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DOES TIME HAVE A SPEED? TIME QUALIA AND BERGSON'S *DURÉE* *

O tempo tem uma velocidade? Os qualia do tempo e a duração de Bergson

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Abstract: **Henri Bergson critiques the traditional view of time as a mere succession of states, arguing that it fails to capture the crucial aspect of time's speed or pace. The paper explores Bergson's concept of time's speed through the lens of modern scientific insights and analytic philosophy, addressing critiques from cognitive science and logical analysis. By introducing the concept of "time qualia," which distinguishes between the quantitative and qualitative aspects of temporal experience, the author defends Bergson's position and provides a new theoretical framework for understanding the relationship between external motion, its measurement, and conscious durée. The formulation of this concept not only sheds light on the intrinsic connections between various related texts but also contributes to the differentiation between two distinct types of time speed — time-qualia-based and flow-qualia-based. The author concludes that the qualitative aspects of time experience have an irreducible reality that complements, rather than opposes, the quantitative aspects, arguing that Bergson's perspective offers a more comprehensive understanding of time's nature and our experience of it.**

Keywords: **Henri Bergson. Time's speed. Time qualia. Experience measurement.**

Resumo: **Henri Bergson critica a concepção tradicional de tempo como mera sucessão de estados por considerar que ela falha em capturar o aspecto crucial da velocidade ou ritmo do tempo. Este artigo explora a concepção bergsoniana acerca da velocidade do tempo pela perspectiva das descobertas da ciência moderna e**

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da Filosofia Analítica, especialmente pelos recursos críticos da ciência cognitiva e da análise lógica. Pela adoção do conceito de "qualia do tempo", o qual distingue entre os aspectos qualitativos e quantitativos da experiência temporal, o autor defende a posição bergsoniana e propõe um novo paradigma teórico para entender a relação entre o movimento externo, sua medida e a consciência da duração. A formulação não apenas esclarece as conexões intrínsecas entre vários textos bergsonianos correlacionados, mas também contribui para diferenciar entre dois tipos distintos de velocidade temporal – uma fundada no qualia do tempo e outra no qualia do fluxo. Conclui-se que os aspectos qualitativos da experiência temporal possuem uma realidade irredutível que mais complementa do que se contrapõe aos aspectos qualitativos, defendendo-se então que a perspectiva bergsoniana oferece um entendimento mais adequado da natureza do tempo e de nossa experiência temporal.

Palavras-chave: **Henri Bergson. Velocidade do tempo. Qualia do tempo. Quantificação da experiência.**

Introduction

Henri Bergson critiques the traditional characterizations of time in philosophy as insufficient in one crucial respect — the question of the speed or pace of time's unfolding. Conventionally, time has often been characterized in terms of 'succession' (e.g., as typically seen in Leibniz). However, Bergson argues that merely conceiving time as a relation of succession misses an essential aspect: the rate or speed of temporal passage itself.

> For that is what our habitual representation of movement and change hinders us from seeing. If movement is a series of positions and change a series of states, time is made up of distinct parts immediately adjacent to one another. No doubt we still say that they follow one another (se succèdent), but in that case this succession is similar to that of the images on a cinematographic film: the film could be run off ten, a hundred, even a thousand times faster without the slightest modification in what was being shown; if its speed were increased to infinity, if the unrolling (this time, away from the apparatus) became instantaneous, the pictures would still be the same.[1]

The definition of time as a successive series of positions or states is neutral with respect to the speed of time. Indeed, while it does determine which event precedes another, this framework remains indifferent to the pace at which such a sequence of events unfolds. Yet in reality, time does not

[1] BERGSON, Henri. *The Creative Mind*. Translated by M. L. Andison. New York: Philosophical Library, 1946, p. 9 [17-18]. Regarding Bergson's texts, the page references are indicated from the English translation, and the page numbers of the original French texts are included within brackets: *La Pensée et le Mouvant* (1934), critical edition by Arnaud Bouaniche, Arnaud François, Frédéric Fruteau de Laclos, Stéphane Madelrieux, Claire Marin, Ghislain Waterlot, 2009.

flow at a faster or slower rate, but rather at a relatively constant pace. This is not a random hallucination but, as Miravete aptly points out, "In Bergson's philosophy, the length of time units defines the 'speed' of time".[2] This aspect of temporal rate or speed is precisely what the conception of time as mere succession fails to capture.

