

Numerical Identity: Process and Substance Metaphysics

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Abstract

Numerical identity is the non-relational sameness of an object to itself. It is concerned with understanding how entities undergo change and maintain their identity. In substance metaphysics, an entity is considered a substance with an essence and such an essence is the source of its power. However, such a framework fails to explain the sense in which an entity is still the entity it was, amidst changes. Those who claim that essence is unaffected by existence are faced with challenge of exploring the epistemic access to such an essence, which is questionable at best. Process metaphysics is a strong candidate for a theory that can ontologically explain regularity and change without appeal to essence. Process and its interactions is the main category. Every process is an emergent organization of constitutive interactions and is individuated on the basis of its interactive powers, that is, the ways in which it interacts with the world around it. Interactions are situated adaptation to changes. In this way, changes are crucial within process metaphysics and are included in the starting point of its investigation. What seems to the naked eyes as one-ness/singularity is a complex process where an organization of interactions is emerging from moment to moment by continually adapting to the changes around and within it. The question of numerical identity over time becomes valid only within substance metaphysics which has no space to accommodate change, due to its allegiance to essence.

Keywords — numerical identity, metaphysics, substance, process, interaction, essence

1 Introduction

Identity is a foundational component of contemporary metaphysics, primarily conceived as a relation and often discussed with respect to objects (with itself

or between two or more objects). In case of numerical identity, an object x is related to itself, in an absolute and non-relational sense, that is, ' x is x '. Qualitative identity is the relation of sameness of qualities between two or more objects. My concern in this paper is with numerical identity and more specifically, with the ontology of identity, that is, the nature of objects involved in identity claims.

2 Thesis

1. The question of whether an entity is numerically identical to itself over time is only valid within substance metaphysics, where substance is inseparable from its essence and essence is source of the identity of entities;
2. Substance metaphysics fails to explain the regularity of an object, amidst changes and its appeal to essence is questionable, owing to latter's epistemic inaccessibility;
3. A metaphysical framework that can explain ontological regularity along with change without appeal to essence would be more adequate;
4. In process metaphysics, the world is populated by processes; such processes are emergent organizations of interactions and have interactive powers, that is, ways to interact with the world around them;
5. There are constitutive interactions and processual interactions: an organization of constitutive interactions leads to emergence of process and such a process carries out interactions with the world around it. These interactions are in reciprocal dependency relationship with each other;
6. Interactions are situated adaptation to changes;
7. What we encounter in the world is not concrete singularities but processes which are continuously emerging from moment to moment through their situated adaptation to changes.

3 Numerical Identity

[I_N] Numerical identity is the non-relational sameness of an object to itself (x is x). Numerical identity is intended to direct towards one-ness of an object.

What constitutes such a oneness is much debated, as is the claim that an object shares absolute qualitative identity only to itself.

Some things are one in respect of number, some in respect of form, some in respect of genus, some in respect of analogy; in number, those whose matter is one, in form those whose account is one.¹

There are broadly two ways in which numerical identity has been studied: firstly, under the language of identity, where the concern has been to talk about informativeness of identity statements; secondly, under the ontology of identity, where the concern is with the nature of entities involved in such identity statements. My domain of research is the latter, and I will be talking about nature of the entities described in identity statements.

4 Ontology of Identity

Discussions on identity generally take two forms: firstly, focused on relation of identity and secondly, on nature of objects being related/identified.

[1] Table x is table x .

An exposition on the ‘is’, emphasis on the criterion for identity and how the criterion holds in relationships of different kinds falls broadly under the first form while exploring nature of the object (table, in this case), with or without reference to temporality (amongst other categories) is classified as under the latter. This paper focuses on the second form of ontology, discussing the nature of entities.

5 Substance Ontology: Chunky Theories

This section discusses the predominant framework in contemporary metaphysics today, the neo-Aristotelian substance metaphysics and advances two main points:

1. The question of numerical identity is reasonable only within substance metaphysics;

1. E. J. Lowe, “Two Notions of Being: Entity and Essence” [in en], *Royal Institute of Philosophy Supplements* 62 (July 2008): 23–48, accessed January 24, 2018, doi:10.1017/S1358246108000568, <https://www.cambridge.org/core/journals/royal-institute-of-philosophy-supplements/article/two-notions-of-being-entity-and-essence/B36B5BEA4173D8382A55D0753AD86BC7>.

2. Substance, in terms of essence, is inadequate to account for supposed numerical identity.

5.1 Substance

Substance-oriented metaphysical theory understands the world around us primarily through the category of substance and its properties. Borrowing from Joshua Hoffman and Gary S. Rosenkrantz , the intuitive notion of substance is that an individual substance has features which are unified by it. Such features do not form part of the substance, as shape or size of a table would not be considered its parts. If an individual substance exists at a time, then it possibly exists at more than that time. Some individual substance persists through changes in their intrinsic features while others persist through changes in their relational features. The length of time of existence of a substance is accidental.² These substances are made up of ‘c/hunk of matter’. Theories which posit substance as fundamental to reality and consider such substance made up of chunk/hunk of matter are labelled Chunky Theories in this paper.

