A defense of the dynamic theory of time

Heetveld, Laurens

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Laurens Heetveld

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‘Of time you would make a stream upon whose bank you would sit and watch its flowing. Yet the timeless in you is aware of life’s timelessness, and knows that yesterday is but today’s memory and tomorrow is today’s dream’ (Gibran 2021, p.55).

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1. Introduction

Time is a concept that has fascinated philosophers of all centuries. The introductory passage from *The prophet* by Kahlil Gibran in my opinion describes time as it appears to us. It is like a river that flows, while the only moment that is real is the present. Does this reflect the true nature of time? Or is there no such thing as temporal passage, is it just an illusion? Time is perhaps the most abstract entity of all and therefore many have questioned its existence, while others argue that it is real.
In ancient Greek philosophy, during the time of the presocratics, there was already a philosophical debate about the nature of time. Heraclitus argued that time is like a river, it is real and one can never experience the same moment of time more than once, just as one can never step into the same river twice (Savitt 2021). On the other hand, Parmenides argued that there is no such thing as the passing of time. He thought that there is no beginning and no end, everything is simply permanently there (Savitt 2021). In the eighteenth century, Immanuel Kant argued in the *Critique of Pure Reason* that time is a precondition within us that makes it possible to experience the world around us (Kant 2004, p.131). According to his view, time is therefore not something that exists independently of us. In the beginning of the 20th century, J.M.E. McTaggart made a famous distinction between two theories of time, namely the A- and B-theory of time, which has been very influential. In the A-theory of time there is a real distinction between past, present and future, whereas in the B-theory of time one only talks about 'earlier' or 'later' events (McTaggart 1908, p.458). He however argued that both theories of time are incorrect, which I will explain in chapter three.

Currently, the debate about the existence of time is still present within philosophy. There are roughly two theories about time, which are the dynamic and the static theory of time, comparable to the A- and B-theories of time. According to the contemporary version of the static theory of time, time is part of a four-dimensional manifold called *spacetime* (Markosian 2022, p. 3). Time and space are thus treated as relatively similar entities in the static theory of time. I will come back to the notion of *spacetime* and its connection to the special theory of relativity in chapters two and three, as the existence of *spacetime* is commonly thought of as a consequence of the special theory of relativity (Markosian 2022, p.2). More importantly, similar to the B-theory of time, there is no objective temporal passage in the static theory of time (Baron & Miller 2019, p.8). In contrast to this, there is also a theory in which time and space are understood as entities that greatly differ. This is commonly called the dynamic theory of time. This theory defends a three-dimensional spatial world, in which there is, similar to the A-theory of time, objective temporal passage (Baron & Miller 2019, p.8). Time is on this view not just an extra dimension (comparable to the spatial dimensions), but it is something completely different, similar to the fact that the moral dimension is not a spatial dimension either (Markosian 2022, p. 4). In this thesis, I would like to defend the latter theory, namely the dynamic theory of time. To me, it seems very counterintuitive that there is no such thing as time, or the passage of time, independently of us. Time passes, it must be a real thing. If not, how can it be that things in the past seem to be so fundamentally gone? How can I explain the fact that I can only experience this present moment, if all moments in time already exist? These are some of the questions that start to arise if one were to think of time as a dimension that is relatively similar to space, which is how time is treated in the static theory of time.

In 2022, Ned Markosian published an article called '*Five new arguments for the dynamic theory of time'.* As the title suggests, he presents some new arguments in favor of the dynamic theory of time. In this thesis, I want to explore the plausibility of his arguments. In particular, I want to examine the three manifold arguments, which argue against the notion included in the static theory of time that *spacetime* is a unified manifold. The three manifold arguments are the arguments from incommensurability, rotation and location. I will explain these arguments in chapter four of this thesis. The arguments all reach the similar conclusion that *spacetime* is not a unified manifold, because *spacetime* does not obey the principles of incommensurability, rotation and location (Markosian 2022, p. 11-16). If it is not the case that *spacetime* is a unified manifold, the static theory of time collapses (Markosian 2022, p.16). One can then conclude that space and time are entities that greatly differ. In that case it is more plausible to assume that only the present time exists, which makes room for temporal passage and therefore the dynamic theory of time. While reading Markosian's article, I found myself wondering to what extent the conclusion that *spacetime* is not a unified manifold is plausible, as at first glance Markosian's conclusion seems to go against a fundamental theory in physics, namely the special theory of relativity. The research question that I will try to answer in this thesis is therefore the following: To what extent are Markosian's five new arguments in favor of the dynamic theory of time, in particular the three manifold arguments, plausible?

To create a better understanding of the debate at hand, I will start off with a detailed explanation of both the static and the dynamic theory of time. I will then present common arguments against and in favor of the dynamic theory of time. After having set out a clear overview of the debate, I will present the five new recent arguments in favor of the dynamic theory of time by Ned Markosian. I will then add my own voice to the debate by further examining the plausibility of Markosian's arguments, in particular the manifold arguments. In doing so, I will raise what in my view is a promising objection that can be given against all three of the manifold arguments. This objection consists in the possibility of *spacetime* being a unified manifold, while it includes temporal passage. It is the position of the philosopher Tim Maudlin, who unites the four-dimensional block universe with temporal passage (Maudlin 2007, p. 109). It is therefore a position that lies in between the static and the dynamic theory. His modified version of *spacetime* allows for a difference between space and time, while both entities still form a unified manifold. The static theorist could argue that Maudlin's version of *spacetime* is an example of a unified manifold that does not obey the three manifold principles (commensurability, rotation and location, which I will come back to in chapter four), as it allows for a difference between space and time, namely that time passes while space does not. It is therefore an exemption to the usual conception of a unified manifold. I will argue that this objection against Markosian only partly works. It works against the argument from rotation, but the arguments from location and incommensurability survive the objection. Furthermore, I will argue that Markosian's sentimental argument, which is an argument that revolves around the connection between our experience of temporal passage and the dynamic theory of time, is plausible. It is very important for the dynamic theory of time as this argument in particular can be used to argue in favor of *presentism.* I will conclude that as part of the manifold arguments from Markosian are plausible arguments, space and time do not form a unified manifold. Presentism can correctly account for this claim. I conclude

that the dynamic theory of time, that includes presentism, is therefore to be preferred over the static theory of time.

2. Conflicting theories of time

2.1 The static theory of time

I will first explain the theory of time known as the static theory of time, before turning to the dynamic theory of time. The core notion of the static theory of time is that temporal passage is not something that is objective, it does not exist independently of us (Baron & Miler 2019, p.8). It is comparable to the B-series of time as formulated by McTaggart, although much more elaborate. According to the static theory of time, time is part of a four-dimensional manifold, together with the three dimensions of physical space, called *spacetime* (Markosian 2022, p.2). Simply speaking, the existence of *spacetime* is believed to be one of the consequences of Albert Einstein's theory of special relativity (Markosian 2022, p.17). Before Einstein, it was common to think of time and space as two absolute entities that exist independently of each other, which follows from Isaac Newton's theories of motion (Bardon 2024, p. 52). However, in Einstein's theory of special relativity, the temporal order of events is relative to an inertial (non-accelerating) frame of reference and there is no such thing as absolute temporal order or absolute simultaneity (Bardon 2024, p.66). I will further explain how the theory of special relativity can be used to argue against the dynamic theory of time in section 3.2. Coming back to the static theory of time, the concept of non-absolute time is integrated in it. It discards the (Newtonian) view that time and space are absolute entities and accepts the (Einsteinian) view that time and space together form a unified manifold, *spacetime* (Markosian 2022, p. 2). Furthermore, there is no temporal passage, because all times (the past, the present and the future) are contained within *spacetime*. The static theory of time is therefore an example of *eternalism*, sometimes also referred to as the four-dimensional block universe (three spatial dimensions and one temporal dimension) (Savitt 2021). In this four-dimensional block universe, 'no one moment of time is metaphysically special (just as no one location in space is metaphysically special)' (Markosian 2022, p.2). For example, a year that is intuitively in the future, like the year 2501 or even a moment three billion years ahead, is part of *spacetime* and therefore exists, on the static account of time.

Another important aspect of the static theory of time is the counterintuitive notion that physical objects have temporal parts, through which they are extended in time (Markosian 2022, p.2). This is also known as *perdurantism*. According to perdurantism, an object persists through time by having different temporal parts at each moment in time (Curtis & Robson 2016, p. 140). This form of temporal persistence is also present in *spacetime*, in which time is relatively similar to space. Perdurantism and *spacetime* are therefore closely connected. If you were to think of yourself one year ago, you would just be thinking about the temporal part of you that was present at that time. Contrary to your intuitive feeling, which would probably say that the version of you has moved through time to become the person that you are today, time is (like space) somehow built into you in the form of a temporal part. Markosian gives a metaphor to get a clearer grasp of this latter notion. An appropriate metaphor to understand the static theory of time is to think of a filmstrip with many frames, each frame showing a different image of you while performing a movement (Markosian 2022, p.2). Each frame shows a different temporal part of you and the fusion of all these parts is you, 'a *spacetime worm* that curves through the four-dimensional manifold known as spacetime' (Markosian 2022 p.2). I understand this as the view that it is not the case

that the individual frames pass one by one, as there is no independent concept of time available to make this happen, there is no 'play-button' and therefore no objective temporal passage. The filmstrip metaphor also helps to understand the previous point that no moment in time is metaphysically special in the static theory of time. None of the frames is the present moment, similar to the fact that no spatial location is *the* present objective location (Markosian 2022 p.2). According to the static theory of time, the filmstrip is never played, although it is completely here (Markosian 2022, p.5). However, the situation pictured by the dynamic theory of time is completely different.

2.2 The dynamic theory of time

Central to the dynamic theory of time is the idea that the passage of time is objective, it exists independently of us (Baron & Miller 2019, p.8). It is therefore the direct opposite of the static theory of time. Time is on this view very different from all of the three spatial dimensions (Markosian 2022, p.3). Markosian gives the following example to illustrate the difference between the temporal and the spatial dimensions in the dynamic theory of time:

> We cannot meaningfully take the three dimensions of physical space and add the moral dimension to them in order to form a unified, four-dimensional manifold in which physical objects are located and extended. This is because morality is not the same kind of dimension as space. On the dynamic theory, it is the same with time (Markosian 2022, p.4).

