

6-24-2016

## The Phenomenology of Temporal Experience

Hilda Loury

*University of California, Los Angeles*

Follow this and additional works at: <http://commons.pacificu.edu/rescogitans>

 Part of the [Philosophy Commons](#)

---

### Recommended Citation

Loury, Hilda (2016) "The Phenomenology of Temporal Experience," *Res Cogitans*: Vol. 7: Iss. 1, Article 7. <http://dx.doi.org/10.7710/2155-4838.1147>

This Article is brought to you for free and open access by CommonKnowledge. It has been accepted for inclusion in Res Cogitans by an authorized administrator of CommonKnowledge. For more information, please contact [CommonKnowledge@pacificu.edu](mailto:CommonKnowledge@pacificu.edu).

# The Phenomenology of Temporal Experience

**Hilda Loury**

*University of California, Los Angeles*

Published online: June 24 2016

© Hilda Loury 2016

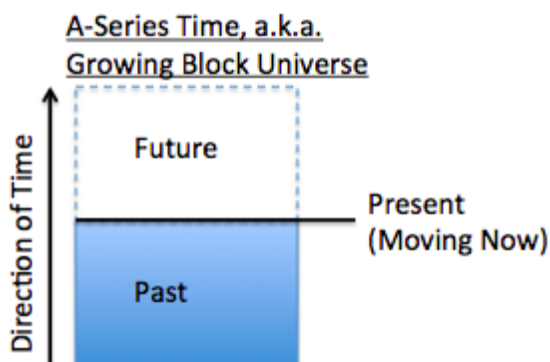
## Abstract

In this paper, I will explore the dissonance between “physical explanation” and “human experience,” while focusing on the experience of temporal passage. As a starting point, I will introduce J.E. McTaggart’s A-Series theory of time and B-Series theory of time. The A-Series illustrates how humans intuitively experience time; the past is fixed and expired, while the present moment seamlessly unfolds forward into an open future. On the other hand, the B-Series is very unlike the intuitive experience of time; “time” is merely the culmination of “static snapshots,” where each snapshot possesses different properties than the preceding snapshot and succeeding snapshot. Furthermore, there is no present moment or direction of time. For the purposes of this paper, and in agreement with McTaggart’s thesis, I will assume that the B-Series theory of time is true. Second, I will consider two problematic implications of the B-Series, i.e. the knowledge asymmetry and the experience asymmetry. If the past and future are equally real and fixed, why do we only possess knowledge about the past, and know nothing of the future? Moreover, why do we exclusively experience time as unfolding in the direction of the future, and never toward the past? Third, I will consider four possible explanations, which are grounded in physical mechanics or neural architecture, that aim to reconcile physical explanation with human experience, i.e. the static snapshot world of the B-Series with the dynamic present as we experience it. These four theories are the Specious Present Theory, Retention Theory, Neuron Theory, and Blind Spot Theory. I will argue that no physical explanation can provide the reconciliation that I am looking for. Fourth, I will consider cases that highlight the inconsistent and subjective nature of temporal flow to further motivate the peculiarity of and explanatory gap between physical explanation and human experience. Finally, in section V, I will argue that the puzzle of temporal experience, i.e. the explanatory gap between physical explanation and human experience, boils down to a problem of qualia, and thus, is a result of the “hard problem of consciousness.”

## 1. Defining the B-Series

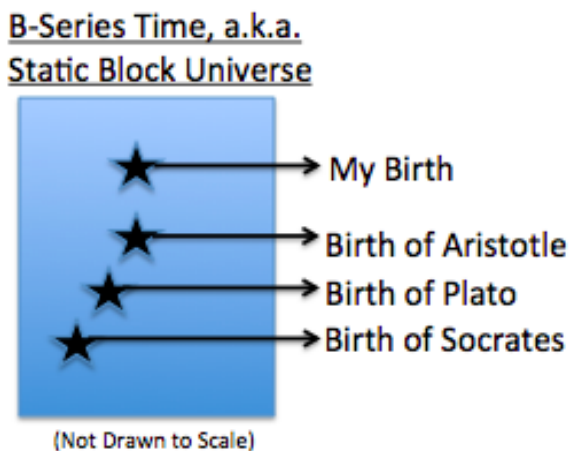
In his “Unreality of Time,” J.E. McTaggart outlines two theories of time, called the “A-Series” and “B-Series” (McTaggart 1908). In the **A-Series**, i.e. the Growing Block Universe, events in time are categorized as past, present, or future. The past is the expired trace of the present, and the present is the “moving now” that unfolds forward in the direction of an unknown and open future.

