“hyper-extensionality”²¹; but recall that speaking of “atoms” does not necessarily indicate speaking of material or physical atoms). Any classical model could, of course, also be conceived as atomless.

Being a non-classical model, the “functional model” too is compositional but regards parthood to be relative to the satisfaction of a functional relation that holds between objects: Organisms are made up of physical objects (this is the compositional aspect), but whether something counts as part of the organism (as “organ”) depends on the role it plays for the viability of the organism. The heart is part of the body in this sense because it realizes the function of pumping blood through it, not because it is made up of the same kind of tissue or because it is located inside the chest. Still, one might address the heart as physical object having properties that are independent from the fact that the heart realizes a particular function. Some of the heart’s properties – that it is made of organic tissue, that it has some location in space and time – do not depend on whether it stands in a (functional) part-whole relation or not. Others do however – hearts are transplanted because of them.

One could go one step further and challenge the compositional aspect of mereology: A “unitary model” is realized if parthood is relative (as is in the case of a functionalist model), but also if it is impossible to specify any property of the part without reference to the comprising whole. Such a situation is often encountered in quantum mechanics, as we have already discussed. In the case of entanglement, the physical properties of system components need no longer be well-defined on their own (i.e. the components are not in a “pure quantum state”). Another logically possible model features a generic sense of parthood, while all (other) properties of parts depend on their whole. Perhaps, societies are good examples of this “social model” of mereology: Any citizen is part of a nation irrespective of her concrete function (she might be a lawyer, a teacher, a scientist or even a philosopher). If she is born in that particular country, she would be part of the nation (in countries accepting the principle of *jus soli*). However, her rights and duties as part of that nation depend not on her but on the constitution of the nation. If the nation only allowed males to participate in the political system of the state, she would not be able to vote or to get elected. If the nation only allowed philosophers to be rulers, she would need to get a philosophy degree before running for office; etc.

An overview over these four models is given in Figure 1. The vertical dimension corresponds to the status of entities (compositional/decompositional approaches); the horizontal dimension corresponds to the status of the parthood relation (generic or relative). Mereological models could also be used to illustrate empirical relations found by the sciences. Classical models would correspond, for example, to the domain of engineering; functional models to biology; unitary models to quantum mechanics; social models to politics and economy.²² We shall discuss in the next section how the mereological analysis translates to the problem of consciousness.

This classification should not leave the impression that the four models – classical, functional, unitary and social – exhaust the space of possibilities. For example, one could conceive of additions to the mereological calculus to better account for additional temporal or spatial structure. Sometimes, one would like to start with a thin mereological model and subsequently enrich it. An example would be the inclusion of the topological concept of connectedness to form a “mereo-topological model”, where two primitive operations (parthood and connectedness) are structuring the set of objects; to account for processual character one could further introduce the concept of temporality; etc. It is thus clear that mereology only serves as starting point for further analyses.

²¹ Goodman, “On Relations That Generate,” 66.

²² For differing interpretations of the relation between mereology and the sciences see Calosi and Graziano, “Mereology and the Sciences”; Findlay and Thagard, “How Parts Make up Wholes.”

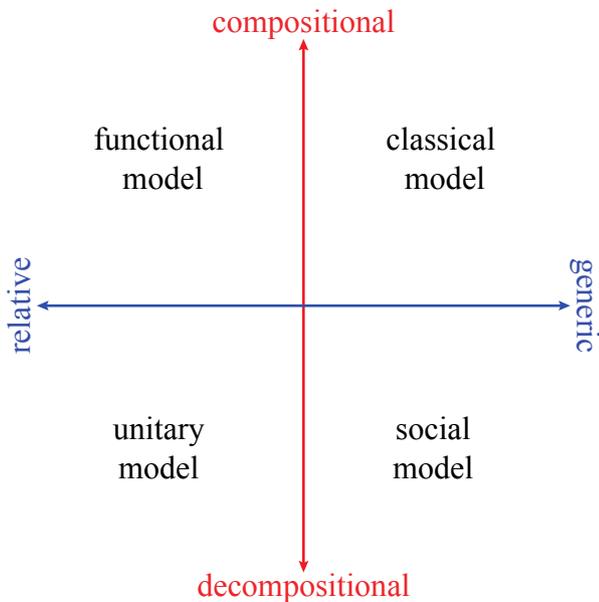


Figure 1: Four “mereological models” as discussed in the text.