In this example, he compares the moral dimension with the temporal dimension, to explain the incomparability of the temporal and the spatial dimensions in the dynamic theory of time. Whether the moral dimension exists is of course another debate. I will leave that debate aside for now, the analogy between the moral and the temporal dimension is what matters most for our present purpose. I think it is clear that if a property like 'good' would exist, it is something radically different from space. The same thing goes for time in the dynamic theory, in which the temporal dimension greatly differs from the spatial dimensions. The difference between time and space will be further discussed in section 5.2.

Furthermore, the somewhat counterintuitive notion of you being a 'spacetime' worm that curves through the spatiotemporal manifold is also absent in the dynamic theory of time. It is not the case that there is only a temporal part of you present at each moment in the dynamic theory of time, you are completely present in the current moment and, as long as you live, in each moment that is to follow (Markosian 2022, p. 4). This position about how objects persist through time is known as *endurantism.* According to endurantism, an object persists through time by being entirely present at each moment in time (Curtis & Robson 2016, p. 136). If you were to look back at yourself a year ago, it is not as if you are looking back on some temporal part of you that was in an earlier position within *spacetime* (that would be the position of the *perdurantist).* You are looking back on something that does not exist anymore, because you have moved through time to become the person that you are at this very moment. You are wholly present at this moment and no other versions of yourself (whether in the past or in the future) exist. The dynamic theory therefore seems to be closely related to presentism, which is roughly the view that only the present time exists

(Baron & Miller 2019, p. 20/27). I will come back to the relation between presentism and the dynamic theory of time in section 5.3.

For a better understanding of the dynamic theory, the filmstrip metaphor that was used to explain the static theory in the previous paragraph can be used. The universe can again be compared to a movie, but the movie is in this case playing (equal to the passing of time) and it is only the current image on the screen (equal to the current moment) that exists (Markosian 2022, p.5). In section 2.1 I explained that in the static theory of time, the universe can be compared to a filmstrip made up of a very large number of frames. The whole filmstrip is however never played, no moment is special or can be described as 'the present'. On the dynamic view however, there is no large filmstrip, there is just the current frame, which then passes into the next, and so on. The current frame is special, it is what the universe is at this current moment (Markosian 2022, p.5).

I will now turn to the most common arguments in favor and against the dynamic theory of time, to create a better sense of its plausibility. The dynamic theory faces several objections, but I will briefly show that these can all be diverted.

3. Common arguments in the debate

3.1 Arguments against the dynamic theory

McTaggart's argument

In 1908, McTaggart published a now famous article called 'The unreality of time', in which he argued against the intuitive distinction between the past, present and future. In the article, he makes a distinction between the A-series of time (in which time flows from the past, to the present and then the future, roughly comparable to the dynamic theory of time) and on the other hand the B-series of time (in which there is only a distinction between earlier and later events, roughly comparable to the static theory of time) (McTaggart 1908, p. 458). He first argues that the B-theory of time is dependent on the A-theory of time for its existence (McTaggart 1908, p.461). This is the case because the B-series of time (which involves properties like earlier and later) already assumes the existence of time, which can only be correctly explained by the A-series of time, which involves actual temporal properties (McTaggart 1908, p. 461). In other words, there is no time without the A-series (McTaggart 1908, p. 461). However, McTaggart argues that the distinction between past, present and future is not as clear as it may seem, because all events possess all three properties (McTaggart 1908 p.468). They are in the future, will at some point be in the present and then move on to the past. The three distinct characteristics apply to all events, which is strange. It is inconsistent that three characteristics which are assumed to be fundamentally incompatible apply to all events and can create temporal passage (McTaggart 1908, p.468). One can object to this by referring to the fact that not all the three characteristics (past, present and future) apply to an event at the same *time,* but then one assumes the existence of time to make the distinction between past, present and future (McTaggart 1908, p. 468). In the objection, the A-theory must be assumed to prove the A-theory and the objection therefore ends up in a vicious circle (McTaggart 1908, p.468). The argument against the A-theory therefore remains to be valid, which is the argument that the A-theory is logically inconsistent as all events possess three incompatible properties (past, present and future). According to McTaggart, the A-theory of time is therefore incorrect. He concludes that time is in fact unreal, there is in reality only a non-temporal series of events, which he calls the C-theory of time (McTaggart 1908, p. 473).

A common strategy to counter the argument from McTaggart against the existence of time is to assume presentism (Bardon 2024, p.89-90). This renders the critique that three distinct characteristics, namely pastness, presentness or futureness apply to all objects insufficient, because (as explained in section 2.2) according to presentism the only time that exists is the present moment. The past is unreal and so is the future, according to presentism. The dynamic theorist can therefore use presentism to counter McTaggart's argument, although presentism faces an objection of its own, namely the truthmaker objection (which I will come back to in section 5.1). Furthermore, one must note that the argument from McTaggart is in essence also an argument against the B-theory and therefore the static theory of time, as it denies the existence of time altogether.

The argument from the special theory of relativity

Another common argument against the dynamic theory is the argument from the special theory of relativity (STR). Together with the general theory of relativity, it caused a revolution in physics and in our conception of time. Before the special and general theory of relativity, it was common to have a Newtonian conception of the universe. In Newton's theory of motion, both time and space can be defined as absolute entities (Bardon 2024, p. 53). They are absolute entities in the sense that if the universe would be completely empty, there is still such a thing as three-dimensional space and time would still pass (Bardon 2024, p.54). Furthermore, time passes independently of everything else, on Newton's view (Bardon 2024, p. 53). However, Einstein proposed a new theory, in which this is not the case anymore. According to the special theory of relativity, the temporal order of events is not absolute and varies relative to an observer's inertial (non-accelerating) frame of reference (Bardon 2024, p.66). In the special theory of relativity, absolute (Newtonian) space and time are therefore discarded and a four-dimensional manifold called *spacetime* takes up their place (Bardon 2024, p.70-71). An event takes place at a certain moment in time relative to a certain inertial frame of reference on this *spacetime* manifold. For example, take a certain point in *spacetime*. From this point, one can only become aware of a limited number of events. This limitation, partly, exists because light always travels at a constant speed ($3*10^8$ m/s), independent of the speed of the source of a beam of light or of the speed of an observer relative to a beam of light (Bardon 2024, p.63). More importantly, one experiences a certain temporal order at this particular point in *spacetime*. However, this temporal order is not absolute. According to the special theory of relativity, the temporal order of events taking place at a given point in *spacetime* is relative to the speed of one's frame of reference (Bardon 2024, p.74). This allows for the existence of other frames of references, in which the temporal order of events differs from the frame of reference I originally mentioned. I will not go into more technical details of the theory here, but one might already sense that this theory forms a big problem for the dynamic theorist. The dynamic theorist sees time as a separate and absolute entity, independent of the spatial dimensions, flowing from the past to the present and into the future. However, in the STR, time is added to the spatial dimensions and more importantly, some events that occur in one frame of reference have not yet occurred or have already occurred in another. The temporal order of events can therefore differ within multiple frames of references. There is therefore no absolute passage of time in the STR, the temporal order of events depends on one's frame of reference. To speak of an objective past, present and future would therefore also be wrong.

While some philosophers take the STR as a good argument against the dynamic theory of time, there are also philosophers who think that while the STR is a good theory in physics, it does not directly apply to a metaphysical theory about the nature of time, like the dynamic theory of time. Yuri Dolev, in his article '*Physics' silence on time',* explains this latter position:

> To recap, physics indeed 'has no possibility of expression' for tense and passage, just as it has no possibility of expression for a host of other important features and aspects of reality. You may conclude from this fact that physics is incomplete, as Hemmo and Shenker (2012). Or you may accept that not everything in reality must fall in the domain

> of physics. But to hold physics as the arbiter as to whether or not tense and passage are real is nothing but dogmatism (Dolev 2018, p.464).

Simply stated, his position is that a physical theory like the STR should not be used in answering certain questions about the nature of time, one of which is the question of passage. That would confuse metaphysics with physics, in his opinion (Dolev 2018, p. 463). You would then assume a *physicalist* position, which is the position that every natural phenomenon falls within the physical realm (Stoljar 2024). However, that is a philosophical position. The claim that it follows purely from the STR that there is no passage of time, is therefore illegitimate, according to Dolev. I will come back to Dolev's argument in section 5.2.

The rate of flow argument

A third common argument against the dynamic theory of time is the rate of flow argument. It is specifically aimed against the 'passing' of time, which is not possible according to the argument. The argument goes as follows: One can only explain the passing of time by referring to itself (Baron & Miller 2019, p.42). For example, time passes at one second per second. This is different to other 'flowing' things, like a river. The flow of a river can be explained by the amount of water that has passed over a certain period, for example. In the case of a flowing river, there is a certain 'variation in one quantity as a function of another' (Baron & Miller 2019 p. 44). The flow of the river varies according to the volume of water that passes. One second per second is however not a meaningful rate, as it cannot be explained by anything external. Time therefore has no meaningful rate, from which one can conclude that there is no objective passage of time (Baron & Miller 2019, p.42).

A good response that the dynamic theorist can give is to deny that temporal passage is similar to what we ordinarily think of as change, namely that it must happen relative to something external (Baron & Miller 2019, p.44). Rather than the usual account of what we see as change, 'temporal passage is not something that happens *in* time, it is something that happens *to* time' (Baron & Miller 2019, p.44). An example of this is the reply from Tim Maudlin to the argument, in his book *The Metaphysics within Physics*. He first clarifies that in his opinion time itself does not flow, it merely passes (Maudlin 2007, p.110). This is the case because he thinks that the concept of 'flow' is dependent on temporal passage. For example, a river only flows because time passes (Maudlin 2007, p.110). He then argues that similar to the fact that a river flows because a certain amount of water has passed over a period of time, temporal passage occurs when temporal states have changed over a certain period of time (Maudlin 2007, p. 112). He gives the following example: One hour into the future, your temporal state has changed, as you are one hour further away from being born (and one hour closer to dying, unfortunately) (Maudlin 2007, p.112). From this example, one can conclude that temporal passage just seems to happen at a rate of one hour per hour, there is nothing wrong with that answer (Maudlin 2007, p.112). This passage happens *to* time, instead of *in* it. In other words, the passing of time at one hour per hour is a primitive feature of our universe. One might object to this explanation of temporal passage that it is not really an explanation. It seems like one must simply accept the fact that there is temporal passage, given Maudlin's explanation. However, every theory must start from somewhere and take some primitive notion as a starting point

(Baron & Miller 2019, p.44). The primitive notion in this case could be to accept temporal passage and build a theory of time around that notion. Maudlin however does give some more explanation about temporal passage being a primitive feature of our universe. I will come back to this while discussing Markosian's manifold arguments in section 5.2.

