Can Discussions in Metaphysics of Time be Applied to Mental Time?

Tora KOYAMA*

Abstract

Metaphysics of time involves plenty of dichotomies, and most of the debates are based on them. It is commonly supposed that contemporary metaphysics of time started with McTaggart's paradox which focuses on the dichotomy between A-theory and B-theory. In the later half of the twentieth century, many philosophers of time came to discuss the dichotomy of the tensed and the tenseless theories. More recent examples are found in the debate between three-dimensionalism and four-dimensionalism and that between presentism and eternalism. This paper aims to explore relationship between metaphysics of time and studies on so-called "mental time" with respect to these dichotomies discussed in metaphysics of time. The conclusion I will draw is that, with one exception, all of the dichotomies can be usefully preserved in studies on mental time. It indicates that the dichotomies accumulated through discussion in metaphysics of time can be useful for scientific studies, at least on mental time.

Key words: mental time, metaphysics of time, dichotomy, usefulness of metaphysics

1. Introduction

Contemporary (or, analytic) metaphysics of time involves plenty of dichotomies, and most of the debates are based on them. This seems to be the case since the beginning. It is commonly supposed that contemporary metaphysics of time started with McTaggart's paradox, which focuses on the dichotomy between A-theory and B-theory, though McTaggart himself introduced C-series as well as A-series and B-series,

* Research Institute for Time Studies, Yamaguchi University, 1677-1, Yoshida, Yamaguchi, 753-8511, Japan

Section 2 is based on my talk at the 48th annual conference of Philosophy of Science Society, Japan. I thank Takuo Aoyama, Yasushi Hirai, Kuniyoshi Morita, Takeshi Sakon, and the audience for the helpful discussion. I also thank the anonymous reviewers whose comments helped me to improve and clarify the manuscript. This work was supported by JSPS KAKENHI Grant Numbers 15K02001.

corresponding to the two theories respectively, to discuss his paradox (McTaggart, 1908). In the latter half of the twentieth century, the debates between A-theory and B-theory came to focus on tense, as the mainstream of philosophy focused on language; many philosophers of time have discussed another dichotomy, one between the tensed and the tenseless theories (e.g., Sellars, 1962). More recent examples are the debate between three-dimensionalism and four-dimensionalism and that between presentism and eternalism. One can easily list more examples.

The present paper aims to explore relationship between metaphysics of time and studies on so-called “mental time”¹ – roughly speaking, the time that human beings perceive cognitively or psychologically, as opposed to the time measured physically – with respect to the dichotomies discussed in the former. If most of the dichotomies are preserved in the latter, there should be parallel arguments between metaphysics of time and philosophical studies on mental time. If not, it would shed a new light on the uniqueness of mental time.

It might seem easy to achieve this aim. At first glance, these dichotomies seem closely interrelated. An A-theorist may well prefer the tensed theory to the tenseless theory, presentism to eternalism, and so on. However, by closely examining the literature, one can easily find several views that do not confirm this expectation, such as eternalistic A-theory, tensed B-theory, and tenseless presentism. This might not be surprising because nowadays philosophers around the world who are interested in the same topic tend to group together and examine every possible view, as scientists do.

Therefore, I first survey the dichotomies in metaphysics of time and examine their relationships in the next section, and subsequently, in the section following that, I explore the relationship between metaphysics of time and studies on mental time.

2. Dichotomies in Metaphysics of Time

This section surveys the dichotomies and debates discussed in metaphysics of time.² However, due to the limitation of space, only six dichotomies are discussed below. Among the dichotomies not discussed here, those about fatalism, causation, and logic should be explored in the future works. Although not exhaustive, I believe the present paper still contributes to studies on mental time.

¹ Mental time travel (Suddendorf and Corballis, 1997) is the most well-known phenomenon studied under the term. Other terms include, *inter alia*, “time perception”, “representation of time”, and “awareness of time”, under which a vast amount of neuroscientific studies have been conducted. But notice that studies on mental time widely range from scientific to philosophical studies.