Bergson's critique of the cinematographic model of time in *Creative Evolution* (originally in 1907) is well known. The above quote from 'Introduction (Part I)' in *Creative Mind* (originally in 1922) also formulates the view under attack through the metaphor of a 'film.' However, Bergson's critique of the cinematographic model encompasses multiple, intimately related lines of argument. One is the asymmetry of constitution: while motion cannot be constituted from a mere series of static snapshots, the converse is indeed possible. Another concerns how the representational nature of intelligence entails a spatialization of time. Additionally, there is the issue that it does not align with the fact that consciousness possesses an apparent breadth of time. And then there is the issue of the speed of temporal unfolding, which is the central focus of this paper. The reason this paper focuses on the problem of the speed of time is that, even if one grants that consciousness requires a duration and time cannot be reconstructed from an aggregate of inert instants, nor assimilated to a series of points in space, there remains the further problem of accounting for the experienced determinacy of temporal flow — why it possesses a specific pace or speed rather than another.

On the cinematographic model, the speed of the temporal unfolding is supposed to have no bearing on what actually happens in the world. But for real time, Bergson insists, the rate at which things unfold is "fixed (déterminée)" — it possesses this specificity of pace rather than another. An adequate theory of time must account for this determinacy of temporal rate.

This line of reasoning may seem intuitively compelling at first glance. However, upon closer philosophical inspection, it reveals complex difficulties. The very notion of a 'speed of time' is far from straightforward, facing numerous conceptual challenges as we shall see later. Besides, there arises the fundamental question of whether there truly exists such a thing as the pace of time in the universe, or if it is merely a subjective phenomenon. Indeed, Bergson has stated the following: "The film which is unrolling is therefore in all probability attached to consciousness which has duration and which regulates its movement."[3] We must not forget the following remark by During:

> Celebrating 'flow' or 'becoming' in general is not an option here: quite the contrary, such unspecified reference to impersonal time is explicitly criticized

[2] MIRAVETE, Sébastien. Defining Philosophy and Cognitive Psychology: Bergson and Bruner. In: HIRAI, Y. (ed.) *Bergson's Scientific Metaphysics*, ed. Yasushi Hirai. London: Bloomsbury Publishing Plc, 2023, p. 113

[3] BERGSON, *Creative Mind*, p. 21 [12].

> as an illusion. In that respect, Bergson would no doubt have been greatly amused to find himself counted in the ranks of the proponents of 'A-time'…[4]

How, then, does his position differ from the view that considers the flow of time to be an illusion?

These questions are closely intertwined and require a delicate treatment. However, they are of vital importance, as they challenge us to reconceptualize our understanding of the nature of reality and our place within it. By drawing attention to the inherent articulation within our subjective experience of time, the answers will illuminate how Bergson conceived of the inextricable connection between the real world and conscious duration.

In the following, we explore Bergson's sui generis determination of time's speed by examining modern scientific insights and the critical perspectives of analytic philosophy. Section one addresses two types of critiques, followed by our responses in sections two and three. The concept of 'time qualia' proposed in section three is repositioned in relation to other qualia in section four. Sections five through ten provide a tentative formalization of this concept, refining it through its relationships with various adjacent concepts. This approach to understanding time's speed in terms of time qualia will provide a new theoretical framework for comprehending the inseparable nature of external motion, its measurement, and the conscious durée.

1. Two Critiques of the Concept of Time Speed

Let us consider the context of contemporary analytic philosophy of time, where critiques of the concept of time's speed are widely observed. The arguments arise from two distinct perspectives: one rooted in cognitive science, the other in logical analysis. We will explore each perspective in turn.