Events in the A-Series are relational, rather than intrinsic, because the same event will be future, present, and past depending on the frame of reference. For example, the event in which Van Gogh painted *The Starry Night* was present in 1889, future in 1888, and past in 1890. Moreover, in the A-Series, the present moment is experienced as dynamic and evolving, i.e. movement and change are fluid. For example, a bird flies seamlessly across the sky, and the horizon fades from blue to orange. The bird moves through each coordinate it passes, and the sky touches each point in the gradient of color between. This is the intuitive experience of time, change, and motion (See Figure 1).



(Figure 1)

In the **B-Series**, i.e. the Static Block Universe, events in time are categorized as earlier than, simultaneous with, or later than other events. For example, the birth of Socrates is earlier than the birth of Plato, and my birth is later than the birth of Aristotle (See Figure 2).



(Figure 2)

The B-Series is a “static block” because the relations between events will always be the case, i.e. they do not depend on the frame of reference. For example, my birth will always be later than the birth of Aristotle. Moreover, there is no intrinsic difference between past and future because all events, i.e. those considered “past” and “future,” are equally real and in existence (Ismael 2011). There is no “present moment” that moves from the past and into the future. B-theorists view time like space, “as an extended dimension of co-existent locations” (Dainton 2010). Further, movement and change are not dynamic and evolving events, but more like static snapshots that possess different properties than the preceding and succeeding snapshot. For example, at Time 1, the bird was at coordinate (7,12) and the sky was blue. At Time 5, the bird was at (10,6), and the sky was orange. At each moment in between Time 1 and Time 5, the bird and sky possessed different properties. This view is very unlike the intuitive experience of time.

McTaggart presents several arguments to illustrate why the A-Series is false, and motivates why the B-Series is true. Moreover, physics seems to agree with something similar to the B-Series theory of time. I will not present and motivate these arguments here because it is outside of the scope of this paper. For further clarification, see McTaggart (1908) and Dainton (2010). Instead, I will assume that the B-Series is true, and explore the phenomenological implications of this unintuitive picture.

## II. Asymmetries in a B-Series World

There are two problematic implications of the B-Series that are antithetical to the human experience of time. They are the knowledge asymmetry and the experience asymmetry. The premise that “there is no intrinsic difference between the past and future” is difficult to grapple with. The knowledge asymmetry acknowledges this problem. First, it explains how we have accurate and detailed information about the past, but we know nothing for certain about the future. We may have reliable predictions, expectations, or hopes for the future, but we don’t know what will happen. For example, I know for certain that Barack Obama won the 2012 presidential election. I recall seeing the results on television, and there are articles written about it that I can locate in archives. However, no one knows who will win the 2016 election. There is no information in circulation on the matter. Second, we cannot change events in the past, but we feel that we can encourage or prevent events from happening in the future. The past feels closed, while the future feels open to possibilities. Perhaps there is no intrinsic difference between the past and future, but there is certainly an experiential difference in the way we relate to both past and future.

Ismael attempts to make sense of the knowledge asymmetry in terms of “memory” and “expectation.” She explains how our knowledge of the past is the result of episodic memory weaved into an autobiographical narrative, and how the future is a series of expectations that will eventually become known near the end of our life (Ismael 2011). However, the fact that we will never know the content of the future before it happens still remains a mystery. Further, we will only know the events of our own lifetime, and nothing beyond that. Perhaps an outside observer, e.g. a deity, can experience the static block universe as it is, and it may be a mere epistemic limitation of human experience that we cannot. However, it remains a large and loaded question why this is the case.