3.2 Arguments in favor of the dynamic theory

Human experience

Turning to the arguments in favor of the dynamic theory, probably the most intuitive argument for the dynamic theory of time is human experience. If you would ask a stranger on the street about his conception of time, he or she will probably believe in temporal passage and a clear distinction between past, present and future. The dynamic theory of time is far more intuitive than the static theory of time, as we all perceive that time *seems* to pass. This could be, of course, merely an illusion or the way that our brains perceive time. However, the experience of temporal passage remains a very powerful argument in favor of the dynamic theory of time. A good account of the argument from experience is as follows:

> (a) We have experiences as of the passage of time.
> (b) If we have experiences as of the passage of time, then any reasonable explanation for this relies on the passage of time being an objective feature of reality.
> Therefore: TPT. The passage of time is an objective feature of reality (Baron 2015, p. 561).

TPT is an abbreviation for 'Temporal Passage Thesis' (Baron 2015, p.560), which is the conclusion of the argument above, namely that the passage of time is an objective feature of reality. I will come back to this argument in the context of Markosian's *sentimental* argument in favor of the dynamic theory of time, in sections 4 and 5.3. In that argument, Markosian highlights some important experiences we all have of the passage of time and argues that the static theory of time cannot adequately account for these experiences (Markosian 2022, p. 20). In the context of the *sentimental* argument, I will also discuss a possible objection against it, which is to reduce the experience of temporal passage to the realm of psychology.

Asymmetry of time

Another aspect of time that can be used in favor of the dynamic theory of time, is the fact that time seems to have a direction. Some events in our world always happen in a certain order. For example, we always grow older, not younger. One could use these observations to conclude that time has a direction, because there is temporal flow (Baron & Miller 2019, p.134). This seems to be an argument in favor of the dynamic theory, in which temporal flow plays a key role. An objection to this argument is that if one explains the direction of time by appealing to temporal flow, the direction of time becomes intrinsic to time itself (Baron & Miller 2019, p. 134). In that case, nothing can be said anymore about all the asymmetric phenomena that happen *in time* (Baron &

Miller 2019, p. 134). Another option against the idea of temporal flow for explaining the direction of time is to appeal to physical phenomena (Baron & Miller 2019, p.137). The fact that events happen in a certain order can for example be explained by the second law of thermodynamics, which states that entropy can only increase, not decrease. Entropy is a benchmark for the amount of chaos that is present (Baron & Miller 2019 p.127). More entropy means more chaos. An egg that that is cracked and poured into a frying pan, for example, is an increase in entropy. The important fact about this is that entropy never decreases, it only increases over time (Baron & Miller 2019 p.127). This is also known as the second law of thermodynamics. A broken egg does not come back together, at least not spontaneously. The same counts for time, as time never seems to go backward. It is therefore tempting to pose that the fact that time only goes forward is explained by increasing entropy. Simply put, one could say that entropy increases towards the future and decreases towards the past (Baron & Miller 2019, p.139). There is then no such thing as the passage of time, there is only increasing entropy.

There are also objections that can be raised against this 'physicalist' explanation of the passage of time, for example that nothing about entropy itself explains the fact that time goes from low to high entropy (Baron & Miller 2019, p. 139). Entropy is asymmetric, but this does not immediately explain the direction of time (Baron & Miller 2019, p.139). It would be fair to say that the asymmetry of temporal passage, or the asymmetry of the second law of thermodynamics if one reduces temporal passage to increasing entropy, is still one of the biggest mysteries of our universe, there is no clear explanation of this yet. I will come back to the alleged connection between entropy and the passage of time while discussing Tim Maudlin's view concerning the passage of time. Maudlin turns the reduction of temporal passage to increasing entropy around and argues that temporal passage underlies the fact that entropy seems only to increase (Maudlin 2007, p.131).

4. New arguments in favor of the dynamic theory of time

4.1 The argument from personal identity and moral responsibility

The first argument that Markosian presents in favor of the dynamic theory, is the argument from personal identity and moral responsibility. It attacks the counterintuitive consequence of the static theory of time that all objects, including human beings, can be seen as 'spacetime worms' that extend themselves in *spacetime*. If you were to look back at yourself a year ago, you would be looking back at a temporal part of yourself and not your *whole* self, according to the static theory of time. This is the case because your existence is spread out in a temporal dimension that is similar to the spatial dimensions. I have also explained this earlier in chapter three. The argument goes as follows:

(1) The Dynamic Theory gives the correct account of the truthmakers for important truths about personal identity and moral responsibility, but The Static Theory does not.
(2) If (1), then The Dynamic Theory is true.
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(3) The Dynamic Theory is true (Markosian 2022, p.7).

Markosian gives two examples to support the argument: He starts off with an example about personal identity, before turning to an example about moral responsibility. The personal identity example he offers is the following: He can be currently embarrassed about something that happened to him at the age of seven (Markosian 2022, p.5). According to Markosian, the static theory is unable to give a correct truthmaker for that example. The truthmaker for this embarrassment is the following, according to the static theory: 'my current *temporal part* feels embarrassment over something that happened to a *distinct temporal counterpart* that is seven years removed from a still earlier temporal counterpart that is being born' (Markosian 2022 p.6). However, Markosian thinks that this is a strange way of explaining what makes himself being embarrassed true. He argues that it is not his temporal part which is currently embarrassed, but that it is himself who is embarrassed (I understand this as the *whole* of him) (Markosian 2022 p.6). This also applies to the distinct temporal counterparts earlier in time, it is not these parts that are embarrassed (which is the situation according to the static theory of time), but the younger versions of himself. According to Markosian, the crucial mistake here is that 'the thing that feels the embarrassment, according to the static theorist, *is not identical* to the thing that suffered the embarrassing experience' (Markosian 2022, p.6). This is impossible, Markosian argues. He does not think that it is possible to be embarrassed about something that happened to a distinct temporal counterpart of him, he can only be embarrassed about something that happened to (a younger version of) *himself*. In contrast to this the dynamic theory of time can provide us with the correct truthmaker, according to Markosian. What makes it true that he is embarrassed now is simply that 'I feel embarrassment over something that happened to me when I was seven years old' (Markosian 2022, p.6).

Markosian uses the same strategy with respect to moral responsibility. He gives the example of him being morally responsible for carrying out a brave action last year (Markosian 2022 p.7). The static theorist would in this case say that what makes that

true is that some temporal counterpart of him has performed this brave deed last year, while the dynamic theorist would argue that it is him who performed the brave deed (Markosian 2022 p.7). Again, only the dynamic theorist can provide us with the correct truthmaker, Markosian argues. In the next chapter, I will examine the plausibility of this argument. I will now turn to the manifold arguments, which attack a different feature of the static theory of time, namely the idea that time is similar to the three spatial dimensions and that they form a unified manifold together.

4.2 The manifold arguments

The manifold arguments all attack the idea of a unified four-dimensional manifold (*spacetime),* in which there are three spatial dimensions and one temporal dimension which are 'relevantly similar' to each other (Markosian 2022, p.8). According to Markosian, *spacetime* does not obey three principles (the principle of *location, rotation and commensurability*) which in his opinion 'must be obeyed by any *n*-dimensional space in order for that space to count as a unified manifold' (Markosian 2022, p. 9). In each of the three arguments, Markosian explains how *spacetime* does not obey one of the three proposed principles (Markosian 2022 p. 8-17). Because *spacetime* is essential to the static theory of time, the violation of these principles is for Markosian enough to reject the static theory of time (Markosian 2022 p. 8-17). Only the dynamic (and not the static) theory of time can account for the fact that *spacetime* is not a unified manifold, as space and time are incompatible entities only in the dynamic theory of time. I will now explain each argument briefly, although in a different order than Markosian does.

The first argument I would like to present is perhaps the easiest and most intuitive argument out of the three manifold arguments. It is the argument from commensurability. Roughly put, a synonym for commensurability is comparability. If two things are commensurable, they are comparable. One might already have an intuition that space and time are two completely different things and therefore incommensurable. Markosian makes use of this intuition, as he argues that the three spatial dimensions and the temporal dimension are incommensurable with each other (Markosian 2022, p.16). More specifically, he argues that *spacetime* does not obey the principle of commensurability (Markosian 2022, p.16), which is the following principle: 'If several dimensions, d_1-d_n, form a unified manifold, then those dimensions must be commensurable. That is, for any two dimensions, d_i and d_k, among d_1-d_n, it must be possible to compare distances along d_i to distances along d_k' (Markosian 2022 p.16). He gives the example of a rock with a diameter of 4 cm that exists for 10.000 years (Markosian 2022 p.16). According to Markosian, it is not possible to compare the distance of 4 cm to a period of 10.000 years (Markosian 2022, p.16). He argues that the four-dimensional manifold as proposed by the static theory does not obey the principle of commensurability and that it is therefore not a unified manifold, which makes the static theory of time false:

The argument from *Commensurability*

(1) There are no meaningful comparisons between distances along the temporal dimension and distances along any of the spatial dimensions.
(2) If (1), then spacetime does not obey *Commensurability*.
(3) If spacetime does not obey *Commensurability*, then spacetime is not a unified manifold.

(4) If spacetime is not a unified manifold, then The Static Theory of Time is false.
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(5) The Static Theory of Time is false (Markosian 2022, p.16).