1) In her insightful paper "Temporal Experience,"[5] L.A. Paul mounts a formidable challenge to the notion that we directly experience the passage of time and its apparent rates of flow. Drawing on findings from cognitive science, she contends that our experiences of events unfolding dynamically over time, accompanied by a palpable sense of "animation" or "flow," are in fact carefully constructed illusions generated by the brain's interpretive processes. As she states, "The reductionist can maintain that, just as with

[4] DURING, Elie. Coexistence and the Flow of Time. In: HIRAI, Y. (ed.) *Bergson's Scientific Metaphysics: Matter and Memory Today*. London: Bloomsbury Publishing, 2023, p. 186.
[5] PAUL, L. A. Temporal Experience, in *The Journal of Philosophy*, v. 107, n. 7, p. 333-359, 2010.

cases of apparent motion (and with color phi in particular), we experience an illusory sense of flow and change as the result of the brain's need to accommodate contrasts between the stages t1 and t2".[6]

Research on phenomena like *apparent motion* and *color phi* shows how the brain integrates a series of distinct static images into the vivid perception of a persisting, moving object that changes qualities such as color or location over time. Paul argues that, in a similar fashion, the brain processes temporally-ordered property instances, creating the phenomenological experience of events dynamically changing and time itself flowing at a certain subjective rate. However, she asserts that this arises not from detecting an objective reality, but from the brain's reconstruction to "accommodate the contrasts between the stages" — an illusion born of reconciling static inputs. As she bluntly puts it, "There is no real flow or animation in changes that occur across time".[7] By anchoring her critique in empirical psychology, Paul deprives our temporal experiences of their prima facie force against the reductionist metaphysics of time.

2) In his book *A Brief History of the Philosophy of Time*, Adrian Bardon critiques the notion of time's passage, highlighting logical paradoxes involved in attributing speed to time itself. He argues that when we speak of change or motion, we typically do so in relation to time. However, when we consider the idea of time itself passing, we encounter a fundamental conceptual difficulty. The following quote from Bardon clearly encapsulates this problem:

> In every other case, when we talk about movement or change, we are talking about movement or change *over time*. But what about the idea of time itself as passing? Time is passing relative to what? How could time pass with respect to itself? Further, if time passes, at what *rate* does it pass? Normally, we think of things in a state of change or motion as having a rate of change or motion measured according to, say, per hour, per minute, per second. How would the passage of time be gauged? "One second per second" is not a rate: It communicates no information.[8]

To determine the rate at which time passes in a meaningful way, a higher-level time dimension (often referred to as "supertime,[9]" "hypertime,[10]"or "metatime[11]"), based on which the speed of time is measured would be

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[6] *Ibid*., p. 352.
[7] *Ibid*., p. 352.
[8] BARDON, Adrian. *A Brief History of the Philosophy of Time*. Oxford: Oxford University Press, 2013, p. 96.
[9] SKOW, Bradford. *Objective Becoming.* Oxford: Oxford University Press, 2015, Chapter 4.
[10] CONEE, Earl, & SIDER, Theodore. *Riddles of Existence : A Guided Tour of Metaphysics: New Edition*. 1st ed. Oxford: Oxford University Press, 2014, p. 46.
[11] WILLIAMS, Donald C. The Myth of Passage. Reprinted in: GALE, Richard M. (ed.) *The Philosophy of Time: A Collection of Essays*. London: Palgrave Macmillan UK, 1968 [1951], p. 107.

required[12]. The critique lies here: if the pace of time is determined using the same time, it trivially always equals one; if a different, higher-order time is used, it leads to an infinite regress. This type of critique is indeed very common within the context of analytic philosophy of time, as seen in the works of Smart, Williams, Le Poidevin, Garrett, and Conee & Sider[13]. They reject the conflation of the rate of motion or change with the rate of time itself. It is important to note that, in terms of rejecting this conflation, Bergson is actually in agreement with them. However, the difference lies in that they consider the latter to be conceptually problematic, whereas Bergson positively defends the latter as belonging to the true nature of duration. How, then, might Bergson respond to these critiques from his perspective? We will discuss this in the following sections.

2. Response to the First Critique: Direct Motion Perception

In this section, we will respond to the first type of the critique from a Bergsonian perspective. The response will be twofold.

First, Paul draws on research demonstrating how the brain constructs experiences of motion and change from sequences of static inputs. However, her characterization of temporal experience may oversimplify the complexity uncovered in studies on the direct perception of temporal rhythms and patterns. Work on the neural foundations of rhythm and interval timing, notably through oscillator models,[14] indicates a more direct engagement with temporality.