Second, it is difficult to comprehend that the experience of a “moving now,” which unfolds in the direction of the future, is an illusion. The experience asymmetry acknowledges this problem by explaining how our lives always feel like they move forward into the future, and never backwards into the past. This feeling is known as a “phenomenal future-directed arrow.” The following two thought experiments illustrate how the experience asymmetry is legitimate because it will always be the case.

(1) *The Reverse Universe*: You fly a spaceship into a universe where all events occur in reverse. However, you would still feel your experiences unfolding forward (Dainton 2010).

(2) *The Past is the Future*: You wake up one day to find that the past is completely unclear, yet you know with absolute certainty what the rest of your day, and life, will look like. However, your experience would still unfold toward the future you know for certain. This thought experiment intends to illustrate how memory is independent of phenomenal flow (Dainton 2010).

Consider a third thought experiment—Avicenna’s “Flying Man” in new context.

(3) *The Floating Person*: Imagine you are in a sensory deprivation chamber. Your five primary senses are muted, and you have no memory of the past or expectations for the future. You will still perceive your experience as being in the present, and time as passing and moving forward.

These cases are meant to highlight that, in regards to human experience, it will always be the case that experience unfolds forward into the future. We experience a phenomenal future-directed arrow, even though the B-Series and physics make it clear that it does not exist outside of our experience. Even the most convincing evidence in support of the B-Series cannot mute the intuition that the knowledge and experience asymmetries are puzzling.

### III. Reconciling “Static Snapshots” and “Dynamic Present” with Physical Explanation

If events in the world consist of static snapshots, then it appears to be a feature of human psychology that makes us experience time as “flowing.” I will discuss four theories, which attempt to close the gap between physical explanation and the human experience of time, that consider possible physical mechanisms responsible for temporal experience. They are Specious Present Theory, Retention Theory, Neuron Theory, and Blind Spot Theory.

First, there is the **Specious Present Theory** (SPT), which was coined by the E.R. Clay, but further developed by William James (James 1890). James aimed to provide a theory about why our experience is phenomenologically fluid. SPT describes the present moment as a “temporally extended window” that consists of an indefinite number of moments. The edges of the temporal window are undetectable because each temporal window overlaps with the window before and after it to create a continuous flow of experiences. For example, at Time 1 there are moments A B C D E, at Time 2 there are moments B C D E F, at (T3) there are moments C D E F G, and so on (James 1890).

Sean Kelly illuminates problems in SPT by asking the following three questions. First, how can one directly experience something in the past? In the window A B C D E, how could one directly experience A at D? If it is in the past, it is no longer being directly experienced. Second, how can one be directly aware of an extended duration? In other words, how could one experience A B C D and E simultaneously? Third, how can one be directly aware of an event that is about to happen? In other words, how could one directly experience D at A? If it is in the future, it is not being directly experienced (Kelly 2005). Kelly shows that the Species Present Theory raises more questions than it answers. What are the biological mechanisms responsible for the Specious Present? What is the size of the temporally extended window, anyway? SPT is not as parsimonious as Ockham would have liked.

The **Retention Theory** (RT), introduced by Husserl, attempts to solve these problems by eliminating the claim that past and future are directly experienced, which is the main cause of contention in SPT. Instead, RT introduces “retention” and “protention.”

Consider the case of music. When I listen to a piece of music, the notes flow like water in a stream. With the addition of each note, I don’t replay every previous note in my mind to make sense of the music. However, the previous notes seem to be retained in my mind to form a coherent representation of the song, all while harmony, melody, and notes continue to be added. Husserl calls this phenomenon “retention.” It is the act of perceiving an event as “just-having-been” (Husserl 1893-1917). Further, with the

addition of each note, we form an expectation of what is about to come next; this is “protention.” In RT, we don’t directly perceive moments in the past and future, like in SPT, but instead maintain an immediate memory and an immediate expectation of moments (Ismael 2011). However, Kelly rightfully argues that Husserl merely names it, but fails to explain it, and explanation is what we are trying to achieve (Kelly 2005). Furthermore, RT may name and describe the illusion of the dynamic present that we are concerned with, but it fails to make any sense of the knowledge and experience asymmetries.