² The survey follows Markosian et al. (2016), although the details are different.

2.1. A-theory and B-theory

Among the dichotomies in metaphysics of time, the A-theory and B-theory are the most famous and are widely supposed to be the topic with which contemporary metaphysics of time begins. Therefore, I too will begin with this topic.

The basic distinction in McTaggart's argument is a distinction of properties (or "qualities" as per McTaggart's original wording). When we ascribe temporal properties, we can use a series of adjectives such as "past", "present", and "future" on the one hand, and "earlier", "later", and "simultaneous" on the other hand. The former series can be taken as ascribing temporal properties such as pastness, presentness, and futurity, respectively, usually used in predicates such as "is past". They are called *A-properties*. The latter series of adjectives can be taken as ascribing temporal relations such as *X-is-earlier-than-Y*, *X-is-later-than-Y*, and *X-is-simultaneous-with-Y*, respectively. If we focus on predication, it can be considered as ascribing relational properties such as *being-earlier-than-Y*, *being-later-than-Y*, and *being-simultaneous-with-Y*, which are called *B-properties*. A-properties and B-properties are both properties of time. The difference is that the former properties are straightforward in the sense that they can be ascribed in simple predications, while the latter properties are relational so that they involve other objects.

Notice that despite the fundamental difference, A-properties and B-properties are inter-definable. Presentness, pastness, and futurity are to be simultaneous with, to be earlier than, and to be later than a designated event respectively for B-theorists.³ *Being-earlier-than-Y*, *being-later-than-Y*, and *being-simultaneous-with-Y* are pastness, futurity, and presentness when Y is present respectively for A-theorists.⁴

³ Some might be skeptical about the definability for the reason that it is not clear how to designate an appropriate event. If the designated event is not present in reality, these properties defined in this way are not proper A-properties. However, this is an *epistemic* problem of how to know that the time we believe to be present is the true present time (Braddon-Mitchell, 2004), which will vanish if there is no true present time as some B-theorists contend, and remain even if only A-properties are to be considered unless presentism in temporal ontology is true, that is, only present things exist (see 2.4).

⁴ The inter-definability can be confirmed by showing that the temporal order among events obtained from A-properties is the same as the one from B-properties. It is much easier to see how B-properties work than how A-properties do. B-properties are basically relational, and no pair of events *X* and *Y* can satisfy *X-is-earlier-than-Y* and *X-is-later-than-Y* both (at least there does not seem to be any problem if we assume so). Therefore, the class of events forms a partial-ordered sequence based on their B-properties. In the case of A-properties, when an event has presentness, every other event has pastness, presentness, or futurity. Since an event with presentness is earlier than the events with futurity and later than the events with pastness, and all events with presentness are simultaneous with each other (or at least we can assume so), either of the three relations holds of the event to all other events. By applying this procedure to every event in the class, the obtained sequence is exactly the same

McTaggart raises the question of which properties are essential for time. Those who answer A-properties to be essential are called A-theorists, and those who consider B-properties to be essential are called B-theorists.

McTaggart believed that A-properties are essential, primary because time requires change and A-properties involve change, while B-properties do not. An event that is present does not remain present permanently. It was future and will be past. Events with A-properties undergo changes in their A-properties. As for B-properties, the relations B-properties express are permanent. An event that is earlier than another event will never be later than or simultaneous with it. McTaggart concludes that B-properties are insufficient for change, while A-properties are sufficient (and even necessary) for change.

However, McTaggart is not an A-theorist, at least not a simple kind. He argues that A-properties cause a contradiction because no event can be present and past, or any combination of two A-properties, *simpliciter*, while an event must have all of them. We usually think that there is no contradiction because no event has them simultaneously; a present event was future and will be past, but no event is present and past or future. According to McTaggart, this reply presupposes A-properties, because it relies on the notion of simultaneousness or tense, just I invoked them in the above description; the former is a B-property and the latter apparently corresponds to A-properties. To avoid contradiction or circularity, a different set of A-properties are required, whatever they may be. However, the new A-properties too cause contradiction just as the original A-properties, hence we have a regress. The notorious conclusion that McTaggart drew from this argument is that time is not real.