The second argument, which is the argument from rotation, is in my opinion an extension of the argument from commensurability. It is perhaps the most difficult manifold argument and therefore requires more explanation than the other arguments. We have just seen that space and time seem to be incommensurable dimensions, at least as far as our understanding reaches. What makes them even more incommensurable is the fact that it is difficult to imagine an object rotating in *spacetime* without altering its intrinsic features (Markosian 2022, p. 12). However, Markosian thinks that such a rotation must be possible, at least conceptually, in every unified manifold. A unified manifold must obey the principle of *Rotation:* 'If several dimensions, d_1-d_n, form a unified manifold, then rotating an object that is located in that manifold, so that its orientation with respect to d_1-d_n changes, will not result in changing the intrinsic features of that object' (Markosian 2022, p. 9). To illustrate the inability of *spacetime* to obey this principle, consider the following example. If one were to visualize the rotation of a brick in a three-dimensional spatial manifold, this can be easily done. Markosian uses the example of a rock with a diameter of four centimeters that exists for 10,000 years (Markosian 2022, p.12). Markosian argues that if one rotates this rock in *spacetime*, it will have a diameter of 10,000 years (in the equivalence of centimeters) and exist for the temporal equivalent of four centimeters (Markosian 2022, p. 12-13). I will however use the example of a brick and describe all three spatial dimensions, to make the example clearer. A brick that is 4 cm high, 5 cm wide and 3 cm deep turned counterclockwise so that its original width is now its depth, is 4 cm high, 3 cm wide and 5 cm deep. More importantly, the *intrinsic features* of the object have not changed. However, turning a brick in a four-dimensional manifold is not that easily imagined. According to the static theory, the temporal dimension is orthogonal (squared) to the spatial dimensions (Markosian 2022 p.13). If you would think of the spatial dimensions being located on the vertical axis and the temporal dimension on the horizontal axis, it is possible to visualize the common way for the static theorist to see this brick. It is a 'spacetime worm' that is 10,000 years long (which is equal to 10,000 years expressed in temporal parts, according to the static theory of time) and extending itself in space at each temporal part (Markosian 2022, p.12). The extension in the three spatial dimensions is then equal to 4x3x5 cm. If we turn the brick counterclockwise, it is now a brick with a size of 4x3x (the equivalence of 10,000 years expressed in centimeters, which is a distance that cannot be determined) lasting for a moment of 5 centimeters expressed in years (which is a temporal interval that cannot be determined). While the 'swapped' distance and temporal interval cannot be determined, Markosian does think that the rotated object has changed. The rotated rock is very different compared to the rock before the rotation, its *intrinsic features* have changed (Markosian 2022, p.13). 'It used to have a roughly spherical shape at any given moment of time, but now it has the shape of a tremendously long cylinder at each moment of its existence' (Markosian 2022, p.13). Furthermore, if it is assumed that intrinsic aesthetic value is real, the aesthetic value of objects also changes if these are rotated in *spacetime* (for example beautiful things like majestic animals, certain buildings, trees etc.) (Markosian 2022 p.14). Markosian therefore concludes that the

principle of rotation is disobeyed by *spacetime* and that it is therefore not a unified manifold, which renders the static theory of time false:

The argument from *Rotation*
(1) There are many objects and events such that certain ways of re-orienting those objects and events in spacetime would alter their intrinsic features (including the shapes, mental properties, moral values, and aesthetic values of those objects and events).
(2) If (1), then spacetime does not obey *Rotation*.
(3) If spacetime does not obey *Rotation*, then spacetime is not a unified manifold.
(4) If spacetime is not a unified manifold, then The Static Theory of Time is false.
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(5) The Static Theory of Time is false (Markosian 2022, p. 14).

The third argument, namely the argument from location, revolves around the principle of location. This is the intuitive principle that 'If several dimensions, d_1-d_n, form a unified manifold, then any object that has a location along one of the dimensions in d_1-d_n must have a location along each of the other dimensions in d_1-d_n' (Markosian 2022 p. 9). If you would think of a three-dimensional spatial manifold, this principle is certainly obeyed by that manifold. Every object (a rock, a car, a table, etc.) that is located in this manifold has a location along the three dimensions. However, if one were to add time to this manifold and therefore create a four-dimensional manifold, a problem starts to arise. According to Markosian, there are many objects that cannot be placed in any spatial dimension but can be placed in the temporal dimension (Markosian 2022, p. 10). Markosian in this case refers to abstract objects, like the singleton set of an individual, numbers, propositions or proposed non-physical objects like souls (Markosian 2022 p.10). If this is the case, *spacetime* does not obey the principle of location, from which one can infer that the static theory of time is incorrect:

The argument from *Location*
(1) There are many objects that have a temporal location but lack a location along any of the spatial dimensions.
(2) If (1), then spacetime does not obey *Location*.
(3) If spacetime does not obey *Location*, then spacetime is not a unified manifold.
(4) If spacetime is not a unified manifold, then The Static Theory of Time is false.
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(5) The Static Theory of Time is false (Markosian 2022, p.11).

4.3 The sentimental argument

The sentimental argument is less technical than the other four arguments, but I agree with Markosian that it is in fact the most forceful argument (Markosian 2022 p.21). It revolves around the fact that there are significant truths about the world, which the static theory of time fails to appreciate (Markosian 2022 p.17). One of the examples that Markosian gives is 'All things come to an end' (Markosian 2022 p.18). The passing of time is a fundamental element of the dynamic theory of time, so it can correctly account for the fact that all things come to an end, according to Markosian. The dynamic theory of time can simply accept that the sentence is true. However, the static theorist cannot do this, because he or she denies the fact that time passes. A paraphrase must be given by the static theorist, which is according to Markosian 'Everything has a latest temporal boundary' (Markosian 2022, p. 19). However, this

sentence has a different meaning. It does not properly capture the inevitable fact that everything that is currently present around you will cease to exist (Markosian 2022, p.19). The spatializing of time, by ascribing some kind of 'border' to it, also lowers the sentimental value of 'all things come to an end' according to Markosian. He compares it to the fact that all things have an 'eastern-most boundary' (Markosian 2022 p.19). He argues that you would not think that is sad, while it is sad that all things come to an end (Markosian 2022, p.19). Admittedly, sometimes it is good that some things come to an end. It is good that wars or other unpleasant experiences end. However, most of the time a feeling of sadness arises if one thinks about the fact that everything ultimately comes to an end. The fact that earth will be taken up by our expanding sun, as it reaches the end of its existence, is sad. Surely most people would agree with this fact. To conclude, the argument goes as follows:

(1) There are certain important yet poignant truths about the passage of time such that The Dynamic Theory is consistent with a proper appreciation of those truths, but The Static Theory is not.
(2) If (1), then The Dynamic Theory is true.
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(3) The Dynamic Theory is true (Markosian 2022, p. 20).

5. The plausibility of Markosian's new arguments

In this chapter, I want to add my own voice to the debate at hand. Specifically, I want to examine the five new arguments that Markosian gives in favor of the dynamic theory of time in his article from 2022. I will give the most attention to the manifold arguments, as I think these are the most interesting and perhaps most controversial arguments, as they argue against the conception of *spacetime* being a unified manifold.

5.1 Plausibility of the argument from personal identity and moral responsibility

I will start off by briefly examining the argument from personal identity and moral responsibility. As the reader may recall, Markosian argues that the static theorist cannot provide good truthmakers for sentences concerning embarrassment or moral responsibility. According to the static theory of time, your temporal existence is spread out across *spacetime*. All these temporal parts together form your existence. However, Markosian argues that it does not seem rational to believe that a current temporal part of you, whatever this may consist in, can (1) feel embarrassment about something that has happened to a temporal counterpart earlier in time or (2) be morally responsible for a brave action performed by a temporal counterpart earlier in time. It is much more intuitive to believe that *you* feel embarrassment about something *you* did in the past. This is so, because this embarrassing moment happened to *you,* not to the temporal counterpart of your current temporal part. In the dynamic theory of time, there are no temporal parts, there is only your current self (and the current state of the rest of the universe), subject to the passing of time. This theory of time can correctly explain the fact that you can feel embarrassment about something in the past, Markosian argues. On this theory, your current self and the version of you in the past, to whom this embarrassing moment happened, are the same thing (Markosian 2022, p.6).

At first glance, this is a very attractive and intuitively plausible argument. It is much more plausible to believe that you feel embarrassed about something that happened to you in the past because this happened to *you*, rather than believe that this embarrassment arises because something happened to a distinct temporal counterpart of your current temporal part. The account of the truthmaker (which explains about what you are currently embarrassed) provided by the dynamic theory is also more elegant and parsimonious. Recalling the truthmakers I mentioned in section 4.1, according to the dynamic theory you can simply point out that you are currently embarrassed about something that happened to a younger version of yourself (as your current self and your younger self are the same thing). In the static theory of time, what you are currently embarrassed about is however something that happened to a distinct temporal counterpart of your current temporal part. The truthmaker of the static theory of time is therefore less parsimonious than the truthmaker of the dynamic theory of time, which makes the truthmaker of the static theory of time less plausible.

However, a simple objection to the argument is that the dynamic theory of time (as proposed by Markosian) can also not provide us with correct truthmakers about actions that happened in the past. Markosian explains that one of the elements of the dynamic theory of time is the fact that 'it is always true that only present objects exist' (Markosian 2022, p.5). According to presentism, only the present time exists, which

includes the notion that only present objects exist. Markosian's version of the dynamic theory therefore involves presentism. The truthmaker objection that is commonly used against presentism can be used against this argument as well. The core of the truthmaker objection is that presentism cannot account for any truths about the past, because according to presentism only present objects exist (Zimmerman 2008, p.218). In other words, the presentist is not in a position to account for any truths that lie in the past, because he or she believes that the past does not exist anymore. Applied to the argument from personal identity, the version of yourself a year ago to which an embarrassing moment happened, does not exist (as presentism is included in the dynamic theory). The static theorist would probably say that something that does not exist, like yourself a year ago, is not a proper candidate for a truthmaker (following the truthmaker objection). In that case, both the static and the dynamic theory cannot provide us with good truthmakers about personal identity and moral responsibility, which make them equally implausible. The argument from personal identity and moral responsibility would then fail, as the dynamic theory of time cannot provide us with a good account of the truthmakers concerning statements about personal identity and moral responsibility as it involves presentism.