I will call the third theory **Neuron Theory** (NT). The purpose of NT is to explain temporal experience through the realization of physical processes, i.e. by correlating representational content with neural states (Lee 2014). Neurons in the brain are constantly firing. The anatomy of neurons is not significant here, but the following information is. Neurons often fire in rapid succession; this is called temporal summation (Pinel 2014). According to Lee, neuron firings that overlap in time are responsible for producing representational content that is continuous (Lee 2014). This may account for the experience that time is felt as moving forward.

I find this theory fascinating because it has explanatory power in line with the values of cognitive science, i.e. neural states correlating with representational content. However, this theory still suffers from a metaphysical elephant in the room, the problem of causation, which causes contention in most theories provided for the experience of fluidity in a static world. It is unclear how movement and change occur at all in a B-Series world. The firing of neurons is an extended process of cause-and-effect, and yet the B-Series hiccups when addressing movement and change as “different events have different properties at different times.” It is difficult to explain how this cause-and-effect dependent process occurs at all, when events in the B-Series world are disconnected. However, aside from the important metaphysical elephant, this theory seems to be the most promising. With further research and investigation on the matter, examining neural correlates could bear some promising explanations on why time is felt as moving forward.

Finally, the fourth theory to consider is the **Blind Spot Theory** (BST). Humans, and most other vertebrates, possess a spot in the back of our eyeballs that contains no photoreceptors so the optic nerve can extend out of the eyes and connect to the brain. Because of the way our anatomy is structured, there is a spot in our vision where we do not receive any visual data, i.e. the “blind spot.” However, our brain fills in the gaps to create a phenomenological picture that is complete, i.e. “completion” (Pinel 2014). It is very likely that our brain also conducts completion to blur static snapshots of the world together to produce the appearance of a fluid continuum. But again, the knowledge and experience asymmetries remain untouched.

The four theories just described are not mutually exclusive; it is possible for them to operate together to produce a phenomenology of the world that appears dynamic and fluid, even if in reality, events are disconnected and static. Further research in biology, chemistry, and physics may illuminate physical truths regarding these matters. The sciences certainly succeed in showing us that the world is very different from the way we experience it. But that is precisely the thread I want to pull on. It seems that no physical explanations, or their future advancements, are capable of explaining away the asymmetries that are deeply woven into our experience of the world and time.

#### **IV. The Subjective Nature of Temporal Extension**

Clocks and calendars operate in an objective manner. Milliseconds, seconds, minutes, hours, days, weeks, months, years, and decades are held to quantifiable standard and measured in systematic intervals. However, our phenomenological experience of time appears to be relative and subjective in nature, even when measured by objective intervals. For example, two periods of time can be of the same objective measurement, e.g. “two hours” or “one day,” yet the phenomenology of the experiences, i.e. what they feel like, can vary greatly within the same person and across persons. Here, the explanatory gap becomes an explanatory abyss. Consider the following cases.

(1) **Hard and Easy:** Imagine you are in a one-and-a-half hour yoga class. The sequence is difficult and the room is hot. When in a difficult pose, every passing second is acknowledged and felt. But after the class, the time it takes you to eat dinner and commute home is also one-hour-and-a half, yet it passed much quicker. Seconds escaped without notice.

(2) **The Identical Twins:** Imagine a pair of identical twins, Y and Z. They are sitting in the same lecture. Y is intensely interested in the subject matter, whereas Z is bored and uninterested. For Y, the same two-hour lecture passes quickly, but for Z, the lecture seems to drag on...

(3) **New and Old:** A twenty-one-year-old complains that the next year, when they finally turn twenty-one, is dreadfully far away; the year feels especially long. However, for a seventy-year-old, the next birthday arrives too quickly; the same year feels especially short.

The following three cases are intended to illustrate how intervals of time can be measured using clocks and calendars; yet, the experience of them can differ greatly within and across persons. It is possible that we can tell some sort of psychological story to make sense of this.