2.2. Tensed theory and tenseless theory

The dichotomy we consider next is the one between the tensed and the tenseless theories. This is about linguistic expressions, unlike A-properties and B-properties. Although the primary reason why this distinction has been introduced seems to be that philosophers in the 1950s or 1960s were inclined to think that linguistic analysis is the right method of philosophy unlike the time when McTaggart's original paper was published, it is easier to understand what these theories are by first considering McTaggart's paradox.

McTaggart's paradox is blocked by denying that the ascription of A-properties causes a contradiction. One way to accomplish it is "taking tense seriously", that is, tense is primitive, and therefore irreducible and unanalyzable, according to the tensed theory (Zimmerman, 2005). The argument given above to derive contradiction is the following: even though we usually ascribe different A-properties to the same single event by using different tenses, such as "was future" and "will be past",

as the one from B-properties.

different A-properties as such are incompatible, hence a different set of A-properties are needed, but it introduces a regress. This argument does not hold when we take tense seriously. As far as different A-properties are ascribed to a single event by using different tense, no contradiction will follow.

A well-known problem with the tensed theory is from the special relativity theory (cf., *inter alia*, Putnam, 1967). Since a tense theorist can avoid McTaggart's paradox by taking tense seriously, she does not need to disagree with other claims of McTaggart, especially the claim that A-properties are essential. It apparently implies that A-properties are *objective* and *real*. This contradicts with the special relativity theory, or it is so argued. If an A-property presentness is objective and real, the present time seems privileged, since it is the central time among others; however, according to the special relativity theory, there is no privileged time, hence no objective or real presentness. A conventional tensed theorist bites the bullet and claims that we do not need to accept all that physics states (cf. Prior, 1970).

It should be noted that such conventional tensed theorists are A-theorists, but a tensed theorist does not have to accept all claims of McTaggart other than the one that A-properties cause a contradiction. Simply put, she can be a B-theorist (e.g., Mellor, 1998). However, perhaps because most philosophers of time have started with McTaggart's paradox, they have only recently realized that there are many unexplored possible options.

The tenseless theory stems from avoiding McTaggart's paradox in a different way. The paradox can be blocked by denying that time requires change, or at least the kind of change that McTaggart supposed in his argument. If time does not require change (or change is simply to have inconsistent properties at different times, contrary to the kind of change that McTaggart supposed to be unavailable for B-theory), there seems no principled reason to deny that B-properties are essential rather than A-properties. If B-properties are essential, there is no reason to take tense seriously. Rather, perhaps tensed expressions can be reduced to tenseless ones, or so the tenseless theorists argue. According to the tenseless theory, the nature of time is to be explained in a tenseless language. The tenseless theorists tend to maintain that B-properties are essential since B-properties do not need tense. However, it would cause no serious problem even if they embrace A-properties as well as B-properties unless a close connection between a linguistic category (tense) and properties is presupposed.

What is favorable for the tenseless theory is that it does not conflict with the special relativity theory. A tenseless theorist does not need any privileged time that physics does not accept. Note that she can accept a privileged time that physics accepts, such as the big bang, but the reason is simply that physics accepts it. The tenseless theory accepts everything physics says about time as far as A-properties and tensed expressions are dispensable. This is why philosophers with a scientific mindset, or who give some priority to science, accept the tenseless theory.

If all tensed expressions can be reduced to tenseless expressions, A-theory will be untenable. It would undermine the central claim of the tensed theory that tense is not analyzable. Unfortunately for the tenseless theorists, most contemporary practitioners believe that probably such reduction is unfeasible (see, e.g., Zimmerman, 2005, pp. 411-2). Similar to any attempts to reduce expressions in ordinary language to expressions in a regimented language, it faces counterexamples, unless the range of expressions is limited *ad hoc*.