Another line of argumentation that the static theorist could pursue is that one should not try to explain truths about personal identity and moral responsibility with a physical theory like *spacetime.* The static theorist could for example reduce these truths to purely subjective experiences that have no place in a physical theory about the nature of the universe, like *spacetime*. According to that possible position, they simply have nothing to do with each other and one should not try to explain truths about the moral dimension with truths about *spacetime*. I have already explained that Markosian stresses the fact that in the dynamic theory of time, the temporal dimension is as incomparable to space as the moral dimension is incomparable to space (Markosian 2022, p.4). One can infer from this claim that the moral dimension is incomparable to *spacetime*, according to Markosian. The static theorist can take this notion one step further and simply deny the whole dimension of morality. If one thinks that because *spacetime* is an empirically verified theory, questions about the *nature* of time are also explained by it, one has a very physicalist view of the universe. This is exactly what the statical theorist does, as he or she reduces the temporal dimension to the fourth dimension within *spacetime.* Physicalists tend to think that everything can be reduced to physical phenomena (Stoljar 2024). The moral dimension cannot easily be reduced to physical phenomena, it is therefore not illogical for a physicalist to abandon the moral dimension. The static theorist can therefore also do this. Following this line of thought, it would make no sense for the static theorist to think of a temporal counterpart of your current temporal part being morally responsible for some brave deed as he or she will probably deny that moral responsibility exists. To be clear, it is not my intention to accuse the static theorist of moral nihilism. The previous passage is simply a possible objection that could be given by the static theorist. Markosian simply dismisses moral nihilism as he briefly mentions the position of moral nihilists (who don't believe in objective, mind-independent moral properties) but then immediately rejects the position (Markosian 2022, p.17). I don't want to delve into this debate here, as it is a whole other topic. The main message here is that the argument above is a possible counterargument aimed at the argument from personal identity and moral responsibility, as moral nihilism is an accepted philosophical position. A similar objection will also be explored in the context of the manifold arguments in section 5.2.

A final remark. The argument on its own is not enough to conclude that the dynamic theory of time is right. As explained in chapter two, the debate between objects having temporal parts or not is very closely connected to the debate between *endurantism* and *perdurantism*. These two positions are both accounts of how objects *persist* through time, namely whether they do so through having temporal parts at each moment in time (perdurantism) or simply by being entirely present at each moment in time (endurantism). What Markosian shows in the argument form personal identity and moral responsibility, if one concludes that it is in fact convincing, is that endurantism is the correct account of persistence. However, one needs more than endurantism to argue for the dynamic theory of time. Endurantism for example does not entail that time has a dynamic nature, or that time is incomparable to space. It is an account of *persistence,* but not an account about the nature of time. The argument from personal identity and moral responsibility on its own is therefore not sufficient to argue in favor of the dynamic theory of time.

5.2 Plausibility of the manifold arguments

Turning to the manifold arguments, the first thing that becomes clear is that they are all arguments against *spacetime* being a unified manifold. The arguments are very interesting, although one can also take a step back and argue that a physical theory like the special theory of relativity should not be used as an argument in any metaphysical theory of time. It can be argued that in doing so, one conflates physics with metaphysics, as Dolev thinks, who I have mentioned earlier. At the very least, using an empirical theory to answer a metaphysical question concerning the existence of the passage of time is something that should be done with great care. Markosian also explains this in his article, as he writes that '*spacetime is a useful framework for observations and predictions concerning the physical world'* (Markosian 2022, p.17). The choice between seeing *spacetime* as a truly existing unified manifold or as a logical construction is up to us, he explains (Markosian 2022, p.17). Physics does not automatically speak the truth, in other words. If one would take this seriously, there is no real need for the manifold arguments to disprove the existence of *spacetime*. One can just reduce the concept of *spacetime* to a consequence of a theory from physics, which should not even be used in metaphysical questions about the nature of time.

However, it makes sense to believe that physics can point us in the right direction in questions concerning the nature of time. In one of his previous articles, Markosian writes that most scientific theories contain a certain amount of philosophy and that a real case of science versus philosophy is very rare (Markosian 2004, p. 31). Other philosophers like Tim Maudlin argue that physics is important for metaphysics. Consider the following passage from Maudlin's book *The Metaphysics within Physics*:

> Metaphysics is ontology. Ontology is the most generic study of what exists. Evidence for what exists, at least in the physical world, is provided solely by empirical research. Hence the proper object of most metaphysics is the careful analysis of our best scientific theories (and especially of fundamental physical theories) with the goal of determining what they imply about the constitution of the physical world. The foregoing thesis strikes me as incontestable (Maudlin 2007, p.104).

If one agrees with Maudlin, philosophers should take the special theory of relativity very seriously and further examine it, to see if it can help answer questions in philosophy about the nature of time. Thus, fundamental physical theories would be philosophically important. They may not be taken to immediately solve metaphysical questions about the nature of time, but they can surely guide us in the right direction where to start in answering these questions. Reducing *spacetime* to something that philosophical enquiry (in this case metaphysical questions about the nature of time) should not go into, is therefore unjust. Markosian also respects the theory of special relativity, as he tests *spacetime* against three intuitive principles which a unified manifold ordinarily should be able to obey.

The second and also the main point that I would like to raise here is the possibility of a counterargument that can be used against all three manifold arguments. The three arguments all share a similar conclusion, namely that *spacetime* is not a unified manifold, because it does not obey one of the principles (location, rotation or commensurability) which a unified manifold normally adheres to. This might be a trivial point, but once this is identified, one can simply attack the three manifold arguments all together. One could for example propose that *spacetime* is a special kind of unified manifold, which does not obey these three principles, but still forms a unified manifold. In that line of argumentation, it is 'special' because the dimensions that form the unified manifold (space and time) differ (enough to account for the fact that *spacetime* does not obey the three principles), but *spacetime* is still a unified manifold. In that case, *spacetime* would be an exception to a unified manifold as commonly perceived (which must obey the three principles). Markosian proposes a similar objection in the context of the argument of rotation, namely to reject the principle of rotation and the claim that if the principle of rotation is disobeyed by *spacetime*, it is not a unified manifold (Markosian 2022 p. 15). *Spacetime* could then still be a unified manifold, although there is a small difference between space and time and it is therefore a counterexample to the principle of rotation (Markosian 2022 p.15). This line of argumentation can also be used against the two other manifold arguments.

Markosian briefly discusses this objection in the context of the argument from location as well and concludes that an alternative explanation of what a unified manifold is must be given by the static theorist if this objection is used (Markosian 2022, p.12). But is that really required? Could the static theorist not simply state that *spacetime* is a unified manifold which fails to obey the three manifold principles because of certain asymmetries between space and time? This is similar to what Markosian writes in the context of the argument of rotation, presented above. If one allows for a slight difference between time and space, although both entities still form a unified manifold, this version of *spacetime* can simply count as a counterexample against all three principles. If this succeeds, the plausibility of the manifold arguments severely diminishes.

Intuitively, the difference between time and space is that time passes and space does not. A question that arises is then the following: if it is possible to unite *spacetime* with an account of time that preserves the fact that time passes objectively, is that account of *spacetime* an example of a unified manifold that does not obey the three manifold principles? I will delve into this question in the rest of this section. I will first give an example of a philosopher that unites temporal passage with *spacetime* and examine if this is a plausible position. I will then test this alternative conception of a unified manifold against the three manifold principles and their associated arguments,

to answer the second part of the question above. Coming back to the first part of the question, a good example of this position is Tim Maudlin's account of the passage of time.

In his book *The Metaphysics within Physics* Tim Maudlin argues for an objective passage of time, coupled to a four-dimensional block universe:

> I am one of those unusual defenders of the block universe who does not deny that there is any objective flow of time. The four-dimensional universe is a single entity of which the *passage* of time, in one particular direction, is an ingredient (Maudlin 2007, p. 109)

As he mentions himself, this is quite an unusual position. Markosian also does not go into this position. It seems to be a unification between the dynamic and the static theory of time, a four-dimensional block universe that somehow incorporates objective temporal passage. Maudlin defends Newton's characterization of time, namely that 'absolute, true, and mathematical time, in itself, and from its own nature, flows equally, without relation to anything external' (Newton 1777, p. 69). In section 3.1, I already pointed out that Maudlin claims that to speak of the 'flow' of time is incorrect, one should speak of the 'passage' of time (Maudlin 2007, p. 110). The objections he defends his view against are relatively similar to the common arguments against the dynamic theory I have already presented in section 3.1. I think we can leave his defense for the passing of time aside and focus on his proposed account of temporal passage within *spacetime* (I assume that if he is a proponent of a four-dimensional block universe, he is also a proponent of *spacetime*), as that matters most for our present purposes. Maudlin discusses two opponents of this theory, by which he explains what his account of temporal passage looks like. The first group of opponents is the 'in-your-face' group, the idealists like Parmenides and Kant (Maudlin 2007, p.126). According to them, Maudlin tells us, change is nothing but an illusion (Maudlin 2007, p. 127). In other words, there is no objective, mind-independent change in the universe. The 'in-your-face opponent' would then argue that without change, temporal passage is not required (Maudlin 2007, p.127). Temporal passage is then also reduced to an illusion. The second group, namely the 'conciliatory' opponents, believe that 'objective, mind-independent change does not require that there be any objective, mind-independent, *intrinsic* passage of time' (Maudlin 2007, p. 127-128). In other words, according to this group of opponents, change is not explained by the passage of time, but by something else, for example the physical phenomenon that entropy only seems to increase (which I have discussed in section 3.2) (Maudlin 2007, p. 128). Maudlin disagrees with both. The objection that change is mere illusion must be wrong, as change seems to be so very fundamentally present in the world around us and there are no good arguments in favor of the position that change is illusional, (Maudlin 2007, p. 127). Secondly, the common way to explain mind-independent change, namely by the direction of entropy, is also wrong. According to Maudlin, it is the other way around. The fact that entropy only increases is explained by temporal passage (Maudlin 2007, p.131). Maudlin explains this by referring to the initial and (possible) final states of the universe. It is common to perceive the initial state of the universe as a state with very little entropy, Maudlin explains. As time passes, entropy only increases, until the final state of the universe is reached (one with very high entropy). The initial state of the universe is 'microscopically typical' because as time passes, entropy will increase (which is our typical conception of how the universe works) (Maudlin 2007, p.131). The

final state of the universe is however 'microscopically atypical', because if time were to pass further along, the entropy would not increase (Maudlin 2007, p.131). In these definitions of the initial and final states, it is clear that the concept of temporal passage plays an important role. One therefore cannot define the initial and final states of the universe without objective temporal passage, according to Maudlin (Maudlin 2007, p.134-135). He therefore argues that temporal passage is an objective feature of the universe, which cannot be explained by anything else. However, he does not really mention how one should further think of the temporal dimension, apart from the fact that it has a one-sided direction.