The first case may be explained by attention. It is possible that when I am in a challenging yoga pose, the present experience is highlighted and my attention is completely fixated on the task at hand. I discard any irrelevant thoughts and focus on survival. Hence, time appears to pass slower because I am attending to every passing second. The same is not required of me when I am partaking in casual activities after-the-fact.

The second case may be explained by mindfulness. When we are undergoing a pleasant experience, e.g. learning something that is intriguing, we tend to become more mindful. We purposely activate our focus and attention on the subject of interest. In mindfulness, it seems as if we purposely slow our experience of time to collect all the data before us. When we are uninterested, our focus and attention loosens its grip, and we allow time to pass quicker.

The third case may be explained by novelty. The twenty-year-old has not had as many life experiences as the seventy-year-old. The twenty-year-old experiences novelties around each twist and turn, whereas the seventy-year-old is more accustomed to the conditions of life. Moreover, the attention of the twenty-year old may be extremely sensitive to the passage of time because they are fixated on a point in the future, i.e. their twenty-first birthday. The seventy-year-old is probably more focused on the present.

Carla Merino-Rajme composed a theory to make sense of the varied phenomenology of duration, which she attributes to “absorption.” She explains how our experience of duration depends on the activity we are absorbed in at the moment, relative to other activities expired or forthcoming around it. The “timeline” of the activity we are absorbed in, is weaved into a greater timeline consisting of different activities with their own timelines (Merino-Rajme 2014).

Merino-Rajme’s paper inspired the following thought. If I am in a difficult yoga pose, my temporal points of reference are the beginning of the pose and the end of the pose. The timeline of the pose is relatively short, and thus, my attention is distributed more potently across each passing second. However, if my temporal points of reference are spanned farther apart, my attention is allocated less to each passing moment. Time and attention operate under the law of supply and demand.

Regardless, it is clear that no matter how hard we try to objectively measure time, it will always have a subjective duration to it. In the following section, I will argue for the thesis of my paper, that the puzzle of temporal experience is a problem of qualia, and similarly, a result of the “hard problem of consciousness.”

## V. The Puzzle of Temporal Passage and the “Hard Problem”

Sean Kelly explicating states that the puzzle of temporal experience is not a result of the “hard problem of consciousness” (Kelly 2005). I disagree. I will argue that the puzzle of temporal experience is a result of the problem of qualia, and thus, the “hard problem of consciousness” (Chalmers 1995) on the basis of three reasons:

- 1) Biological mechanisms responsible for temporal experience and temporal experience itself are not identical.
- 2) The length of duration is objectively measurable, but the experience of the duration is subjective.
- 3) I will never know how time is experienced by other beings outside of myself.

First, I argue that the biological mechanisms responsible for temporal experience and temporal experience itself are not identical. This point is similar to the fact that physical explanation does not completely align with human experience. If I could experience the world outside of my human perspective, the world would be unrecognizable. I would experience solids, liquids, and gases as masses of atoms, molecules, and ions in motion. Further, I would experience light and color as wavelengths, and I would experience more wavelengths than I was previously capable of detecting. It is clear that my human perspective is a representation of something outside of myself, assuming that the world outside of myself exists.

As a result, I am inclined to consider distinct perspectives of the world as “dimensions,” or facets of the world that is being represented. For example, if the grand objective reality was “R,” my experience would be “r1,” yours would be “r2,” and every other person and species would have their own representation of “R” in the form of “rX.” It would be foolish to argue that objective “R” and my measly “r1” were identical. Sure, my perspective is a result of, a representation of “R,” but they are not the same.

Consider this example. The HTML coding for a website and the design it produces are not identical. They represent the same thing, but they are not the same in themselves. An HTML code is a compilation of brackets, letters, and numbers, e.g. the code for the color white is “FFFFFF.” However, if you put the HTML code and the final website design side-by-side, it is apparent how different the two are. The code “FFFFFF” surrounded by brackets symbols, and the white background it produces, look very different. Here, the code is the physical explanation for time, and the appearance of the background itself is the phenomenology of the experience of time. We could conduct years and years of scientific research to pinpoint the exact mechanisms responsible for the experience and perception of time, e.g. advancements in the Specious Present Theory, Retention Theory, Neuron Theory, Blind Spot Theory, as well as new theories,

yet we would have nothing objective, i.e. independent from experience, to say about the fabric and texture of time itself. Just like “R” and “r1” are not identical, time and the experience of time are not identical.