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[12] Smart argues for an infinite regress, stating, "Furthermore, just as we thought of the first time-dimension as a stream, so will we want to think of the second time-dimension as a stream also; now the speed of flow of the second stream is a rate of change with respect to a third time-dimension, and so we can go on indefinitely postulating fresh streams without being any better satisfied." (SMART, J. J. C. The River of Time, in *Mind*, v. 58, n. 232, 1949, p. 484) However, those who defend the speed of time merely wish to argue that time flows, not that meta-time flows. It is sufficient to adopt a static interpretation of meta-time and argue that ordinary time flows at a constant speed relative to this static meta-time. In this sense, the infinite regress critique misses the mark. Nevertheless, I do not adopt A-theory for this reason. Skow presents a similar solution, but despite being an A-theorist himself, he does not adopt this as his own position. SKOW, *Objective Becoming*, Chapter 4.

[13] SMART, J. J. C. The River of Time, in *Mind*, v. 58, n. 232, p. 483-494, 1949; WILLIAMS, Donald C. "The Myth of Passage" reprinted in Gale, Richard M. (eds.) *The Philosophy of Time: A Collection of Essays*. London: Palgrave Macmillan UK, 1968[1951]; LE POIDEVIN, Robin. *Travels in Four Dimensions: The Enigmas of Space and Time*. Oxford: Oxford University Press, 2003; GARRETT, Brian. *What is this thing called Metaphysics?* London: Routledge, 2011; CONEE, Earl; SIDER, Theodore. *Riddles of Existence: A Guided Tour of Metaphysics*. Oxford: Oxford University Press, 2014.

[14] MERCHANT, H.; HARRINGTON, D. L.; MECK, W. H. Neural basis of the perception and estimation of time, in *Annual Review of Neuroscience*, v. 36, p. 313-336, 2013; MATELL, M. S.;

These models propose that the brain has multiple oscillators with different frequencies, and the combined activity of these oscillators can be used to directly encode and track time intervals. The idea of using oscillators for timing has a long history, with early proposals by Treisman and Gallistel[15] laying the groundwork for more recent models. The striatal beat frequency (SBF) model, for example, suggests that the medium spiny neurons in the striatum detect specific patterns of cortical oscillations, allowing for the perception and processing of temporal information.[16] Similarly, Buonomano's multiple clock principle posits that a distributed network of neural oscillators throughout the brain processes temporal information in parallel, enabling time perception across various time scales.[17]

Interestingly, this view aligns with Bergson's perspective on the direct perception of movement and change. As he states, after critiquing the idea that mobility can be constituted from halts, "our mind is able to follow the reverse procedure. It can be installed in the mobile reality, adopt its ceaselessly changing direction, in short, grasp it intuitively."[18] Bergson argues that there is a capacity to directly apprehend the continuous flux of reality, without relying on an intellectual reconstruction from static snapshots. Of course, Bergson is not simply denying the mechanisms of our reconstructive cognition. Through his various theories on attentive recognition and intelligence, he fully acknowledges the utility of these capacities in life. For example, in the context of reading, Bergson acknowledges "memory-images which, projected on the paper, take the place of the real printed characters and may be mistaken for them".[19] He even goes so far as to state, "we fancy we are seeing it, but we are actually producing in ourselves the hallucination of it".[20] However, as the foundation enabling such higher cognitive functions, he consistently affirms

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MECK, W. H. Cortico-striatal circuits and interval timing: coincidence detection of oscillatory processes, in *Cognitive Brain Research*, v. 21, n. 2, p. 139-170, 2004; BUZSÁKI, G. *Rhythms of the Brain*. Oxford: Oxford University Press, 2006; BUONOMANO, D. *Your Brain Is a Time Machine: The Neuroscience and Physics of Time*. New York: W. W. Norton & Company, 2017.

[15] TREISMAN, M. Temporal discrimination and the indifference interval: Implications for a model of the "internal clock", in *Psychological Monographs: General and Applied*, v. 77, n. 13, 1-31, 1963; GALLISTEL, C. R. *The Organization of Learning*. Cambridge, MA: MIT Press, 1990.