In a previous essay, *Remarks on the passage of time,* which appears to have been re-used in *The Metaphysics within Physics,* Maudlin presents his position regarding the passage of time more clearly:

> This essay is the first act of a two-act play. My ultimate aim is to defend a simple proposition: time passes. To be more precise, I want to defend the claim that the passage of time is an intrinsic asymmetry in the structure of space-time itself, an asymmetry that has no spatial counterpart and is metaphysically independent of the material contents of space-time. It is independent, for example, of the entropy gradient of the universe. This view is part of common-sense, but has been widely attacked by philosophers (Maudlin 2002, p. 259).

In the above passage, Maudlin writes that the passage of time is '*an intrinsic asymmetry* in the structure of *spacetime'.* He clarifies here that passage is an intrinsic property of time, which space does not possess. Maudlin however does not here discuss any other differences between space and time. Clearly, time and space must on his view be similar dimensions, apart from the fact that he thinks that time has a fundamental direction, because he is a proponent of a four-dimensional block universe (*spacetime*). It is difficult to see how it would be possible for time and space to form a unified manifold if they are not very similar dimensions.

It is important to think about the plausibility of Maudlin's position if one wants to use it to object to the manifold arguments. At first sight, it does not appear to be very plausible, as it unites temporal passage with *spacetime* and the four-dimensional block universe. For example, if all times already exist, why would there even be objective temporal passage? Maudlin's theory alone cannot really give an answer to this question. Temporal passage seems to be intuitively connected to presentism, not eternalism and *spacetime*, as presentism requires a constant passage of time. Examples of a theory that do give an answer to this question are some versions of the *moving-spotlight* theory. Some moving-spotlight theories are more closely related to presentism, while other theories lie closer to eternalism (Emery et al., 2024). To make things easier I will focus on the version of the moving-spotlight theory that combines eternalism with temporal passage, as this is Maudlin's position. This version of the moving-spotlight theory entails that all times (past, present and future) exist, but that there is only one time with a unique metaphysical status, which is the present time (Skow 2009, p. 666). Additionally, the time that possesses this unique metaphysical status, the 'absolute present', keeps changing, making room for temporal passage (Skow 2009, p. 666). Temporal passage therefore consists in the succession of moments that all briefly possess a unique metaphysical status, namely being the absolute present. While it faces some objections, for example McTaggart's paradox regarding the existence of past, present and future times, an advantage of the theory

is that it can divert the truthmaker objection (commonly used against presentism), as it assumes that all times exist.

An example of a moving spotlight theory that clearly discards presentism but includes temporal passage is set forth in an article called *Tense and Reality*, written by Kit Fine. In the article Fine argues in favor of the existence of temporal properties (similar to the A-theory of time) although he maintains an unusual position regarding reality, namely *fragmentalism*. He writes that the connection between temporal passage and the belief in objective temporal properties (he calls it realism of tense, this is similar to the A-theory of time) is usually taken for granted, as temporal passage can be explained by consecutive moments of 'being present' (Fine 2006, p. 404). However, Fine thinks that the time-realist oversees something important. He explains that there is nothing in the property of 'being present' that can account for the perceived passing of that property from the current moment to the next (Fine 2006, p.405). To avert this problem and preserve the notion of objective temporal passage, Fine thinks that one should not think of any specific moment in time as 'the present' (Fine 2006, p.406). In other words, he thinks that there is no 'absolute present' that is equal for all frames of reference, which is also a feature of the special theory of relativity. He therefore proposes two alternative views that can preserve objective temporal passage, one of which is fragmentalism. On the fragmentalist approach, reality is constituted by the fact that a certain time is present (Fine 2006, p. 406). This point might become clearer if one applies fragmentalism to the theory of special relativity, which is also what Fine does, to show that the objective passage of time can be incorporated within the special theory of relativity. Remember that in the special theory of relativity, there is not something like absolute simultaneity. Time is relative to the reference frame of an observer, there is no absolute and objective passage of time. In fragmentalism however, the reference frames of each observer are all equally good (Fine 2006, p. 412). The crucial point here is that each of these multiple frames of references can allow for an objective passage of time. In other words, it does not matter that there is not one single and absolute objective passage of time. Instead, using a fragmentalist view, there are simply multiple frames of reference which each possess an objective passage of time. The passage of time can therefore be incorporated within *spacetime,* on the fragmentalist view. Coming back to the moving-spotlight theory, Fine's theory of time is that there are multiple moving-spotlights, which all have a different absolute present, but none of these is to be classified as *the* single or correct present. The cost of this, however, is that one should give up the idea of a 'single coherent reality' (Fine 2006, p.413), as multiple objective frames of reference imply the existence of multiple equally good 'forms' of reality. I will here leave aside if that is a bridge too far; my point is that a fragmentalist approach is one of the possible ways to account for temporal passage within *spacetime*, which further strengthens Maudlin's view.

A final point concerning the plausibility of Maudlin's view is that, coming back to the argument from moral responsibility and personal identity, his view can in fact provide correct truthmakers concerning truths about moral responsibility and personal identity. I have argued that additional to the static theory of time, the dynamic theory of time can also not provide us with good truthmakers for a sentence like 'I feel embarrassed today about something that happened to me when I was seven years old' (Markosian 2022, p.5), as the truthmaker objection can be applied to the dynamic theory of time (because it includes presentism). However, Maudlin's position can

provide us with a good truthmaker, namely that the above sentence 'is true now because I feel embarrassment over something that happened to me when I was seven years old' (Markosian 2022, p.6). This is the truthmaker that, according to Markosian, can be given by the dynamic theory of time. In this case, it is a correct truthmaker, because Maudlin's position allows for the existence of earlier times, as eternalism is part of his theory of temporal passage. One might object that Maudlin is committed to the truthmaker of the static theorist involving temporal parts, which Markosian (successfully) argues against. As Maudlin is a proponent of *spacetime*, one could argue that he is also committed to *perdurantism* (which I have explained in section 2.1, the view that objects persist through time by having different temporal parts at each moment in time). In *spacetime,* time and space are treated as similar entities. Similar to being extended in space, an object is also extended in time by having distinct temporal parts at each moment in time. Perdurantism is therefore intuitively connected to *spacetime,* in the absence of objective temporal passage, as it is a way to account for temporal passage within *spacetime*. As Maudlin unites objective temporal passage with *spacetime,* he can however just as well be an *endurantist* about persistence. If there is objective temporal passage in *spacetime,* why can objects not just wholly move through the temporal dimension in *spacetime*? Claiming that objects persist through *spacetime* by having different temporal parts at each moment in time, while also being a proponent of temporal passage seems to be a 'double' account of temporal passage. I therefore don't see the immediate need to involve temporal parts concerning persistence in *spacetime*. Maudlin's theory of time can therefore give correct truthmakers concerning truths about moral responsibility and personal identity, which further strengthens its plausibility.

Now that I have explained Maudlin's account of *spacetime* and its plausibility, it is time to answer the question what this all means for the plausibility of the manifold arguments. The first thing that becomes clear is that if one takes up Maudlin's position, the argument from rotation becomes less plausible. If the temporal dimension in *spacetime* is dynamic and passes into a unique direction (towards the future), surely it is not possible to rotate an object in *spacetime.* It does not make any sense to conceive of rotating an object in Maudlin's conception of *spacetime*, because that would alternate the direction of time, which is not possible if it goes into a unique direction. I suppose that the dynamic theorist could respond that this is not the main point of the argument. The argument mainly shows that it is not possible to rotate an object in *spacetime* without altering the *intrinsic features* of that very object. The dynamic theorist would then argue that, although it may in reality not be possible to rotate an object in *spacetime* using Maudlin's account of *spacetime*, one can imagine that the *intrinsic features* of an object will change if one rotates an object in Maudlin's account of *spacetime*. In other words, expressing distance in time and the other way around (which is what happens if one rotates an object in *spacetime*) alters the *intrinsic features* of an object, regardless of the fact that time passes into a unique direction. However, the fact remains that it is simply not possible to somehow 'turn' the temporal dimension in *spacetime*, because it can only move in one direction (from the initial to the final state of the universe), using Maudlin's account of *spacetime.* The response from the dynamic theorist therefore does not hold. Markosian's claim that *spacetime* is not a unified manifold because it does not adhere to the principle of rotation is therefore invalid if one accepts Maudlin's account of *spacetime*, as Maudlin's version of

spacetime is an example of a unified manifold that is not even meant to obey the principle of rotation.

Secondly, the argument from location is more difficult to attack, using Maudlin's view. Even if the temporal dimension in *spacetime* passes into a unique direction, abstract entities still do not seem to be able to fit *spacetime*. It remains true that abstract entities have no location in space, but do have a location in time, even if time passes into a certain direction and space does not. A different objection to the argument is that it does not make much sense that abstract entities must fit a physical model of the universe, which is what *spacetime* is. Can't abstract entities and *spacetime* simply exist separately from each other? One could pose that *spacetime* is a model of the universe used in physics, not meant to accommodate abstract entities like numbers or fictional characters. However, if one assumes that some abstract objects do exist in the temporal dimension but deny that they are in *spacetime*, this temporal dimension would then be another temporal dimension than the one in *spacetime.* But that just seems wrong, there is only one temporal dimension. This objection to the argument from location therefore does not work.