We call substances [what is] not predicated of a subject but everything else is predicated of [it]. That which, being present in such things as are not predicated of a subject, is the cause of their being. The parts which are present in such things, limiting them and marking them as individuals, and by whose destruction the whole is destroyed. The essence, the formula of which is a definition, is also called the substance of each thing.³

The identity of substances is primitive in the sense of being unanalysable. A substance is individuated by its matter. Which substance it is (i.e. of what kind) is given by its form, but its identity conditions are not given by those of its form. The substance has an identity- it is one or another kind of thing- and its identity is traceable through time. But it has no conditions of identity, nothing else that has to be true in order for it to have the identity it has or to be reidentifiable. A substance is in some sense an ontologically independent entity. It has existence in itself and

2. Joshua Hoffman and Gary S. Rosenkrantz, “Substance Among Other Categories,” *Mind* 109, no. 433 (2000): 149–152.

3. Aristotle, *Metaphysics*, ed. W. D. Ross (Oxford: Oxford University Press, 1924; Newton Abbot: Sandpiper Books, 1997), 1017b (hereafter cited as Aristot. Met.).

by virtue of itself as an ultimate distinct subject of being.⁴

5.2 Substance *to* Essence

The essence of a substance is what it is⁵. Though there are heated debates about the nature of such an essence (that is, its fundamentality, whether it is ontologically in/dependent or the grounding relation of an object to its fundamental entities), a commonality between the chunky theories, is their allegiance to essence.

[E_x] Essence of x is what- x -is or what-it-is-to-be- x .

Essence is explored in many ways and can be minimally defined as ' x is what it is in virtue of/owing to its essence'. Further qualifications can be made to this definition to account for the type of substance x is and for other categorizable features (general essence).

5.3 Substance *to* Essence *to* Numerical Identity

Within substance ontology, numerical identity is axiomatic, in the sense that, it is a core tenet on essentiality of the object. When one asserts ' x is x ', it points out, in a sense, to the irreducible nature of the object, which is reflective of its essentiality. In saying ' x is x ', the claim is 'There is essence. x is what it is.'. Thus, the starting point of numerical identity is that we are, at a crucial level, capturing its essence.

[2] Table _{x} ^e is Table _{x} ^e where e refers to the essence.

Then, while talking about numerical identity of table _{x} , in saying that 'Table _{x} is table _{x} ', I am pointing to its essence: 'There is essence to table _{x} '. Such an essence is self-contained and is considered to be the source of being of the object.

[3] Table _{x} ^e_{at-time-t} is the Table _{x} ^e_{at-time-t*}

When a reference to time is made and numerical identity is asserted, we have to account for the changes that the table _{x} undergoes and if it does go

4. David S. Oderberg, *Real essentialism*, Routledge studies in contemporary philosophy 11, OCLC: ocm85898989 (New York ; London: Routledge, 2007), p.78.

5. Properties belonging to a substance are either essential or accidental. These are also variously called relational and non-relational, dispositional and categorical. The essential properties typify the substance (determines the kind of substance it is i.e. general essence) while the accidental qualities are subject to change and do not determine nature of the substance. A common debate is the relation of essence to essential properties. The essential properties can be posited as determining the individual essence: the essential properties make x what it is. However, there are challenges to associating essence with essential properties including the need to explicate relation between substance and the essential properties, of whether the substance is merely a bundle of such essential properties.

through such changes, then in what way it affects the essence. The answer usually is that the essence is unaffected by the existence of $table_x$, that is, by changes which occur in virtue of its participation in the world. Attempts to talk about identity of substance through time have led to largely two positions: perdurance and endurance.

Perdurance says that material objects persist through time via temporal parts/stages. These temporal stages exist at different times and can be differentiated with reference to the times of their existence. This means that at any one point, only a certain part of the object exists. The object is divided into a series of temporal parts: $table\text{-on-Monday}$, $table\text{-at-2pm}$ and so on. Such a position is also called four-dimensionalism where time is considered to be a fourth dimension, along with three spatial dimensions. Persistent objects are four-dimensional entities. This position has been advocated by Quine (1975), Lewis (1983), Armstrong (1980), Heller (1990) and Hudson (2001) amongst others. The challenge to four-dimensionalism is that properties are generally attributed to objects and not to its temporal parts. The inclusion of temporality as parts is incompatible with the framework of substance and its properties where the properties are applied to the substance and not to a substance reserved to a temporal stage.

Endurance position claims that material objects are wholly present at each time and that there are only spatial and no temporal parts. Endurance position is supported by Thomson (1965), Simons (2000), van Inwagen (1990) and Oderberg (2004). However, endurance position faces the challenge of explicating the criterion of essence and how one accesses it, a charge put up against the broad concept of essence as well.

When a reference to time is made, the question of numerical identity is to explain in what sense $table_x$ is still the $table_x$. The concept of essence is invoked to warrant that though there are changes occurring in the world, the substance is unaffected owing to its immutable essence.