[16] MATELL, M. S.; MECK, W. H. Cortico-striatal circuits and interval timing: coincidence detection of oscillatory processes, in *Cognitive Brain Research*, v. 21, n. 2, p. 139-170, 2004; BUHUSI, C. V.; MECK, W. H. What makes us tick? Functional and neural mechanisms of interval timing, in *Nature Reviews Neuroscience*, v. 6, n. 10, p. 755-765, 2005.

[17] BUONOMANO, *Your Brain Is a Time Machine: The Neuroscience and Physics of Time*.

[18] BERGSON, *Creative Mind*, p. 224 [213].

[19] BERGSON, Henri. *Matter and Memory*. Translated by N. M. Paul and W. S. Palmer. London: George Allen and Unwin, 1911, p. 126 [113]. *Matière et mémoire* (1896), critical edition by Camille Riquier, 2008.

[20] BERGSON, Henri. *Mind-Energy*. Translated by H. Wildon Carr. New York: Henry Holt and Co., 1920, p. 97-119 [98]. *L'Énergie spirituelle* (1919), critical edition by Arnaud François, Élie During, Stéphane Madelrieux, Camille Riquier, Guillaume Sibertin-Blanc, Ghislain Waterlot, 2009.

the direct apprehension of mobility, which separates Bergson's theory of cognition from mere idealism[21].

The findings from cognitive science and neuroscience, which suggest that the brain is attuned to the inherent dynamism of temporal experience, lend empirical support to Bergson's philosophical insights. Thus, Paul's reductionist approach, positing that the brain constructs an erroneous experience of flow from static inputs, may overlook crucial aspects of our deeper sensitivity to the inherent dynamism disclosed in temporal experience itself.

Another response to the cognitive science critique is as follows: Paul's argument might commit a philosophical oversight akin to that of eliminative materialism about consciousness. Just as eliminativist attempt to dismiss consciousness itself as an illusion, Paul proposes reducing our experience of temporal flow and the rates of passage to mere cognitive illusions constructed by the brain. However, even if we were to grant, for the sake of argument, that our experiences of time are illusory, the presence of such illusions of temporal flow and rate cannot itself be illusory.

As Bergson emphasized, the experience of temporal flow and unfolding duration is fundamental to our lived reality as conscious beings. To dismiss it as merely an epiphenomenon of purely physical brain processes is to undermine and neglect the phenomenological aspect of our life. Even though we do not accept Paul's view that our consciousness of passage arises from the brain's resolution of contrasting inputs, hypothetically assuming it does, this does not change the fact that the 'illusion' of flow occurring at a specific rate must still be explained in some way. The felt rates and varying rhythms of duration's flow remain indelible aspects of our temporal consciousness that a reductive metaphysics cannot simply wipe away as illusory.

However, Paul may well remain unmoved by this objection. From an epiphenomenalist stance, conscious phenomena are considered ontologically secondary and derivative. Even acknowledging their reality would not fundamentally challenge such a view, as the purported illusions would still be just that — mere epiphenomena resting atop the bedlock reality they envision. To effectively address Paul's challenge, a Bergsonian response must go further and question the very ontological scheme that such views presuppose. However, before exploring that line of argument, it is worth examining a response to the second objection raised.

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[21] Bergson develops a version of dual-process theory of cognition. For more on this point, see HIRAI, Yasushi. What Is the 'Thickness' of the Present? Bergson's Dual Perception System and the Ontology of Time. In: HIRAI, Y. (ed.) *Bergson's Scientific Metaphysics*. London: Bloomsbury Publishing Plc, 2023.

3. Response to the Second Critique: Time Qualia

The second critique represents a more intrinsic challenge to the concept of the speed of time itself. From a Bergsonian perspective, the response unfolds as follows: The critique primarily arises from considering the speed of time solely in terms of "measurement." However, measurement is not our sole means of engaging with time; experience also plays a critical role. Time, when approached through measurement, is quantified and expressed in the number of units. In contrast, time encountered through experience is appreciated qualitatively. We can sensorily distinguish between allegro and adagio tempos, and three minutes versus ten minutes evoke different feelings within us. This distinction of measurement and experience highlights the innovative conceptual realm introduced by Bergson's notion of duration. The concept of the speed of time encounters logical difficulties when solely considered through quantitative measurement. However, by appealing to the qualitative aspects of time, we can imbue it with meaningful significance.