4 The hard problem reconceived

4.1 The problem of constitution

In sections 1 and 2, we have proposed to conceive of some apparent metaphysical puzzles as problems that pertain to the relations between entities. An example of such a relation is the part-whole relation, and we have introduced “mereology”, the formal study of this relation, in section 3. In particular, it seems, the metaphysical puzzles surrounding consciousness are amenable to a mereological re-conception. To further probe this, we shall now look at two concrete issues related to the hard problem and interpret them in terms of mereology: First, questions about the *constitution* of the mind and secondly, questions about *causation*. We shall argue that these questions can be translated into mereological language which subsequently deflates their “ontological potential”, countering, for example, the tendency to view mind as being categorically distinct from matter and thus being a distinct substance in the Cartesian sense.

Constitution often pertains to the question how something is made of smaller things. This is a mereological question, and one could conceive of it in terms of *material constitution*. Accordingly, the physical properties of any object result from the properties of the material parts that make up the whole. Today, it is well-known that elementary physical quantum fields make up any form of matter. But another important sense of constitution pertains to the question of how a function is related to its substrate. Another one: How do collections of functionally separate units compose an organism? One could infer from this that the problem of constitution should not simply be regarded as question about the “substance” of things, but as question about its mereological structure; not all questions pertaining to constitution need ultimately refer to elementary particles. This gets more pertinent when thinking about consciousness, and worries might emerge when confronted with philosophers who state that consciousness could be located in space and time²³ or that it “consists of inner, qualitative, subjective states and processes of sentience or awareness”.²⁴ While one could be a traditional Cartesianist and state that consciousness is ultimately composed of *res cogitans*, this would be an unsatisfactory answer if one were asked about the functional structure of consciousness. Even more so, if the relation of consciousness to its parts were one of mereological unitarity.

²³ Strawson, “Realistic Monism.”

²⁴ Searle, “Consciousness,” 200.

In a process model à la James or Whitehead, consciousness is thought to be related to a succession of events that seamlessly fuse into an overarching whole. Then, a decompositional understanding of how such a (qualitative) whole is broken down into well-separated (and thus quantifiable) parts is needed to make sense of the question of constitution. In short, if there are different (mereological) aspects to the question of what constitutes consciousness, it should be expected that different kinds of answers and explanations are needed to address them. This cries for a diversification in the study of consciousness that goes beyond many contemporary (neuronal) models. For example, the question of how conscious perception is constituted might not be exhausted by an explanation of how sense organs transduce environmental stimuli into neuronal signals which subsequently get processed and are made available to a central and integrating unit. This point gets highlighted in the “microgenetic theory” of Jason Brown.²⁵ Complementing the received “stimulus-processing” view of perception, Brown lays out a model according to which perceptions arise from differentiating a primordial mental state. Importantly, Brown’s model is a scientific one: The mechanisms of differentiation are described in terms of neuroscience and closely follow evolutionary development, based also on many empirical (clinical) findings. Environmental stimuli are not “combined” into percepts but constrain an endogenous activity of “decomposition” – mereologically, two quite distinct approaches to perception.

More generally speaking, what something is made of does not necessarily imply that it derives its “nature” from the nature of the things it is made of. Without further specification, it is an empty question to ask what the “nature” of the mind is. Going back to the hard problem, it is not always clear which sense of constitution is indicated there. While qualia are often assumed to be irreducible to functional relations that hold between the physical components of an organism, it is not obvious whether qualia themselves are supposed to constitute consciousness in a substance-like, functional or compositional sense.