5.4 Three non-modal accounts of essence and their inadequacies

For the purposes of this paper, I have chosen three non-modal accounts of essence. My claim is that all these accounts presuppose a chunky theory of reality and fail to resolve the question of what-essence-is and the access to essence. The questionability of essence moves one towards alternate ways to understanding identity of an object. Owing to limitation of space, I have provided terribly condensed versions of the accounts.

Kit Fine provides an account where the essence of something is that which

is stated in its real definition. A real definition of x tells us what- x -is and not simply how to use the word. However, he fails to provide a clear idea of what a real definition is and how it is to be constructed.

Joseph Almog explores the distinction between essence and accident in terms of generation. He takes the example of model, Nastassja Kinski and says, ‘My own theoretical account traces the forging of her essential traits to the generative process by which she came into being.’ The main idea is that every object comes to exist through a historical process and it is possible to distinguish between essential and accidental properties on basis of their relation to such a historical process. Those features that come to exist through this process are essential while those which come to exist for other reasons are accidental. Almogs account does not tell us where we are to draw the line in tracing such a generative process. Moreover, as Michael Gorman points out it is hard to imagine that we could give an account of the essence of the table-generation process without giving an account of the essence of tables.⁶

Michael Gorman grasps essentiality as fundamentality, through the concept of support relations. ‘Let a and b stand for things and let F and G stand for features possessed by a and b , respectively. Whenever we want to talk about somethings being the case because something else is the case, the full formulation will look like this: a is F because b is G .’ (Gorman 2014, 127). He takes example of an atom and a car to demonstrate: A certain hydrogen atom is prone to bond at least because it has one proton; My car is the temperature that it is because its heater is on. Support relations are these kinds of because relations, which cannot be reduced to other prior kinds of relations. He proposes that there is at least one unsupported feature while there are many other supported ones through different layers of support. The unsupported one is called foundational. He avoids infinite regress by introducing that there is at least one foundational feature. F is a foundational feature of a if and only if a is F and there is no G such that as being G supports as being F . Here, a stands for some-thing and F/G refers to some real features. That feature is essential which is unsupported and thus, foundational. However, there is no systematic way to determine the criteria for such unsupported feature, since it is possible to trace relational underpinnings to every feature attributed to an entity.

In neo-Aristotelian contemporary metaphysics, accounts of essence are embedded within chunky theories, that is, theories which talk about an object

6. Michael Gorman, “Essentiality as Fundamentality,” in *Neo-Aristotelian perspectives in metaphysics*, ed. Daniel Novotný and Lukáš Novák, Routledge studies in metaphysics 8 (New York ; London: Routledge, Taylor & Francis Group, 2014), p.124.

x and its properties. There has been a gradual shift from talk of essence to talk of essential properties. This reflects that the scholars working in the domain have taken notice of the need for relational underpinnings in an account of objects, owing to the realization that there is rarely any empirically heavy evidence for an absolutely independent substance. However, in such a shift, the object has been reduced to a bundle of properties: essential/accidental, categorical/dispositional, relational/non-relational. Expositions on essence are crowded with accounts of distinction between such properties.

Those accounts which continue loyalty to substantial essence fail to provide a strategic account of its access. The epistemic access to essence is questionable, at best. Though there are reasons why we need such an essence, there is no systematic method to access it. In his illuminating paper on epistemology of access, Tuomas Tahko remarks:

To conclude, it seems that Lowe has given us an intriguing picture of the role of a priori knowledge in the epistemology of essence, but this picture does need to be completed with the help of empirical elements. If this is right, then it would be a mistake to describe Lowes account as purely rationalist, even in the sense that we first grasp the essences of possible entities a priori and then proceed to determine which ones of them actually exist with the help of empirical evidence. Instead, we can see that Lowes account assumes a subtle interplay of a priori and a posteriori elements, which may, properly interpreted, come close to a type of hybrid view about the epistemology of essence.⁷

Thus, within chunky theories, we encounter the world as an arrangement of substances with essences and intuitively accept that each of these substance is singular-one over time. Such a picture of the world is also highly compatible with our common sense. However, we have no access to such an essence and due to the inability to explicate the essence, there is no way to validate how the substance is still one in spite of the changes it undergoes through its interaction with the world.

6 Spatial Sameness and Identity

It is important to differentiate between spatial sameness and identity. Spatial sameness is the common-sense notion of shape and size. In discussions on

7. Tuomas E. Tahko, "The epistemology of essence" (2016), <http://www.ttahko.net/papers/epistofessence.pdf>.

numerical identity, questions like: Would the table_x still be table_x if it lost a leg? are plenty. Here, table_x is being identified with its spatial qualities, its shape and size. If being-one means to be of that particular shape and size, then one would have to admit that table_x is not table_x - if it changes shape or size. However, one could counter that even after loss of a leg, table_x could still be considered table_x . How can we justify such an attribution? This calls for a mention of the criterion for identity.

One could answer either that table_x is still able to fulfil the functions it previously did with mild alteration (functional justification) and thus, it is still table_x or that, even if it lost all of its legs and was broken, the table_x without its capacity to fulfil its previous functions, could still be called table_x owing to the way in which it continues to participate in the worlds of other processes surrounding it (relational justification).