Second, the length of duration is objectively measureable, but the experience of the duration is subjective. A calendar day is objectively measured as “24 hours.” It is strange, however, how my experience and your experience of the same calendar day can feel very different. For example, if I am engaging in a particular exciting day at school, i.e. my classes are challenging and fascinating, I have several meetings to attend and work to complete at the library, 24 hours seems to fly by. However, imagine you have a particularly boring day. No work requires your immediate attention, no meetings or classes are scheduled, and you decide to spend the day partaking in slow and relaxing activities. The same “24 hours” may feel like it takes longer to elapse.

I would like to point to something here. In his *Being and Time*, Heidegger makes a distinction between “ready-to-hand” and “present-at-hand.” When an object is ready-to-hand, e.g. a functioning cellphone, we are “absorbed” in the use of it in the ordinary sense, perhaps to achieve some end, without contemplating it for what it is. But suppose the cellphone is to lose battery power, suddenly it becomes “present-at-hand,” or present to us for exactly what it is, a hunk of metal and glass. The “brokenness” and dysfunction of the phone rips us out of absorption, and reveals the characteristics of the object itself and the value of it to us. (Heidegger 1962).

The point of this discussion of Heidegger is this. Perhaps when we are “absorbed” in our day, i.e. busy engaging in particular activities, the passage of time is ready-to-hand. However, when we are bored or no longer engaged we are ripped out of absorption, and there is a brokenness or dysfunction that is achieved. The brokenness of our own boredom or fixation makes the passage of time as suddenly “present-at-hand,” and we are fully aware of it for what it is, and thus, time passes more slowly.

I find Heidegger’s discussion of absorption and brokenness to be very apt in explaining our experience of time. But it serves another purpose. It highlights the phenomenology of temporal passage as phenomenology. It illustrates the subjective nature of the experience of time. It seems as if no discussion of neural correlates or biological architecture can explain the fact that experience can be varied in this way. No amount of objective measuring of time, e.g. minutes, hours, days, can account for the feeling of the duration of those measurements. An experience of temporal extension will be measured in objective intervals, but the experience of duration within those intervals is subjective.

Third, I will never know how time is experienced by other beings outside of myself.

A person who has never experienced the color green but possesses every piece of physical data about the experience, i.e. the neurophysiology of vision science, the structure of the wavelength of the color green, the resulting mechanism in the nervous system, etc., will still not understand what it is like to see the color green (Jackson 1982). Moreover, it is impossible to explain what C minor sounds like to a deaf person who has never experienced the sound of it. You can tell me in terms of minutes how long it took for a certain event to elapse for you. But I will never know how long that event felt for you.

The point is, just like there appears to be an “explanatory gap” between molecules and mind, there also seems to be an explanatory gap between the account of time made by physicists and the experience of temporal passage itself. Just like how I will never know if I have an inverted spectrum, or what it is like to be a bat (Nagel 1974), I will never know how you experience time, and if it is different from the way that I experience time. Clocks and calendars may attempt to measure these intervals objectively, but it seems like they are hardly touching the measurement of our experiences. Our subjective experience of temporal passage occurs in accordance with objective intervals, i.e. seconds, minutes, etc, yet the experience of them can be very much distorted depending on the activity, person, or frame of reference as illustrated in the thought experiments above. There is no way to tell how a person outside of you, or even a species outside of you, is experiencing the passage of time. For these reasons, I argue that the puzzle of temporal experience is a problem of qualia, and as a result of the hard problem of consciousness.

## VI. Concluding Remarks

Philosophy of Time is a difficult topic to write and think about. To borrow Heideggerian terminology once more, we suffer from the “paradox of proximity.” Temporal experience is so intimately weaved into the fabric of our experience, that it is almost undetectable and difficult to isolate.