2.3. Objectivity/subjectivity of time's flow

The dichotomy of the tensed and the tenseless theories shed a new light on the dichotomy of A-theory and B-theory. The original dichotomy is purely a matter of properties, but the new dichotomy is a matter of *language*. If a certain kind of expressions are primitive and irreducible, what does it imply about properties that are closely connected to the expressions? A bold answer is that since these expressions must be used for every purpose, even when we try to describe the objective reality, or the totality of facts, such properties are indispensable. For tensed theorists who agree with the above answer, A-properties are not only essential but also objective and real. In contrast, for tenseless theorists, they are merely subjective, not real.

The third dichotomy we discuss here is the objectivity/subjectivity or reality/unreality of the flow of time. Several theories of the flow of time have been known to support its objectivity. First, an A-theorist can argue that the flow of time is the change of A-properties; since A-properties are objective and real, so is the flow of time. Second, a tensed theorist can argue that the flow of time is the change from the future tense ascription of a property to an event to the past tense ascription of the same property to the same event; since tense is primitive and irreducible, so is the flow of time.

Both of A-theorists and tensed theorists can embrace the objectivity of the flow of time. However, the connection between these theories and the objectivity is not so strong. This is because A-theory does not claim that the flow of time is the change of A-properties, and B-theory can accept the objectivity of the flow of time as well as the objectivity of B-properties. Similarly, the tensed theory does not claim that the flow of time is the change of tense in the ascriptions of properties, and the tenseless theory can accept the objectivity of the flow of time as well as the reducibility of tense.

Moreover, there is a third theory that supports the objectivity of the flow of time. Presentism is a theory of temporal ontology according to which only present things objectively exist or are real (see the next section for more discussion). A presentist can claim that the flow of time is such that an event comes to existence and goes away. Since such existence is a matter of objectivity or reality, so is the flow of time.

It should be noted that despite that it is natural for A-theorists to endorse any

of the three accounts of the objectivity of the flow of time – the A-theoretic account (the change of A-properties), the tensed-theoretic account (the change of tense ascription), and presentism – B-theorists can endorse the two account other than the first one. A tensed theorist who approves the second account can be a B-theorist as mentioned in the previous section. Moreover, presentism is arguably available even for tenseless B-theorists (Tallant, 2012, sec. 4-5). This suggests that there is no close connection between the objectivity of the flow of time and the two dichotomies discussed previously.

Temporal ontology brings another complexity. The current temporal ontology involves a debate between three theories, so move on to temporal ontology.

2.4. Egalitarianism and non-egalitarianism in temporal ontology

Temporal ontology is the part of ontology involving theories of time, focusing on three rival theories, unlike the case of A-theory and B-theory or the tensed and tenseless theories (e.g., Sider, 2006, especially n. 1). However, it does not mean that there is no dichotomy related to the debate; rather, a close examination suggests that it results from a combination of dichotomies.

The three rival theories in temporal ontology are presentism, eternalism, and the growing block universe theory. Presentism is, as explained in the previous section, the view that only present things objectively exist or are real. Eternalism is, in contrast, the view that all present, past, and future things objectively exist or are real equally. The growing block universe theory is the view that only present and past things objectively exist or are real. It can be wondered if other combinations are possible, such as the view that only present and future things are real. However, it is practically difficult to provide an independent reason for such a strange view. Although it is common to express the difference between the three theories by the combinations of the present, past, and futures, it is reasonable to think that there might be something missing. In fact, the growing block universe theory is quite different from the other two theories. It not only states that what kind of things are real but also that the block universe, the totality of real things, grows as time flows.

An explanation of why only the growing block universe theory has an additional claim is to suppose the dichotomy of ontological egalitarianism and non-egalitarianism of time. According to egalitarianism, there is no ontologically privileged time, while according to non-egalitarianism, there is ontologically privileged time, and the present time seems the first candidate of such privilege. If only the present time is ontologically privileged, then eternalism and presentism are consequences of egalitarianism and non-egalitarianism, respectively. Of course, other versions of non-egalitarianism are possible, but it needs an additional claim to explain why some other time and not the present is ontologically privileged. The claim that the block universe grows as time flows, the additional claim of the growing block universe theory, does a good

job of explaining this.