The argument from location however does very much depend on one's belief in abstract objects existing in the temporal dimension. As Markosian rejects *spacetime,* it is possible to do this. On his view space and time are separate and incomparable entities. It is then possible to account for Markosian's claim that abstract objects exist in time, but not in space (which I have explained in section 4.2). However, according to the static theorist, space and time cannot be seen separately from each other, as they are the two ingredients of *spacetime.* Space and time are closely intertwined and inseparable in *spacetime,* therefore it seems odd to assume that an object can exist in space but not in time or the other way around. Thus, the static theorist must make a choice about the existence of abstract objects if he or she wants to counter the argument from location. It is the choice between claiming that abstract objects exist in *spacetime* or do not exist in *spacetime.* Markosian discusses both objections, while I want to mainly focus on the latter option here. It is more rational to believe in the latter option, as abstract objects do not seem to exist in the spatial dimensions. Markosian for example argues that it would be very crowded if every abstract object had its own spatial location (Markosian 2022, p.12). I want to add to this that it is simply implausible that abstract objects are located at any spatial location, as they cannot be perceived by our senses. No one has ever seen an abstract object walking through the streets. If abstract objects do not exist in space, then for proponents of *spacetime* it automatically follows that abstract objects do not exist in time either. Therefore, a reasonable option the static theorist has concerning the existence of abstract objects is to deny that abstract objects exist in *spacetime.* Markosian suggests this objection while discussing the argument, as he writes that 'the most likely objection to this argument will be the following. All abstract objects, it might be claimed, lack both a spatial and a temporal location' (Markosian 2022, p.11). Only then it is plausible to argue that *spacetime* obeys the principle of location, as it simply does not have to accommodate abstract objects anymore. The static theorist could for example pose that abstract objects are a product of our imagination and therefore fictive. However, that does not seem to do justice to abstract objects like for example numbers. Numbers seem to be more than purely imaginary. The fact that there is a certain number of trees in the backyard of my parents seems to be more than something imaginary, for example. The static theorist should therefore come up with an argument to show that

abstract objects do not exist in *spacetime*, while show that abstract objects are more than something purely subjective. That is surely easier said than done, because the static theorist takes *spacetime* as the very fundamental framework of the physical universe.

A possibility the static theorist has is to defend mathematical platonism, which is the view that abstract mathematical objects such as numbers exist and 'are independent of intelligent agents and their language, thought and practice' (Linnebo 2024). In that case, numbers are clearly more than something purely subjective. The static theorist must however also defend the claim that numbers exist outside of *spacetime*, to counter the argument from location. One can argue that this is the case within mathematical platonism. Mathematicians for example are not interested in the spatiotemporal *location* of mathematical objects, one can therefore argue that mathematical objects are abstract entities (Linnebo 2024). Otherwise, mathematics is an inadequate science, which is a conclusion that one ought to avoid in the philosophy of mathematics (Linnebo 2024). It is reasonable to conclude that if numbers do not have a spatiotemporal location, they do not exist in *spacetime.* However, if the static theorist defends the claim that numbers have no spatiotemporal location, *spacetime* is then not as all-encompassing as the static theorist wants it to be. Properties like pastness, presentness and futureness (which are essential to the A-theory/dynamic theory of time, as explained in section 3.1) could then also possibly exist, although *spacetime* cannot explain the existence of these properties. Furthermore, defending mathematical platonism only covers the existence of mathematical objects such as numbers outside of *spacetime,* but not the other abstract objects that Markosian mentions. One of the examples that Markosian gives is the set of propositions that you believe at this current moment, which according to Markosian possesses a temporal location, but lacks a spatial location (Markosian 2022, p.10).

To conclude, it is reasonable to accept that Maudlin's account of *spacetime* must obey the principle of location. Other objections against the argument, like concluding that abstract objects do not exist in *spacetime*, are difficult to defend. The argument from location therefore seems to be a good argument.

Thirdly, we find ourselves left with the argument from commensurability. This is in my opinion the best manifold argument, as it is the most parsimonious out of the three. It is based purely on the fact that one cannot compare a physical distance to a temporal 'distance'. Coming back to the example of Markosian I presented in section 4.2, four centimeters and 10,000 years do seem to be hard to compare. Using Maudlin's account of the temporal dimension, can solely the fact that time passes into a unique direction account for this difference? I don't see how. The difference between time and space is bigger than solely the fact that time passes into a unique direction (while space does not). In that case, the claim that Maudlin's version of *spacetime* is an exceptional unified manifold which does not obey the principle of commensurability is obviously wrong. Maudlin's account of time can therefore not account for the fact that *spacetime* does not obey the principle of commensurability. The claim that *spacetime* is an exceptional unified manifold which does not obey the principle of incommensurability requires a small difference between space and time to account for the fact that distances in space and time are incomparable. This seems to be a difficult, if not impossible, task for the static theorist to fulfill.

There is however another objection that the static theorist can make against the argument from commensurability. This is to argue that it is in fact possible to compare

distances between the temporal and physical dimensions, namely by referring to the speed of light. It is common to measure distances in the universe using *lightyears.* A *lightyear* is the distance in *space*, in a vacuum specifically, that a light beam travels during a certain period of *time*, namely a year (Bardon 2024, p.72). Isn't a lightyear therefore a perfect example of a good comparison of a distance in the temporal and a distance in the physical dimension? It seems like there is in fact a connection between measuring spatial and temporal intervals, namely a lightyear (Bardon 2024, p.72). This is equal to a distance of $9{,}46*10^{12}$ km (*Measuring the universe, n.d.*). Does this objection suffice to argue against the argument from commensurability? Let's see if it works if one applies it to Markosian's example of a rock with a diameter of four centimeters that exists for 10,000 years (Markosian 2022, p.16). The spatial dimension is in this case four centimeters, while the temporal dimension is equal to 10,000 years. Would the temporal dimension expressed in a spatial distance then be equal to $9{,}46*10^{12}$ * 10,000 km? That is an extraordinarily long distance, but one cannot determine if that is equal to a temporal interval of 10,000 years. It is simply the distance that light travels during a period of 10,000 years, but it does not compare space to time. The fact that time and space are incommensurable remains to be true here. The other option is to express four centimeters in terms of a year, $0{,}00004/9{,}46*10^{12}$ year, which is an extremely small temporal interval. It is the amount of time it takes light to travel 4 centimeters, but it does not compare space to time. One cannot determine if that temporal interval is equal to a distance of four centimeters, as space and time are incommensurable. Only the lightyear by itself is a good comparison between the temporal and spatial dimensions, but as soon as one uses it to compare the distances between the temporal and spatial dimensions of objects in *spacetime*, it does not work as space and time are simply incommensurable. A possible answer from the static theorist is to then argue that it is also possible to conceive of distances that are dimensionless. In that case, one should not think of the distances mentioned above as either a spatial or a temporal distance, but just as numbers. My previous point that a distance of $9{,}46*10^{12}$ * 10,000 km is not adequate to describe a period of 10,000 years, would then fail. In that case both are simply numbers and it would then be difficult to make the point that they are not comparable, as they don't belong to a dimension. However, the price that the static theorist pays if he or she gives this response is very high. To purely think of distances in terms of numbers, but not in dimensions, renders the original point of referring to the lightyear as an example of comparing distances between the physical and temporal dimension meaningless. A lightyear can compare two distances, but if one leaves out dimensions, the distances represent nothing anymore. One almost has to think of a distance in the form of a dimension, it is otherwise hard to be able to perceive of any distance. The example of a lightyear as something that is able to compare distances within the spatial and the temporal dimensions therefore collapses, if one argues for dimensionless distances. To conclude, the *lightyear*-objection does not succeed and the argument from commensurability still stands.

Coming back to Maudlin's position versus Markosian's arguments, one could reply the following to the previous matter: 'Why does all this matter to the dynamic theorist? Maudlin and Markosian both seem to argue in favor of temporal passage, right?' Yes, that is true. However, Maudlin couples temporal passage to *spacetime,* in which past, present and future are all equally real (eternalism). In contrast to that, Markosian

couples temporal passage to presentism, in which only the present moment exists. I want to suggest that presentism is preferable over eternalism, as it does more justice to how we experience the world around us. I will come back to this point while discussing Markosian's last argument, namely the sentimental argument. Furthermore, as already discussed previously, presentism is a good way to avoid McTaggart's paradox (Bardon 2023, p.90). It is therefore important that the manifold arguments are plausible, because they support the dynamic theory as proposed by Markosian in which temporal passage is coupled to presentism and they preserve Markosian's conception of the temporal dimension as something that is incomparable to space. In other words, it is important to argue that *spacetime* is not a unified manifold, because that allows time and space to be incomparable entities and therefore makes room for the dynamic theory of time (and presentism in particular). Furthermore, another advantage of space and time being very different (and therefore not forming a unified manifold) is that one can be a presentist about time and not about space (Bourne 2006, p. 159). Presentism concerning only time is much more plausible than presentism that concerns both time and space. It is implausible to assume that only the present spatial location exists, which is what presentism about space entails. Being a presentist about only time seems more plausible. The only time that exists is the present moment and time shows a dynamic behavior as it continuously passes on to the next moment, while the spatial dimensions are static and at rest.

To conclude, it must be noted that Maudlin's account of the temporal dimension is very different from Markosian's account of time, as Markosian argues that the temporal dimension is incompatible with the spatial dimensions, similar to how the moral or modal dimensions are incompatible with the spatial dimensions (Markosian 2022, p.4). The plausibility of the manifold arguments therefore depends on one's conception of the temporal dimension. Given Markosian's conception of the temporal dimension space and time really are something completely different, they can't form a unified manifold. Markosian's account of time can also incorporate abstract entities, as he reduces the temporal dimension to a dimension which is completely incomparable to space. On Maudlin's view, there is a unified manifold, one can treat space and time mathematically similar and construct *spacetime,* but one cannot deny that time has a fundamental direction. Using Maudlin's theory of *spacetime* combined with temporal passage, the argument from rotation is invalid. The arguments from incommensurability and location however still stand, even using Maudlin's view. There is still one more argument from Markosian which I would like to briefly discuss, namely the sentimental argument.