The option of functional justification, that it is still capable of following through certain functions it previously had, would need to answer the following query, What is the threshold of functionality, after which we say that it is not table_x anymore? This would mean that one would have to mention the functions that are determinative of table_x . However, such a functional list is relative and would not enable a description of nature of table_x since function is dependent upon agency of the users. One could of course point out that the table_x was built for such functions and that is what must be determinative of its identity. The risk we face is of cases where objects are built for one purpose and used for completely others. Those who point out that such are only exceptions would do themselves well to look at the uses a table is often put to, from standing on it to reach a certain height to as a play-toy for a child and in this spectrum of uses, the table is used for writing amongst other normal functions.

The option of relational justification is employed by certain types of process metaphysics, to talk about identity of the table_x . The identity of table_x emerges from the relationships it has to the world around it: its functions are also a product of such relationships, owing to the powers it possesses on account of its organization. In the following section, this idea of relational justification is explored followed by a discussion on status of numerical identity within process metaphysics.

7 Process and Its Interactions

In encountering the world, we come across objects which are concretely separate from one another. They have clear boundaries. It can be said that they have spatiotemporal integrity which is preserved over time, through

the changes they undergo. Their properties change, however, the substances last. When asked, ‘What is it that lasts?’, a substantialist response is ‘The essence.’ This gives the impression that the world keeps changing, that is, the world of properties while the substances are transported across such changes without any alteration to what-they-are. This could be the only way to explain that the substances I encounter are the same I encountered a few days, years, or decades ago. Continuity of identity is ensured by invocation of essence. However, as mentioned earlier, a probe into essence reveals that there is no reasonable access to such an essence. Process metaphysics is a strong candidate to understand the identity of entities around us without appealing to essence.

Process metaphysics posits two core categories: process and its interactions⁸. The world is populated by processes which possess ways of interacting with the world.

[P] Process is emergent organization of constitutive interactions, directed towards sustenance of interactive powers.

[E] Emergence is the development of global novelty from local interactions.

[O] Organization is the mode through which constitutive interactions are related to one another.

[IP] Interactive powers refers to the ways in which the process interacts with the world around it.

[I] Interaction is situated adaptation to changes.

In a more detailed (and condensed) manner: There is a process. This process is identified through the ways in which it interacts with the world around it. (This is a manifestation of its powers). The process emerges as a novel mode through the organization of its constitutive interactions. It is this organization that makes it possible for the process it to interact with the world in certain ways and at the same time, it is the ways in which the process interacts with the world that conditions such an organization. This means that the organizational mode of the process and its interactive powers are in reciprocal dependency relationship with one another. To the question, What is Table_x ?, the answer is: It is an organization which emerges moment-to-moment through its interaction with the world. This means that at any

8. This is in contrast to the category of substance and its properties within substance metaphysics.

point when we delve into identity of table_x , we consider the organization of its constitutive interactions that enables it to have the interactive powers it and the ways in which it interacts with the world around it.

7.1 From Compositional to Organizational Viewpoint

What is table_x made up of? Is it the atoms that are present in the spatiotemporal region which the table occupies? Process metaphysics, as I have espoused here, does not talk about the make-up of entities. The obsession of substance-oriented metaphysics with make-up of entities has led to the heaviest camping within metaphysics: monism, dualism, pluralism. These positions are answers to the question: ‘What do you think the entities around us are made up of?’: Are they made up of one kind of substance, maybe two or many? The origin of emphasis on make-up of entities in substance metaphysics comes from the idea that source of the powers of an entity is in virtue of its substance, intimately related to the idea that the substance is inseparable from essence. Thus, essence is the source of powers of the entity. It is only post the exposition of substance that one can conveniently explore powers of the entities.

The shift within process metaphysics is to focus on the mode of organization, instead of the substance in which such a mode is realized. The mode of organization of interactions is the source of powers of processes. Here, power is interactive in nature, that is, it refers to the capacity of a process to carry out a certain set of interactions with the world around it. The question that process metaphysics is concerned with is: What enables the process x to be able to interact in such-and-such ways with the world around it? The answer to this is that it is the way in which its constitutive interactions are organized that leads to emergence of the interactive powers of the process. Thus, instead of focusing on the $c/hunk$, we focus on what occurs between the constitutive interactions.

Those who complain that this reduces the nature of an entity to its behaviour alone or to the series of interactions view the entity as a substance to which properties are attached. Such a substance moves across spatiotemporality without alteration to its nature. This indicates an underlying loyalty to essence. The more fitting question could be, ‘Is the table_x a process which is reducible to its constitutive interactions?’. This question can be answered by pointing out that it is the organization of constitutive interactions that enables the interactive powers of the table_x . The emphasis is on viewing the organization as causally relevant and not the material.

There could be a more difficult question that could open a can of worms for a process metaphysician: *This seems circular. Interactions are the source*

of interactive potential and interactive potential is the source of interactions.