4.2 The problem of causation

Another puzzling issue in the vicinity of the hard problem pertains to causation. How should the mind possibly cause some effect in the body and vice versa? What is even more puzzling, is that both directions of fit (mind to body and body to mind), although hard to conceive in a dualist model, frequently occur in our everyday lives. We swallow a pill and get rid of our back pain or drink a glass of wine and feel relaxed; but we also go to the fridge because we are hungry or raise our arm because we want to say something. In every case we relate some physical behaviour to some conscious feeling or thought. It seems that one is thereby encountering causation between the (conscious) mental and the (unconscious) physical.

Contrast this to the mereology of causation. “Bottom-up” causation, where parts cause the behaviour of their comprising whole, U, is perhaps the most prominent example of a causal mereological relation in physics. One could give the following analytic scheme to conceptualize how physicists construe an explanation of U’s behaviour:

1. Analyze U in terms of its constituents,
2. Establish the corresponding equations of motion for these constituents,
3. U’s behaviour follows as a solution to these equations.

Even in physics, it is far from clear that such explanations are always feasible. Some might raise the issue of complexity or computability, but also the (im-)possibility of analyzing U into well separated parts – in each possible (mereological) sense – has to be considered. The applicability of the simple recipe “from material structure to dynamics to behaviour” becomes doubtful in such situations. Thus, other models of causal explanation should be considered. A type of causation that proceeds from the whole to its parts – “top-down” causation – is often evoked when discussing the mind-body problem. It has been argued that the notion of “top-down” causation is fundamentally confused, in particular when discussed in relation to

²⁵ Brown, “Microgenetic Theory.”

emergence.²⁶ Many discussions, however, regard causation to be linear and mereologically conservative, meaning that causation is a relation that proceeds from separable causes to effects and stays neatly within mereological domains: the movement of atoms causes other atoms to move, but the movement of atoms does not “cause” a certain function (it might realize it though); etc. We could distinguish this from the concept of “circular causality”: If, for example, some molecules realize a macro-molecular system, the behaviour of which constrains the dynamics of the molecules that constitute it, this would be an instance where bottom-up and top-down types of causation meet, and descriptions in terms of internally structured processes become most adequate. This pertains to the situation where some “whole” is defined in terms of a boundary that separates it from the environment. The paradigmatic example of this case is the cell. There exist no unmediated causal interactions between internal states of the cell and its environment – exactly because there exists a cellular boundary. Yet, if one were asked which events “caused” the change in the cell’s internal state, one would most likely explain this change by referring to changes in the extra-cellular environment, e.g. changes in chemical concentrations; and if one were asked what “caused” the movement of the cell in the environment, one would most likely explain this by referring to an internal decision mechanism²⁷ by which the cell decided to move into the corresponding direction. But in fact causation does not flow linearly from a cell’s internal state to the environment (or vice versa). Puzzles of causation arise if we try to linearize what is circular. One could, however, dissolve this apparent paradox by referring to a process that comprises internal (cellular) and external (environmental) parts and which enfolds over time.

Given this perspective, any form of causation between body and mind could perhaps be understood similarly in terms of a process, the internal (causal) structure of which corresponds to the interplay between parts and a system-whole. This interplay follows certain rules, and science might illuminate what these rules are. This line of reasoning is consistent with the range of evidence that has accumulated in the field of embodied cognition and puts it on a new metaphysical foundation, namely on process metaphysics. Our decision and subsequent movement to go to the fridge is more akin to the way decisions are made and executed in the cell than to the way how motion is induced by the dynamics of material particles exerting a force or pushing against each other.

Perhaps the main confusion surrounding such a model of mental causation pertains to the role of consciousness. Isn’t it our *feeling* hungry that causes our body’s motion toward the fridge? Isn’t it our *conscious intention* that causes the movement of our right arm? If we stated that consciousness were itself simply part of a larger process, are we then better off than epiphenomenalists who think that certain kinds of brain activity are accompanied by but not causally depended on consciousness? Here it is that mereology becomes helpful. Just as one should not limit constitution to material constitution, one should not think of causation exclusively in terms of physicalist or “efficient” causation²⁸ and assign to consciousness the role of some material agent in the suggested circular scheme. There might be no sense in which consciousness enters into such effective causal relations, and still there could be an important sense in which consciousness grounds or constrains the causal paths that could be taken by the system. A model that ascribes a non-efficient causal role to the mind was recently suggested by Walter Freeman and Giuseppe Vitiello. In their model, to every sequence of physical state changes in a macroscopic and dissipative perception-action system (such as the brain), there corresponds an entangled and apparently goal-directed (intentional) mental dynamics.²⁹ The causal role of consciousness could well be found on such a level of description.