5.3 Plausibility of the sentimental argument

Turning to the sentimental argument, this is the only argument from Markosian that directly defends the presentist component of the dynamic theory of time. Neither the argument from personal identity and moral responsibility nor the manifold arguments argue directly in favor of presentism. Firstly, the argument from personal identity and moral responsibility does not argue for presentism. It can even be used against presentism. The argument concludes with the fact that the static theory of time cannot provide us with a good account of truthmakers concerning sentences about moral responsibility and personal identity, but the dynamic theory of time also cannot provide us with these truthmakers as it includes presentism. The truthmaker objection used

against presentism can therefore also be used against the dynamic theory of time. Secondly, the manifold arguments only argue against the existence of *spacetime,* not in favor of presentism. One might be tempted to say that if *spacetime* cannot be a unified manifold, presentism is the only viable alternative. However, there are alternatives, like for example the growing-block theory in which both past and present times exist, but the future does not (Savitt 2021). The *sentimental* argument however does clearly argue in favor of presentism. The dynamic theory can properly appreciate certain truths about the world, like the fact that everything in the past is for always gone, only if it contains a presentist component. I think that the sentimental argument is therefore very important for the dynamic theory of time because it defends its presentist component.

Consider another example that Markosian mentions in his paper as one of the truths for which the static theory cannot provide a good paraphrase, namely *Nostalgia.* '*Nostalgia:* Every event that has already happened is irretrievably past. The world will never be like that again (Markosian 2022, p.17).' This sentence awakens sadness in me, I suspect it also does the same to you. We sometimes feel sad about everything in the past being for always gone, because the past does not exist anymore. If it would still exist, you might still feel sad because there is no way to reach it, but surely that is less sad than the past not existing anymore. The paraphrase of *Nostalgia* using the static theory of time is the following, according to Markosian: 'There are certain events that are earlier than this utterance, and these earlier events are not duplicated at any time later than this utterance' (Markosian 2022, p. 18). Markosian argues that the paraphrase does not give rise to the nostalgic feelings which do come with *Nostalgia* (Markosian 2022, p.19). I agree with Markosian on this, the fact that a past event is not duplicated in the future is not something that causes nostalgic or sad feelings, while the fact that a past event *is for always past* does cause feelings of nostalgia. Furthermore, in the static theory of time a past event still exists, although one is not able to reach this event. This is due to the fact that in the static theory of time the past, present and future all exist (eternalism). This also lowers the sentimental value of the paraphrase of *Nostalgia* in the static theory of time. Markosian gives an analogy in the context of another example concerning to make this clear, namely the scenario of a friend on a spaceship which you will never meet again (Markosian 2022, p.20). Surely that scenario feels less sad than that friend not existing anymore (Markosian 2022, p.20). The same goes for events in the past. If these would somehow still exist, although one cannot reach them, surely one would feel less sad than when an event in the past is for always gone, right? I think that the sentimental argument therefore argues in favor of presentism and against eternalism (and therefore against *spacetime).* According to presentism, events in the past are in fact for always gone. It indeed seems true that things in the past are for always gone, there is no way for us to somehow 'relive' our lives. This truth, as well as other truths about time, can only truly be accounted for by the dynamic theory of time (Markosian 2022, p. 20).

Markosian suggests that the most plausible objection against the sentimental argument is to place the feelings of sadness that arise due to certain temporal experiences in the realm of psychology (Markosian 2022, p.21). A similar position is the position of Adrian Bardon in an article from 2023, *The Passage of Time is Not an Illusion: It's a Projection.* In this article, Bardon argues that our belief in temporal passage arises out of psychological projection (Bardon 2023, p. 485). Psychological projection regarding temporal passage can be either direct (which is to project one's

experience of time to the outside world and to take it as an objective fact that temporal passage exists), or indirect (which is to attribute our thinking of what change is to temporal passage) (Bardon 2023, p. 493). Bardon ultimately argues that it is a combined account of these two forms of projection that give rise to our belief in temporal passage (Bardon 2023, p. 504). It is unclear, however, how Bardon can respond to the force of the sentimental argument. We experience genuine feelings of sadness when realizing that the past is for always gone. These feelings may be psychological, but does this make temporal passage less real? I don't think so. Feelings of sadness are subjective, but they seem to be caused by something outside of us, something objective (in this case objective temporal passage). The static theorist could object to this, by stating that a certain spatiotemporal distance (which is the replacement of the passing of time in the static theory) within *spacetime* is also something that is objective. This distance can also cause genuine feelings of sadness, like I previously explained using Markosian's example of a friend on a spaceship. However, the spaceship example illustrates that sad feelings that arise when one starts to think about someone being for always gone simply do not match sad feelings about a (large) distance in *spacetime* between yourself and someone else, even if one is not able to bridge that distance.

Furthermore, the static theorist can object that a faulty belief in passage is also something that is objective, which can therefore also cause feelings of sadness. We might think of temporal passage as something that is objective, but at a closer look, that belief is mistaken. Bardon for example compares our alleged sense of objective temporal passage to other (subjective) things like colors or values (Bardon 2023, p. 503). I however object to this comparison. Consider the following passage from Bardon's article:

> Just like intrinsic colour or objective value, objective passage isn't even the sort of thing we could experience. Various kinds of 'seemings' are involved, but we err cognitively in taking such seemings as seemings as of temporal passage. This results in beliefs about the objective passage of time, not because we have an experience as of passage but because we think we do (Bardon 2023, p.503).

Color for example seems to be objective, but taking a closer look, it is not. One could for example argue that color is not an intrinsic or objective property, as our perception of the color of objects is made possible by the reflection of light rays. When sunlight strikes an object, a certain proportion of this light is reflected, which is what we perceive as the color of that object (Kernell 2016, p.59). Which color we see, is dependent on which wavelengths of light the object transmits, absorbs, or reflects (Kernell 2016, p. 59). The color of an object can therefore be reduced to a certain wavelength of light that an object reflects, color is therefore not an intrinsic or objective property of an object. Furthermore, it could be the case that the experience of color may vary between two or more individuals. My perception and your perception of blue might vary, though we still both call it 'blue'. I therefore agree with Bardon that color is not an intrinsic property of an object, that belief turns out to be mistaken at a closer look. However, there is a crucial difference between color and time. It is possible to imagine that a color is a subjective experience, the world is then still relatively the same place. In the case of time however, this is not the case, as we have just seen in the sentimental argument. Abandoning the dynamic theory of time and settling for the static theory of time results in a world that is quite different to our common experience of the world, in

which it is for example much more sorrowful that someone does not exist anymore compared to someone that is located at an unbridgeable distance from you, similar to the example of a friend on a spaceship earlier in this section. Bardon writes that it is not clear how our experience of a world with and without objective temporal passage would differ (Bardon 2023, p. 494). The sentimental argument proves him wrong on this point. It shows that our experience of a world without objective temporal passage does differ from a world with objective temporal passage. The sentimental argument therefore survives the objection that can be given if one assumes that our experience of temporal passage is the result of psychological projection, which is Bardon's position. The passage of time is not the result of psychological projection, but it is objective and real.

6. Conclusion

I would like to conclude with what I believe is the central story of this thesis: As I have argued that two out of the three manifold arguments can resist a plausible objection, namely that Maudlin's theory of *spacetime* combined with objective temporal passage is an example of a unified manifold that does not obey the three manifold principles*,* I agree with Markosian that *spacetime* is not a unified manifold. This makes way for a conception of space and time as incomparable entities, which is the case in the dynamic theory of time. The dynamic theory of time discards *spacetime* and settles for presentism. I have argued that the sentimental argument is plausible and implies presentism. I therefore agree with Markosian that the dynamic theory of time is preferable over the static theory of time.

To recapitulate, I have examined the plausibility of the five new arguments in favor of the dynamic theory of time, given by Ned Markosian. Firstly, I have argued that the argument from personal identity and moral responsibility is incorrect. While it is true that the static theory of time cannot provide good truthmakers concerning sentences about moral responsibility and personal identity that apply to past times, I have shown that the dynamic theory of time can also not provide us with these truthmakers. Secondly, I have argued that two out of the three manifold arguments can resist a plausible objection, which is that *spacetime* is a special kind of unified manifold that does not obey the three principles of location, rotation and commensurability. I have examined whether the manifold arguments fail if this objection is applied, using a version of a unified manifold that is special as it allows for a difference between space and time (time passes objectively while space does not), which is Maudlin's account of *spacetime*. I have shown that the arguments from location and incommensurability can survive this objection and also other possible objections. The argument from rotation however fails, as it does not make sense to rotate an objection in *spacetime* if the temporal dimension in *spacetime* passes into a unique direction. Two out of the three manifold arguments however remain plausible and can be used to argue in favor of the dynamic theory of time. Even a 'special' kind of unified manifold, like Maudlin's version of *spacetime,* cannot be a unified manifold because it does not adhere to the principle of location and commensurability. There must be more differences between time and space, not merely the fact that time passes, to account for the fact that time and space seem to be incomparable entities. One of the options is to therefore abandon *spacetime,* which is coupled to eternalism (or at least regard it as a purely physical theory which does not have a good answer to questions about the ontological nature of time, like Dolev's position in section 5.2) and settle for presentism, in which time is in fact very different from space. Presentism is included in Markosian's version of the dynamic theory of time. The sentimental argument, Markosian's final argument in favor of the dynamic theory of time, also argues in favor of presentism. Thirdly, I have defended the sentimental argument against a possible objection proposed by Markosian, which is to reduce the feelings of sadness we experience due to the passing of time to psychology (Markosian 2022, p.21). I have shown that this objection does not work, which makes the sentimental argument more plausible. A theory that includes temporal passage and presentism is therefore the most viable option for a good theory of time, which is exactly the type of theory of time that Markosian defends, namely the dynamic theory of time. I therefore conclude that the dynamic theory of time is to be preferred over the static theory of time.

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