Here, it is significant to differentiate between two forms of interactions: the constitutive interactions and processual interactions. The criteria for interactions to be considered constitutive is through their causal participation in enabling interactive powers of the process. This means that only those interactions which contribute towards the interactive powers of the process will be considered relevant. Processual interactions are the interactions of the process, as a whole, with the world around it. The individuation of a process occurs through this method of acknowledging interactive powers. Thus, as mentioned earlier, the constitutive processes enable the processual interactions while the processual interactions condition the constitutive interactions.

7.2 A rock, dog and me?

A possible objection to process metaphysics, as endorsed above, could be that it fails to distinguish between the differences between entities of varying complexity. What makes a rock different from my dog Martha? And what makes Martha different from me? The difference between processes is in the ways in which they interact with the world around them, the interactive powers. If the kind of answer the questioner is looking for is: ‘A rock is made up of so-and-so. A dog is made up of so-and-so. It is the internal structure of the process which gives it its interactive potential.’, then I will admit that such explanations are compatible with process metaphysics. Any theory that intends to talk about the composition of processes is not at odds with process metaphysics as long as it does not claim that powers of the process are grounded in such a composition. The organization of the interactions that occur within such supposed internal structures is source of the interactive powers.

8 Coming back to Numerical Identity

In substance metaphysics, the main categories are substance and its properties. Substance is inseparable from its essence and it is through essence that the numerical identity of an entity is sourced. Such an essence insulates the substance from changes occurring over space and time. The powers of an entity are owing to its essence. However, there is no epistemically systematic access to such an essence. A metaphysical framework which can explain the regularity of our experience of the objects along with role of change would be a more adequate alternative. Currently, process metaphysics fulfils such

a requirement, in better ways than substance metaphysics.

In process metaphysics, we encounter processes which possess varying ways to interact with the world (interactive powers). Such processes are emergent phenomenon- they emerge from the ways in which their constitutive interactions are organized. The organization of such constitutive interactions is the source of interactive powers and such a mode develops over time, so do the interactive powers. No matter which matter we choose to compose our world in, it is the ways in which they adapt to each other (situated adaptation to changes) that will determine the organization of the constitutive interactions. Process metaphysics dismantles the concept of numerical identity by pointing out that we encounter processes in the world around us and such processes are emerging moment to moment through their interaction with the world.

What seems to the naked eye to be concrete singularity is a process, which is continuously interacting with the environment to sustain its organization. Change is inherent to process, as it is the adaptation to changes that determines the constitutive interactions. Thus, process metaphysics enables the accounting of regularity in our experience: the constancy of processes as organizations of constitutive interactions along with accounting for change: interactions as situated adaptation to changes.

References

- Almog, Joseph. "X-The Structure-in-things: Existence, Essence and Logic" [in en]. *Proceedings of the Aristotelian Society (Hardback)* 103, no. 1 (June 2003): 197–225. Accessed February 28, 2018. doi:10.1111/j.0066-7372.2003.00070.x. <https://academic.oup.com/aristotelian/article-lookup/doi/10.1111/j.0066-7372.2003.00070.x>.
- Aristotle. *Metaphysics*. Edited by W. D. Ross. Oxford: Oxford University Press, 1924. Newton Abbot: Sandpiper Books, 1997.
- Baars, Bernard J. "The Global Workspace Theory of Consciousness." In *The Blackwell Companion to Consciousness*, edited by Susan Schneider and Max Velmans, 236–246. Oxford: Blackwell Pub, 2007.
- Baars, Bernard J. *In the theater of consciousness: the workspace of the mind*. New York: Oxford University Press, 1997.
- Bigaj, Tomasz, and Christian Wüthrich. *Metaphysics in Contemporary Physics* [in en]. Google-Books-ID: 1bW9CwAAQBAJ. BRILL, December 2015.

- Bird, Alexander. "Causation and the manifestation of powers" [in eng]. In *The metaphysics of powers: their grounding and their manifestations*, 1. iss. paperback, edited by Anna Marmodoro. Routledge studies in metaphysics 2. OCLC: 935344665. New York, NY: Routledge, 2013.
- Blackburn, Simon. *The Oxford Dictionary of Philosophy* [in en]. Google-Books-ID: Mno8CwAAQBAJ. Oxford University Press, 2016.
- Block, N. "Paradox and cross purposes in recent work on consciousness" [in eng]. *Cognition* 79, nos. 1-2 (April 2001): 197–219.
- Block, Ned Joel, Owen J. Flanagan, and Güven Güzeldere, eds. *The nature of consciousness: philosophical debates*. Cambridge, Mass: MIT Press, 1997.
- Brock, Stuart, and Edwin David Mares. *Realism and anti-realism*. Central problems of philosophy. OCLC: ocm71540599. Montreal ; Ithaca: McGill-Queen's University Press, 2007.
- Capps, John. "Epistemology, logic and inquiry." In *The Continuum companion to pragmatism*, edited by Sami Pihlström. New York: Continuum, 2011.
- Chalmers, David J. "Facing up to the Problem of Consciousness." In *Toward a science of consciousness II: the second Tucson discussions and debates*, edited by Stuart R. Hameroff, Alfred W. Kaszniak, and Alwyn Scott, 5–28. Complex adaptive systems. Cambridge, Mass: MIT Press, 1998.
- Contemporary Debates in Metaphysics - Google Books*. Accessed January 29, 2018. <https://books.google.co.in/books?id=LRV-Tzcry8EC&pg=RA3-PT363&dq=ontological+pluralism&hl=en&sa=X&ved=0ahUKEwji-vFpv3YAhUFPo8KHX7kBrYQ6AEIQDAE#v=onepage&q=ontological%20pluralism&f=false>.
- Damasio, Antonio R. *Self comes to mind: constructing the conscious brain* [in eng]. OCLC: 824522259. London: Vintage Books, 2012.
- Dennett, D. "Are we explaining consciousness yet?" [In eng]. *Cognition* 79, nos. 1-2 (April 2001): 221–237.
- Dennett, D. C., and Paul Weiner. *Consciousness explained* [in eng]. 1. paperback ed. OCLC: 23648691. Boston: Back Bay Books, 1991.
- Descartes, René. *Key philosophical writings* [in English]. OCLC: 37600400. Hertfordshire: Wordsworth Editions Ltd., 1997.