There are well-known problems with non-egalitarianism in temporal ontology. First, there are propositions that include expressions seemingly referring to future objects (or any object in the area that is not real according to the version of non-egalitarianism). This is similar to the classical problem of empty names. Is the proposition that the present king of France is bald true or false? Russell infamously considers this proposition as false and proposes the theory of description to eliminate the problematic definite description “the present king of France”. Even if the proposition is neither true nor false, it should be explained why the proposition is meaningful. A non-egalitarianist can utilize any theory for empty names, but since expressions referring to future objects usually are not regarded to be similar to empty names, some explanation seems needed.

The second problem is related to the first one. There are propositions that include expressions seemingly representing a relationship to future objects (or any object in the area that is not real according to the version of non-egalitarianism). Because a relationship is usually supposed to require the existence of its *relata*, this problem is basically the same as the problem of empty names in that both of the problems involve expressions that seemingly imply non-existent objects. However, the second problem is arguably more pressing. Causation is a typical relationship between objects located in different times. Application of any theory of empty names to causation seems to require us to modify our understanding of causation, unless a *relatum* in the future (or any area that is not real) is a non-existent object.

The third problem is from truthmaker theory. There are true propositions seemingly about future objects (or any object in the area that is not real). Such propositions must have truthmakers according to truthmaker theory, but what kind of objects can make them true? It is commonly held that truthmakers are the objects referred by expressions in the propositions. For instance, the truthmaker of the proposition that Socrates is a philosopher is Socrates himself. It will not be available for presentism, because Socrates is in the past and a past object does not exist according to presentism. The difference here from the previous two problems is that while the previous ones are more or less matters of language, the current one is a matter of what the nature of truthmaking is. The orthodox truthmaker theorists claim that all contingent truths have truthmakers. If a presentist accepts that Socrates is a philosopher, there must be the truthmaker for the truth, but Socrates himself is not available because he does not exist.⁵

There is a solution to these three problems, namely to assume that there are non-existent objects. If future or past objects are available as non-existent objects,

⁵ Admittedly, some truthmaker theorists claim to abandon Truthmaker Maximalism, the thesis that all contingent truths have truthmakers. However, the thesis is considered as an orthodox one.

they can easily serve as referents of the expressions, *relata* of causal relations, and truthmakers. However, at least from the viewpoint of Quinean metaontology (for details of Quinean metaontology, see van Inwagen, 1999), non-existent objects are not viable. Since there is no substantive difference between to exist and to be an object under Quinean metaontology, there cannot be a non-existent object (it is contradictory that an object is non-existent), or presentism is not a purely ontological claim, meaning that “exist” appearing in the claim that only present things exist (and the noun “non-existent objects”) does not mean existence but a certain property that only a part of objects in your ontology have. You can follow different metaontologies, and some philosophers even claim that the fact that non-existent objects are unavailable under Quinean metaontology shows a serious defect in it. Unfortunately, due to the limitations of space, I will not explore ontological egalitarianism and non-egalitarianism under non-Quinean metaontologies here, and will simply presuppose Quinean metaontology.

Whether non-egalitarianists can solve these problems or not, there seems no reason to suppose that they commit any theory discussed in 2.1–2.2. No doubt A-theorists and the tense theorists are happy with non-egalitarianism. Still, a non-egalitarianist can deny the connection between these dichotomies and ontology for the reason that they are merely a matter of properties and of language independent of the theory of what there is. However, as for the dichotomy discussed in 2.3, the subjectivist view of the flow of time seems unavailable for non-egalitarianism because if the ontologically privileged present for non-egalitarianism is merely subjective, it would be questioned that ontology is about the objective reality. In contrast, every theory is open to egalitarianists.

2.5. Three-dimensionalism and four-dimensionalism of persistence

There is a related dichotomy to the one in temporal ontology: three-dimensionalism and four-dimensionalism. Both are theories of temporal persistence, which state how an object remains the same object through changes (for details, see Sider, 2001).