²⁶ Kim, “Mind in a Physical World.”

²⁷ Balazsi et al. “Cellular Decision Making”.

²⁸ Aristotelian “formal causes” but also other types of causal relations that correspond to composition or functional realization might come to mind.

²⁹ Freeman and Vitiello, “Mater and Mind.” Their model is based on a quantum field theoretical treatment of biological systems, the explanation of which lies beyond the scope of this discussion.

5 Summary

We began this article by discussing and evaluating the hard problem of consciousness. We thereby identified three problematic premises: (i) the idea that consciousness is composed of qualia, i.e. of intrinsic and non-structural properties of experience, (ii) the idea that phenomenal and functional aspects of consciousness are empirically separable, and (iii) equating the phenomenal/functional distinction with a Cartesian mind/body duality. We proposed processual thinking as antidote to a tendency of reification and abstraction, and we argued for the necessity to revive the metaphysical project along these lines. In the words of Whitehead, “what he [Descartes] has described as primary *attributes* of physical bodies, are really the forms of internal relationships *between* actual occasions.”³⁰

To make intelligible how different parts or aspects are related or comprised within a process, we introduced mereology – the logic of part-whole relations – and provided an informal discussion of the conceptual basis of mereology. Different mereological models distinguish different senses of parthood (generic vs. relative) and differ in their regard of the status of entities (compositional vs. decompositional).

We then proposed that the notion of phenomenal consciousness should be re-conceived, which would result in an anti-substantialist re-evaluation of the hard problem. Consciousness and its constitution should be understood in terms of different mereological structures – instead of picking out “the one feature” (e.g. qualia) that distinguishes consciousness from matter. This is primarily directed against the first premise. Contrary to it, a mereological analysis presupposes that the entities involved enter into various structural relations. Although it might be the case that there is an irreducibly non-structural aspect to consciousness, we believe that much of what is discussed in the vicinity of the hard problem is wrongly and hastily said to be resulting from consciousness’ “purely intrinsic” character. This hinders much progress in the study of consciousness.

Our analysis of the causal role of consciousness pertains to the phenomenal/functional distinction. We discussed the mereological structure of causation in contrast to the concept of mental causation. In particular, we advanced a model of “circular causation” where the phenomenal (“what-is-it-like”) aspect of consciousness is closely associated to descriptions of the overall system’s behaviour. On reflection, circular causal structure undermines the claim that phenomenal and functional properties related to consciousness could always be neatly distinguished, let alone that this would indicate categorically-different forms of being or “essences” as typically proposed by Cartesian dualists.

The mereological analysis given here is a first step into the direction of an empirically adequate process theory of consciousness. It is necessary to make intelligible how conceptual dichotomies like “intrinsic/extrinsic” or apparent oxymora such as “mental causation” refer to dual aspects or perspectives within a larger process instead of referring to different “natures” or “substances.” Process thought is of course not limited to the problem of consciousness. Yet, we believe that it could most usefully be applied in this still-contested field of investigation where science intermingles with speculative thought to resolve the “subject-predicate dogma”³¹. We believe that our discussion of mereology is part of a larger metaphysical project – one that rejects the belief in self-sufficient and persistent things in favor of ever-changing processes that comprise subjective as well as objective aspects.

Being just a first step, this analysis necessarily stays incomplete. We wish to note that a final analysis in terms of structures and relations will likely include temporality as fundamental relation. The concept of temporality is needed to distinguish between process thought and mere structuralism, an issue of tantamount importance also for consciousness studies, where temporal relations on multiple scales will need to be addressed. This defines a field of inquiry, to which considerable efforts should be directed in the future.³²

³⁰ Whitehead, “Process and Reality,” 471.

³¹ *Ibid.*, 49.

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