- Dewey, John. *Leibniz's New Essays: Human Understanding* [in en]. Google-Books-ID: euoDCwAAQBAJ. 8c376708793e, November 2015.
- . *The Essential Dewey: Pragmatism, education, democracy* [in en]. Google-Books-ID: ZIgn5l73hmEC. Indiana University Press, 1998.
- Edelman, Gerald M., and Giulio Tononi. *A universe of consciousness: how matter becomes imagination* [in eng]. 1. paperback ed., [Nachdr.] OCLC: 248138082. New York, NY: Basic Books, 2001.
- Eklund, Matti. “The picture of reality as an amorphous lump.” In *Contemporary debates in metaphysics*, edited by Theodore Sider, John Hawthorne, and Dean W. Zimmerman. Contemporary debates in philosophy 10. OCLC: ocn132681443. Malden, MA: Blackwell Pub, 2008.
- Fine, Kit. “The Question of Realism.” *Philosophers' Imprint* 1 (2001): 1–30.
- . “What is metaphysics?” In *Contemporary Aristotelian Metaphysics*, edited by Tuomas E. Tahko, 8–25. DOI: 10.1017/CBO9780511732256.003. Cambridge: Cambridge University Press, 2011. Accessed February 28, 2018. <http://ebooks.cambridge.org/ref/id/CB09780511732256A008>.
- Fraassen, Bas C. van. *An Introduction to the Philosophy of Time and Space*. Nousoul Digital Publishers, 2015. <https://www.princeton.edu/~fraassen/BvF%20-%20IPTS.pdf>.
- Frith, Chris, and Geraint Rees. “A Brief History of the Scientific Approach to the Study of Consciousness.” In *The Blackwell Companion to Consciousness*, edited by Susan Schneider and Max Velmans, 9–22. Oxford: Blackwell Pub, 2007.
- . “Methodologies in Identifying the Neural Correlates of Consciousness.” In *The Blackwell Companion to Consciousness*, edited by Susan Schneider and Max Velmans, 72–87. Oxford: Blackwell Pub, 2007.
- Gold, Bonnie, and Roger A. Simons, eds. *Proof and other dilemmas: mathematics and philosophy*. Spectrum series. OCLC: ocn229309020. Washington, D.C.: Mathematical Association of America, 2008.
- Gorman, Michael. “Essentiality as Foundationality.” In *Neo-Aristotelian perspectives in metaphysics*, edited by Daniel Novotný and Lukáš Novák, 119–137. Routledge studies in metaphysics 8. New York ; London: Routledge, Taylor & Francis Group, 2014.

- Hameroff, Stuart R., Alfred W. Kaszniak, and David John Chalmers, eds. *Toward a science of consciousness III: the third Tucson discussions and debates*. Complex adaptive systems. Cambridge, Mass: MIT Press, 1999.
- Heidegger, Martin. *Being and Time* [in en]. SUNY Press, July 2010.
- Heller, Mark. *The ontology of physical objects: four-dimensional hunks of matter*. Cambridge studies in philosophy. Cambridge [England] ; New York: Cambridge University Press, 1990.
- Hirsch, Eli. “Ontological arguments: Interpretive charity and quantifier variance.” In *Contemporary debates in metaphysics*, edited by Theodore Sider, John Hawthorne, and Dean W. Zimmerman. Contemporary debates in philosophy 10. OCLC: ocn132681443. Malden, MA: Blackwell Pub, 2008.
- Hoffman, Joshua, and Gary S. Rosenkrantz. “Substance Among Other Categories.” *Mind* 109, no. 433 (2000): 149–152.
- Hudson, Hud. *A materialist metaphysics of the human person*. Ithaca, N.Y: Cornell University Press, 2001.
- Humphreys, Paul. *Emergence*. New York, NY, United States of America: Oxford University Press, 2016.
- James, Williams. “The Stream of Consciousness.” In *The nature of consciousness: philosophical debates*, edited by Ned Joel Block, Owen J. Flanagan, and Güven Güzeldere, 71–82. Cambridge, Mass: MIT Press, 1997.
- Järvillehto, Lauri. *Pragmatic A Priori Knowledge: A Pragmatic Approach to the Nature and Object of What Can Be Known Independently of Experience*. Jyväskylä: Jyväskylä University Printing House, 2011.
- Kant, Immanuel, Marcus Weigelt, and Max Müller. *Critique of pure reason* [in eng]. Penguin classics. OCLC: 439726598. London: Penguin Books, 2007.
- Kim, Jaegwon. “The Causal Efficacy of Consciousness.” In *The Blackwell Companion to Consciousness*, edited by Susan Schneider and Max Velmans, 406–417. Oxford: Blackwell Pub, 2007.
- Koch, Christof. *The Quest for Consciousness: A Neurobiological Approach*. Denver, Colo: Roberts / Co, 2004.
- Kraus, Elizabeth M. *The metaphysics of experience: a companion to Whitehead’s Process and reality*. 2nd ed. American philosophy series, no. 8. New York: Fordham University Press, 1998.