So, how might we more effectively confront the challenges of understanding speed by recognizing qualitative experiences? Ordinarily, we might quantify a certain duration of time using the standard units of seconds, minutes, and hours, distinguishing it from different durations based on quantitative measures. However, different *experiential* times, *durées*, differ from each other in a different way. Consider, for instance, the difference between waiting for someone for 3 minutes and waiting for 30 minutes. While measurements may reveal a tenfold quantitative relationship between the two, this does not preclude the qualitative distinctness of these experiences. With regard to our experience, the difference is neither a mere linear tenfold relationship nor a logarithmic proportional relationship, as proposed by Fechner. Rather, Bergson argues that it is not a relationship that can be characterized by any form of quantitative comparison.[22]

The issue at hand concerns the relationship between quantitative and qualitative distinctions. The case of time is particularly challenging to understand, which is why we may turn to the example of sensory sensations as a heuristic. Consider how electromagnetic waves at 630nm and 460nm correspond to the qualia of red and blue, respectively, without implying that blue is 1.37 times red. The distinction between red and blue is purely qualitative.

By agreeing to use the term 'sensation' to refer not to the physical stimuli that cause it (which are quantitatively measurable) but to the qualitative

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[22] BERGSON, Henri. *Time and Free Will*. Translated by F. L. Pogson. London: George Allen & Unwin, 1910, chap. 1. *Essai sur les données immédiates de la conscience* (1889), critical edition by Arnaud Bouaniche, 2007.

aspects of the experience, it becomes clear that any assertion of a quantitative relationship between two sensations is a fallacy resulting from a confusion of meanings. This argument forms the core of the critique of intensive magnitudes presented in the first chapter of *Time and Free Will*. People mistakenly assume that there is a quantitative relationship between the sensations of holding weights of different heaviness, with one being greater than the other, but this is a category mistake. The conflated concept of intensive magnitude is born from this.

The absence of a quantitative relationship between two qualities can be rephrased to suggest that there is no residual sensation derived by subtracting one sensation from another, thus challenging the concept of ΔS, used by Fechner.

> The only realities are the states S and S′ through which I pass. No doubt, if S and S′ were numbers, I could assert the reality of the difference S′-S even though S and S′ alone were given…. But if S and S′ are simple states, what does the interval that separates them consist of?[23]
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> The mistake which Fechner made, as we have just seen, was that he believed in an interval between two successive sensations S and S′[24].

As indicated, Bergson acknowledges both the quantitatively measurable and qualitatively experiential aspects of time. "There is at least one reality which we all seize from within, by intuition and not by simple analysis. It is our own person in its flowing through time, the self which endures".[25] In this context, it is illuminating to draw a parallel between the well-established concept of sensory qualia and the perplexing phenomenon of temporal experience. Utilizing this analogy, we can refer to the different qualities in temporal experience as '*time qualia*'[26]. We know *what it is like* to see electromagnetic waves at 630nm., which is commonly called 'sensory quale' of redness. Similarly, since we know *what it is like* to experience something lasting for three minutes, this can be called 'time quale' of three minutes.

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[23] BERGSON, *Time and Free Will*, p. 66 [49].
[24] *Ibid*., p. 67-68 [50].
[25] BERGSON, *Creative Mind*, p. 191 [182].
[26] I have proposed this elsewhere (HIRAI, Yasushi. *Made Out of Time: An Invitation to Bergson's Philosophy of Time.* Tokyo: Seidosha, 2022.). As will be touched upon later, subjective impressions of time are suggested to be complex, with different implementations depending on the time scale in question and whether it is prospective or retrospective. A comprehensive treatment of this is beyond the scope of this paper. Tulving's 'chronesthesia' is not used here because it refers more broadly to a person's awareness of the temporal dimension of their own and others' existence, in a more macroscopic scale of time. TULVING, Endel. Chronesthesia: Conscious Awareness of Subjective Time. In: STUSS, D. T. & KNIGHT, R. T. (ed.) *Principles of Frontal Lobe Function*. Oxford: Oxford University Press, 2002, p. 311-325.