The usual way to introduce the notion of persistence is by means of the problem of change. (e.g., Hinchliff, 1996). When a change occurs, the same object has different properties at different times. Your shape when you are asleep is different from your shape when you are awake and standing, so your shape has changed after getting up. We usually think that there is nothing strange because we can have a specific shape only at a certain time. However, shape itself is independent of time. Even purely abstract entities such as mathematical objects can have shape. A shape seems an *intrinsic* property, a property such that no other object is relevant to whether an object has it. Why can we have shape only relative to certain times? A theory of temporal persistence is to answer the question and explain how we persist through

changes in intrinsic properties like shape.

According to four-dimensionalism (4D), the answer is that because we are four-dimensional objects extending in not only space but also time (more precisely, space-time), it is one of our temporal parts that has a specific (three dimensional) shape at a time, which means that change is for different temporal parts of the same object to have different properties *simpliciter*.

Three-dimensionalism (3D) opposes 4D. Particularly, according to 3D, we are not four-dimensional but three-dimensional objects, just as we ourselves usually believe so. It is not our temporal part that has a specific property at a certain time. Our whole selves have the property. 3D diverges when explaining how we can accomplish it. For the standard presentism in temporal ontology, nothing can be four-dimensional because reality consists of only objects that exist at the present instance and properties that objects have change as time flows, if it is real.⁶ Another non-egalitarianism, the growing block universe theory can provide a different explanation. Reality is four-dimensional because it is a block universe; not only present objects but also past objects are real, but we are three-dimensional, located in the present. As time flows, reality grows and our properties change. Even egalitarianism can explain how we persist in accordance with 3D likewise.

2.6. Substantivalism and relationalism

The last dichotomy that this paper will discuss is from philosophy of spacetime (see, e.g., Dasgupta, 2015). There is a well-known debate between Newton and Leibniz on the nature of spacetime. The view Newton advocated is called *substantivalism*. According to substantivalism, spacetime itself is an object in which material objects are located. Spacetime is like a container for material objects that stand in spatiotemporal relations. It also implies that spacetime exists regardless of what kind of material objects exist, and the facts of spatiotemporal relations between them hold in virtue of the facts of spacetime.

Leibniz opposed this. There is no object other than material objects that stand in spatiotemporal relations. His view is called *relationalism*. It implies that spacetime itself is not an object and that the facts of spacetime are reducible to, or hold in virtue of, the facts of spatiotemporal relations between objects or events.

Proponents of 4D are inclined to favor substantivalism (see, e.g., Lewis, 1986). However, there is no reason to suppose that 4D and Relationalism are inconsistent.⁷

⁶ For a version of presentism combined with 4D, see Brogaard (2000).

⁷ In fact, Sider (2001, Chap. 4.8) argues against the combination of relationalism and 3D.

3. Implications for Mental Time

This section explores implications of the dichotomies discussed in the previous sections for mental time. The conclusion I will draw is that, with one exception, all of the dichotomies can be usefully preserved in studies on mental time.

First, we will consider the dichotomy of A-theory and B-theory. Mental time is often characterized as the consciousness of past, present, and future (Khoo and Otake, 2017). This may suggest that mental time is closely related to A-theory since pastness, presentness, and futurity of events are A-properties. However, there seems no principled reason not to study mental time from the B-theoretic perspective. We perceive an event as earlier or later than another event just as its A-properties, so we can study the awareness of B-properties just as scientists of mental time have done with A-properties. Some might maintain that the awareness of B-properties may not occur when A-properties are not perceived. However, it is an empirical claim to be confirmed by scientists. Accordingly, even if “mental” B-properties depend on “mental” A-properties, the former is to be studied as well as the latter.

It is even clearer in the case of the tensed theory. Mental time is studied with tensed language as well as tenseless language. Subjects are asked about the pastness or futurity of an event in experiments, as well as if two events are simultaneous or one of them is earlier or later than the other. If scientists of mental time restrict their language to tensed one in their experiments, only restricted conclusions can be drawn from such restricted experiments.