- Levine, Joe. "Anti-materialist Arguments and Influential Replies." In *The Blackwell Companion to Consciousness*, edited by Susan Schneider and Max Velmans, 371–380. Oxford: Blackwell Pub, 2007.
- Lewis, David K. "Survival and Identity." In *Philosophical papers*. New York: Oxford University Press, 1983.
- Lowe, E. J. "Essence and Ontology" [in English]. In *Metaphysics: Aristotelian, Scholastic, Analytic*, edited by Prokop Sousedík and David Svoboda, 93–112. OCLC: 978647591. Berlin: De Gruyter, 2012. Accessed January 27, 2018. <http://search.ebscohost.com/login.aspx?direct=true&scope=site&db=e000xna&AN=603523>.
- . "Primitive Substances." *Philosophy and Phenomenological Research* 54, no. 3 (September 1994): 531. Accessed February 28, 2018. doi:10.2307/2108580. <http://www.jstor.org/stable/2108580?origin=crossref>.
- . "Two Notions of Being: Entity and Essence" [in en]. *Royal Institute of Philosophy Supplements* 62 (July 2008): 23–48. Accessed January 24, 2018. doi:10.1017/S1358246108000568. <https://www.cambridge.org/core/journals/royal-institute-of-philosophy-supplements/article/two-notions-of-being-entity-and-essence/B36B5BEA4173D8382A55D0753AD86BC7>.
- Marmodoro, Anna. "Power mereology." In *Philosophical and scientific perspectives on downward causation*, 1 [edition], edited by Michele Paolini Paoletti. Routledge studies in contemporary philosophy 91. New York: Routledge, Taylor & Francis Group, 2017.
- Metaphysics and the Philosophy of Science: New Essays - Matthew Slater - Google Books*. Accessed January 29, 2018. <https://books.google.co.in/books?id=izfjDQAAQBAJ&pg=PA48&dq=interaction+ontology+metaphysics&hl=en&sa=X&ved=0ahUKEwjL6Nz1pf3YAhVMrI8KHfvoBW44FBD0AQhJMAY#v=onepage&q=interaction%20ontology%20metaphysics&f=false>.
- Metaphysics and the Philosophy of Science: New Essays - Matthew Slater - Google Books*. Accessed January 29, 2018. <https://books.google.co.in/books?id=izfjDQAAQBAJ&pg=PA48&dq=interaction+ontology+metaphysics&hl=en&sa=X&ved=0ahUKEwjL6Nz1pf3YAhVMrI8KHfvoBW44FBD0AQhJMAY#v=onepage&q=interaction%20ontology%20metaphysics&f=false>.

- Oderberg, David S. *Real essentialism*. Routledge studies in contemporary philosophy 11. OCLC: ocm85898989. New York ; London: Routledge, 2007.
- . “Temporal Parts and the Possibility of Change” [in en]. *Philosophy and Phenomenological Research* 69, no. 3 (November 2004): 686–708. Accessed February 28, 2018. doi:10.1111/j.1933-1592.2004.tb00523.x. <http://doi.wiley.com/10.1111/j.1933-1592.2004.tb00523.x>.
- *Philosophy Documentation Center*. Accessed January 29, 2018. https://www.pdcnet.org/process/content/process_1996_0025_0000_0055_0071.
- *Philosophy Documentation Center*. Accessed January 29, 2018. https://www.pdcnet.org/process/content/process_1996_0025_0000_0055_0071.
- Pihlström, Sami. “Metaphysics.” In *The Continuum companion to pragmatism*, edited by Sami Pihlström. New York: Continuum, 2011.
- Polger, Thomas. “Rethinking the Evolution of Consciousness.” In *The Blackwell Companion to Consciousness*, edited by Susan Schneider and Max Velmans, 72–87. Oxford: Blackwell Pub, 2007.
- Quine, W. V. *Word and object* [in eng]. The MIT Press paperback series 4. OCLC: 258620969. Cambridge, Mass: M.I.T. Press, 1975.
- Rescher, Nicholas. *Process Metaphysics: An Introduction to Process Philosophy* [in en]. Google-Books-ID: 8MjR29eJLYIC. SUNY Press, 1996.
- . *Process Metaphysics: An Introduction to Process Philosophy* [in en]. Google-Books-ID: 8MjR29eJLYIC. SUNY Press, 1996.
- . “The Promise of Process Philosophy” [in en]. In *Process and Analysis: Whitehead, Hartshorne, and the Analytic Tradition*, edited by George W. Shields. Google-Books-ID: qhiZ7KOTH64C. SUNY Press, February 2012.
- Rescher, Nicholas, and The Center for Process Studies. “The Promise of Process Philosophy.” *Process Studies* 25 (1996): 55–71. Accessed January 29, 2018. doi:10.5840/process1996252. http://www.pdcnet.org/oom/service?url_ver=Z39.88-2004&rft_val_fmt=imuse_id=process_1996_0025_0000_0055_0071&svc_id=info:www.pdcnet.org/collection.