Unfortunately, unlike in the case of red and blue, our language lacks specific expressions to denote the *time qualia* corresponding to durations of 3 minutes and 30 minutes. For the purpose of completing the analogy, let us introduce the terms *Triminutalitas* for the quality of experiencing a duration of 3 minutes, and *Semihoralitas* for that of 30 minutes. Thus, we can construct the following analogical description:

> [Analogy between Sensory Qualia and Time Qualia]
>
> The electromagnetic waves at 630nm and 460nm, though distinguishable quantitatively in measurement, do not exhibit qualitative differences. Sensory qualia of red and blue, while qualitatively distinguished by experience, do not bear a quantitative relationship.

Likewise, the durations of 3 minutes and 30 minutes, though distinguishable quantitatively in measurement, do not exhibit qualitative differences. Time qualia such as *Triminutalitas* and *Semihoralitas*, though qualitatively distinguished by experience, do not bear a quantitative relationship.

Although qualia-based discrimination may initially appear less precise than quantitative measurement, it is not the case. Qualitative distinctions, while not quantifiable, possess their own unique form of precision. According to Bergson's philosophy, the experience of time's speed is deeply connected to these *time qualia*, offering complementary insights that are not accessible through quantitative methods alone.

4. Relationship between Time Qualia and Other Qualia

While not the thematic focus of this paper, it is worth mentioning the quality of the *spatial* whole, which is generally referred to as *Gestalt*. As is well known, Gestalt is a psychological concept that refers to the idea that the mind perceives objects, patterns, and structures in their entirety rather than as individual components, and that this holistic perception gives rise to new, emergent qualities. Time qualia can be related to the temporal counterpart of this concept, albeit with crucial differences that will be discussed later.

Historically, the idea of the qualitative aspect of temporal experiences is not unique to Bergson. Ernst Mach had already explored the sense of temporal form in his work *The Analysis of Sensations*[27] and Christian von Ehrenfels also extensively explored both temporal and non-temporal (spa-

[27] MACH, Ernst. *The Analysis of Sensations, and the Relation of the Physical to the Psychical*. La Salle, IL: Open Court Pub. Co., 1914 [1886].

tial) Gestalt qualities in his seminal paper[28]. However, Bergson's unique contribution lies in how he intriguingly relates this concept to the speed of time, as we focus on in this paper.

Time qualia are not given in isolation from sensory qualia; rather, they are experienced together in an intertwined form[29]. The same sensation can qualitatively change by either shortening or extending its duration. Bergson notes, "A sensation, by the mere fact of being prolonged, is altered to the point of becoming unbearable".[30] Additionally, he states, "it is impossible to cut off a moment from them without making them poorer by the loss of some impression, and thus altering their quality".[31]

In this paper, however, 'time qualia' specifically denotes the *duration--derived component* of the entire experience. Consider, for instance, the scenario where the sourness of a lemon persists unusually long after consumption. This alteration is discernible through experience (without explicit measurement), as we are familiar with the typical duration of sourness when biting into a lemon. Such an extended sourness informs us that the time qualia are integrated into the experience of the lemon's flavor, leading Bergson to argue that we should view the quality of the entire experience, wherein the sourness and its duration are intertwined, as having changed rather than merely the sourness being extended. This illustrates the holistic nature of experience, where sensory qualia and time qualia do not linearly add to one another.

Conversely, however, from this experience, we are also supposed to be able to experientially analyze the sensory qualia of the lemon and the time qualia of its duration to infer that it is the duration of the sourness that has extended, rather than the taste of the lemon itself having altered. Bergson interprets this as a "qualitative sign of quantity"[32] and elaborates on time estimation learned through experience, which we will see in the section six.

5. Formulation of Time Qualia

To illustrate the aforementioned concepts concisely, let us introduce symbolic notation. Let p denote the conditions related to the object, and

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[28] EHRENFELS, Christian von. Uber 'Gestaltqualitäten', in *Vierteljahrschrift für wissenschaftliche Philosophie*, XIV, p. 249-292, 1890.