I am confident that a further development in the study of cognition, as well as, further research and experimentation on the matter will illuminate problems and reveal some answers regarding the mental and neural architectures that are responsible for temporal perception and experience. I do not argue that there is “no point” in conducting further research or that we will never make advancements in our understanding of temporal experience. Furthermore, it is correct that sometimes “five minutes” really feels like “five minutes.” My intentions are to shed light on the strange cases, peculiarities, and non-ideal cases of temporal experience to acknowledge how strange it is really is.

Philosophy of time is a very fascinating and underrated area of research. I am sure with more time and resources, this paper could be a long thorough exploration and

investigation of the topics at hand. My opinions and arguments presented on the matter are the result of intuition. I find it very difficult to reconcile the fabric of experience, particularly regarding temporal experience, with physical explanation. I am extremely sensitive to the explanatory gap between Physicalism and phenomenology, and the puzzle fascinates me to no end. That being said, I am certainly open to literature and dialectic against my views regarding the explanatory gap, the puzzle of temporal experience, qualia, and the hard problem itself. However, I have yet to find any satisfying discussions on the matter, which completely hit the mark, in my studies thus far. But until then, I remain curious and receptive.

## References

- Chalmers, David J. (1995). "Facing Up to the Problem of Consciousness." *Journal of Consciousness Studies* 2 (3): 200-19.
- Dainton, B. (2010). "Temporal Consciousness." Stanford Encyclopedia of Philosophy entry: [plato.stanford.edu/entries/consciousness-temporal/](http://plato.stanford.edu/entries/consciousness-temporal/)
- Dainton, Barry Francis. (2010) *Time and Space: Second Edition*. Acumen Publishing. 13 25, 44-47, 103-117.
- Grush, Rick (2005). "Brain Time and Phenomenological Time." In Andrew Brook & Kathleen Akins (eds.), *Cognition and the Brain: The Philosophy and Neuroscience Movement*. Cambridge: Cambridge University Press 160.  
<http://dx.doi.org/10.1017/CBO9780511610608.006>
- Heidegger, Martin. *Being and Time*. New York: Harper, 1962. Print.
- Husserl, Edmund. (1893-1917) *On the Phenomenology of the Consciousness of Internal Time*. John Barnett Brough (trans.) The Netherlands: Kluwer Academic Publishers, 1980.
- Ismael, Jenann (2011). "Temporal Experience." In Craig Callender (ed.), *The Oxford Handbook of Philosophy of Time*. Oxford: Oxford University Press.  
<http://dx.doi.org/10.1093/oxfordhb/9780199298204.003.0016>
- Jackson, Frank (1982). "Epiphenomenal Qualia." *Philosophical Quarterly* 32 (April): 127-136. <http://dx.doi.org/10.2307/2960077>
- James, William. (1890) *The Principles of Psychology*. Dover Publications.  
<http://dx.doi.org/10.1037/11059-000>

Kelly, Sean D (2005). "The Puzzle of Temporal Experience." In Andrew Brook (ed.), *Cognition and the Brain: The Philosophy and Neuroscience Movement*. Cambridge: Cambridge University Press. 208-238.

<http://dx.doi.org/10.1017/CBO9780511610608.007>

Lee, Geoffrey (2014). "Temporal Experience and the Temporal Structure of Experience." *Philosophers' Imprint* 14 (3).

McTaggart, J. Ellis. (1908) "The Unreality of Time." *Mind* 17 (68): 457-474.

Pinel, John P. J. *Biopsychology*. Boston: Pearson, 2014.

<http://dx.doi.org/10.1093/mind/XVII.4.457>

Merino-Rajme, Carla (2014). "A Quantum Theory of Felt Duration." *Analytic Philosophy* 55 (3): 239-275. <http://dx.doi.org/10.1111/phib.12047>

Nagel, Thomas (1974). "What is it like to be a bat?" *Philosophical Review* 83 (October): 435-450. <http://dx.doi.org/10.2307/2183914>