- Robert C. Koons, Timothy Pickavance-*The Atlas of Reality_ A Comprehensive Guide to Metaphysics-Wiley-Blackwell (2017).pdf.*
- Robinson, Howard. "Substance." In *The Stanford Encyclopedia of Philosophy*, Spring 2014, edited by Edward N. Zalta. Metaphysics Research Lab, Stanford University, 2014. Accessed January 30, 2018. <https://plato.stanford.edu/archives/spr2014/entries/substance/>.
- Ruphy, Stéphanie. *Scientific pluralism reconsidered: a new approach to the (dis)unity of science* [in eng]. Pittsburgh, PA: University of Pittsburgh Press, 2016.
- Schneider, Susan, and Max Velmans, eds. *The Blackwell companion to consciousness*. Oxford: Blackwell Pub, 2007.
- Sider, Theodore, John Hawthorne, and Dean W. Zimmerman, eds. *Contemporary debates in metaphysics*. Contemporary debates in philosophy 10. OCLC: ocn132681443. Malden, MA: Blackwell Pub, 2008.
- Simons, Peter M. *Parts: a study in ontology*. New York: Oxford University Press, 2000.
- Tahko, Tuomas E. "The epistemology of essence." 2016. <http://www.ttahko.net/papers/epistofessence.pdf>.
- Thomson, Judith Jarvis. "Time, Space and Objects" [in en]. *Mind* LXXIV, no. 293 (1965): 1–27. Accessed February 28, 2018. doi:10.1093/mind/LXXIV.293.1. <https://academic.oup.com/mind/article-lookup/doi/10.1093/mind/LXXIV.293.1>.
- Tononi, Giulio. "The Information Integration Theory of Consciousness." In *The Blackwell Companion to Consciousness*, edited by Susan Schneider and Max Velmans, 287–299. Oxford: Blackwell Pub, 2007.
- Tye, Michael. "Philosophical Problems of Consciousness." In *The Blackwell Companion to Consciousness*, edited by Susan Schneider and Max Velmans, 23–35. Oxford: Blackwell Pub, 2007.
- Vailati, Ezio. *Leibniz and Clarke: A Study of Their Correspondence* [in en]. Google-Books-ID: _6aJiMz7rvEC. Oxford University Press, November 1997.
- Van Inwagen, Peter. *Metaphysics*. FOURTH EDITION. Boulder: Westview Press, 2015.

- Van Inwagen, Peter. "Symposia Papers: Four-Dimensional Objects." *Noûs* 24, no. 2 (April 1990): 245. Accessed February 28, 2018. doi:10.2307/2215526. <http://www.jstor.org/stable/2215526?origin=crossref>
- Velmans, Max. "Dualism, Reductionism and Reflexive Monism." In *The Blackwell Companion to Consciousness*, edited by Susan Schneider and Max Velmans, 346–358. Oxford: Blackwell Pub, 2007.
- Wernze, H., M. Hilfenhaus, I. Rietbrock, R. Schüttke, and K. Kühn. "[Plasma renin activity and plasma aldosterone during anaesthesia and operative stress and beta-adrenergic blockade (author's transl)]" [in ger]. *Der Anaesthetist* 24, no. 11 (November 1975): 471–476.
- Whitehead, Alfred North. *Modes of thought* [in eng]. 1. Free Pr. paperback ed. A Free Press paperback Philosophy. OCLC: 595011. New York: The Free Press, 1968.
- . *The concept of nature: the Tarner lectures delivered in Trinity College, November 1919*. Cambridge philosophy classics edition. Cambridge philosophy classics. Cambridge: Cambridge University Press, 2015.
- Whitehead, Alfred North, David Ray Griffin, and Donald W. Sherburne. *Process and reality: an essay in cosmology: Gifford Lectures delivered in the University of Edinburgh during the session 1927-28* [in eng]. Corr. ed., first Free Press paperback edition. OCLC: 551220203. New York: Free Press, 1985.
- Wolfram, Sybil. *Philosophical logic: an introduction*. London ; New York: Routledge, 1989.