The flow of time needs a subtler consideration. It is commonly assumed that psychological experiments do not imply anything about objectivity or reality. Any result that can be obtained in a psychological experiment will be from a subjective viewpoint. However, it does not mean that the dichotomy of objectivity and subjectivity of the flow of time is useless for the mental time. Even though the conscious actions of subjects in experiments are somehow subjective in the sense that they are always done consciously or intentionally from a subjective viewpoint, unconscious events or activities may not be so. They may be subjective in a different sense, e.g., they entirely depend on physiological or physical states of the subject. Even so, we can call our *conscious* perception of the flow of time as the “subjective” flow of mental time, and *unconscious* one as the “objective” flow of mental time. It will be justified especially when the physical is considered to be objective as most scientists probably think so.

Temporal ontology needs a different consideration. If temporal ontology is taken to be an inquiry of mind-independent reality, mental time might well totally irrelevant. However, if ontology is considered in an old-fashioned Quinean sense, that is, what our best theory is committed to (Quine, 1948), *ontology* of mental time would be an inquiry of what our best theory of mental time is committed to; this should be

a topic of philosophy of mental time.

Another approach to making room for temporal ontology in philosophy of mental time is to take ontology as an inquiry of description of the totality of every phenomenon, reconstructing all that we believe to exist. This is different from ontology as an inquiry of mind-independent reality. We may call the former *descriptive ontology* and the latter *fundamental ontology*.⁸ Descriptive ontology needs a strong apparatus committed to various unusual entities. Perhaps we need non-existent entities such as the present king of France, contradictory entities such as round squares, or fictional entities such as Sherlock Holmes. These entities are usually considered not to exist, but they are still useful in describing a wide range of what we believe. Seemingly, there may well be various theories in descriptive ontology for mental time, and the dichotomy of egalitarianism and non-egalitarianism might be useful to articulate differences or similarities among them.

The dichotomy of three-dimensionalism and four-dimensionalism seems to be handled in a similar way with temporal ontology. If both theories are taken to be theories of persistence in mind-independent reality, it is unclear how mental time is related. If they are taken to be descriptive theories of persistence about mental time – and indeed, most theorists seem inclined to do so in recent years (e.g., Sider, 2011) – both theories are possible alternatives. Although some argument would be needed to be modified, the dialectic seems to remain basically the same. The difference from temporal ontology would be that which theory will win would depend on what theoretical virtues should be preferred.

Lastly, the dichotomy of substantivalism and relationalism is different from the dichotomies discussed in the paper. Since arguably the dichotomy is about spacetime and the nature of spacetime is independent of awareness and perception, there seems no room for substantivalism or relationalism of mental time. Moreover, substantivalism of mental time is apparently untenable simply because we cannot directly perceive (or aware of) the past, the future, or spacetime itself as a container for material objects. At least as far as I am aware, relationalism is the only option among the dichotomy.⁹

⁸ What I call descriptive ontology is a combination of one theorized in Strawson (1959) as opposed to prescriptive one and a deflationist metaontology endorsed in Thomasson (2007). What I call fundamental ontology is one under the methodology revealed in Sider (2001, xiv–xv), which is a combination of descriptive and prescriptive methodologies.

⁹ There is a room for the dichotomy of substantivalism and relationalism in *ontology* of mental time, in which spacetime may be *represented* as an independent container for perceived objects. However, I see no reason to think that this kind of substantivalism is true even in ontology of mental time, so that the usefulness of the dichotomy is still unclear to me.

4. Concluding Remarks

In this paper, I explored the relationship between metaphysics of time and studies on mental time, particularly with respect to the dichotomies discussed in metaphysics of time. Contrary to what seems to be the case at first glance, these dichotomies are not simply interrelated to each other. It cannot be overemphasized that we have found *no close connection between them*. And most of them can be preserved concerning mental time. The only exception is the dichotomy of substantivalism and relationalism in philosophy of spacetime.

This conclusion might be criticized as being insignificant or simply dull. I disagree. Most philosophers tend to think that analytic metaphysics has no implications for scientific studies at all.¹⁰ Such a tendency is not rare even among metaphysicians. On the contrary, the conclusion of the paper indicates that the dichotomies accumulated through discussion in metaphysics of time can be useful for scientific studies, at least on mental time. Not any discussion is useful, however, as the dichotomy of substantivalism and relationalism shows. Of course, most metaphysicians of time do not keep in mind such usefulness. Nevertheless, their discussions can shed a different light on mental time. Even possibilities of collaboration are suggested. For instance, experiments that include only A-properties or tensed language as instructions to subjects might have different results from those that include B-properties or tenseless language. Purely metaphysical discussion can result in a useful resource for scientific studies.

References

- Braddon-Mitchell, David (2004). “How Do We Know It is Now Now?” *Analysis* 64(3): 199–203.
- Brogaard, Berit (2000). “Presentist Four-Dimensionalism.” *The Monist* 83(3): 341–356.
- Dasgupta, Shamik (2015). “Substantivalism Vs Relationalism About Space in Classical Physics.” *Philosophy Compass* 10(9): 601–624.
- Hinchliff, Mark (1996). “The Puzzle of Change.” In James Tomberlin (ed.), *Philosophical Perspectives*, volume 10, 119–136. Cambridge, Mass.: Blackwell.
- Khoo, Er Sin and Mihoko Otake (2017). “Mental time of conversations with photos using speech, event and photographing time.” *Proceedings of the Annual Conference of JSAI* JSAI2017: 1D3OS29b5–1D3OS29b5.
- Ladyman, James and Don Ross (2007). *Every Thing Must Go: Metaphysics Naturalized*. Oxford University Press.
- Lewis, David (1986). *On the Plurality of Worlds*. Oxford: Basil Blackwell.
- Markosian, Ned, Meghan Sullivan and Nina Emery (2016). “Time.” In Edward N. Zalta

¹⁰ The most hostile attitude to analytic metaphysics is found in Ladyman and Ross (2007).

- (ed.), *The Stanford Encyclopedia of Philosophy*, fall 2016 edition. Metaphysics Research Lab, Stanford University.
- McTaggart, J. Ellis (1908). “The Unreality of Time.” *Mind* 17(68): 457–474.
- Mellor, D.H. (1998). *Real Time II*. London: Routledge.
- Prior, A.N. (1970). “The Notion of the Present.” *Studium Generale* 23: 245–248.
- Putnam, Hilary (1967). “Time and Physical Geometry.” *Journal of Philosophy* 64(8): 240–247.
- Quine, W. V. O. (1948). “On What There Is.” *Review of Metaphysics* 2: 21–38.
- Sellars, Wilfrid (1962). “Time and the World Order.” In Herbert Feigl and Grover Maxwell (eds.), *Minnesota Studies in the Philosophy of Science*, volume 3, 527–616. Minneapolis: University of Minnesota Press.
- Sider, Theodore (2001). *Four-Dimensionalism*. Oxford: Clarendon.
- (2006). “Quantifiers and Temporal Ontology.” *Mind* 115(457): 75–97.
- (2011). *Writing the Book of the World*. Oxford University Press.
- Strawson, P. F. (1959). *Individuals*. Routledge.
- Suddendorf, Thomas and Michael C. Corballis (1997). “Mental time travel and the evolution of the human mind.” *Genetic, social, and general psychology monographs* 123 2: 133–67.
- Tallant, Jonathan (2012). “(Existence) Presentism and the A-Theory.” *Analysis* 72(4): 673–681.
- Thomasson, Amie (2007). *Ordinary Objects*. Oxford University Press.
- van Inwagen, Peter (1999). “Meta-Ontology.” *The Proceedings of the Twentieth World Congress of Philosophy* 1999(2-3): 233–250.
- Zimmerman, Dean W. (2005). “The A-Theory of Time, the B-Theory of Time, and ‘Taking Tense Seriously’.” *Dialectica* 59(4): 401–457.

(Received 2018.8.19; Revised 2019.4.13; Accepted 2019.4.20)