[29] While a detailed discussion is beyond the scope of this paper, a significant implication of Bergson's 'contraction' theory is that sensory qualia are ultimately temporal qualia. For a more in-depth exploration of this idea, refer to HIRAI, Y. *Made Out of Time: An Invitation to Bergson's Philosophy of Time.* Tokyo: Seidosha, 2022

[30] BERGSON, *Time and Free Will*, p. 153 [115-116].

[31] *Ibid*., p. 196 [147-148].

[32] *Ibid*., p. 224 [169].

t denote those corresponding to the duration (note that t is not a variable for entering measured values, as in classical physics). Measurement M and experience Q are operators that take these as a common domain and map them to distinct codomains. The elements of the codomain of M are not qualitatively different from each other but have quantitative discrimination. In contrast, the elements of the codomain of Q exhibit qualitative discrimination and lack quantitative discrimination[33].

Using this notation, *sensory qualia* can be described as follows: Two electromagnetic waves p_1 and p_2 are, on the one hand, transformed by M into quantitatively distinguishable values such as 630nm and 460nm. These are M (p_1) and M (p_2). On the other hand, they are transformed by Q into qualitatively distinguishable sensory qualia such as red and blue. These are Q (p_1) and Q (p_2). While M (p_1) and Q (p_1), and M (p_2) and Q (p_2) have a relatively stable correlation, this does not imply that the quantitative difference between M (p_1) and M (p_2) holds between Q (p_1) and Q (p_2). The converse is also true.

Similarly, *time qualia* can be described as follows: Two time intervals t_1 and t_2 are, on the one hand, transformed by M into quantitatively distinguishable values such as 3 minutes and 30 minutes. These are M (t_1) and M (t_2). On the other hand, they are transformed by Q into qualitatively distinguishable time qualia such as *Triminutalitas* and *Semihoralitas*. These are Q (t_1) and Q (t_2). While M (t_1) and Q (t_1), and M (t_2) and Q (t_2) have a relatively stable correlation, this does not imply that the quantitative difference between M (t_1) and M (t_2) holds between Q (t_1) and Q (t_2). The converse is also true.

Bergson defines two different 'multiplicities' based on whether the elements are qualitatively or quantitatively distinguished. If we consider them to be divided according to the type of elements, it would be an imprudent approach, as it would negate from the outset the intersection between experienced duration and measured physical reality. The distinction between multiplicities is not necessarily an ontological claim about the existence of two sets of elements with different essences that have no possible link whatsoever. It rather concerns two types of *differences* between elements. He states, "we must admit two kinds of multiplicity, two possible senses of the word "distinguish," two conceptions, the one qualitative and the other quantitative, of the difference between *same* and *other*".[34] This definition, which focuses on the operation of distinguishing, is compatible with our view of interpreting measurement and experience as operators

[33] It is also important to note that unlike in Kant's table of categories, quantity and quality are attributed not to an object, but to a discrimination and that the two codomains are not distinct; rather, quantity is a "limiting case" of quality. BERGSON, *Creative Mind,* p. 225 [215].
[34] BERGSON, *Time and Free Will,* p. 121 [90].

from an ontologically neutral domain to codomains defined by different systems of discrimination.

As previously mentioned, Bergson's critique of intensive magnitude is directed at the failure to recognize that the principles of discrimination permitted in the two codomains are different. However, equally important is the fact that the domain from which the two operators receive their inputs is shared. Had this domain been distinct from the beginning, quality and quantity would appear as if belonging to two distinct worlds, which would lead to classical parallelism. Even though the numerous qualia are irreducible to quantitative measurements and vice versa, this only holds true at the level of the results of the operation of distinguishing, and it does not imply a dualism of the underlying reality.

6. Motion or Duration?

How can the qualia of motion speed be described using this notation? In this section, by addressing this question, we will demonstrate the reasons why we use the qualia of time length instead of qualia of speed of motion.

In everyday life, we can qualitatively distinguish between the differences in the speed of two motions, as well as the differences in the time length of two events. If the speed of a clock hand or a pedestrian is unusual, or if a class or routine work takes longer than usual, we notice it at a perceptual level. Therefore, both can be considered qualia; however, the latter should be called time qualia, while the former should be referred to as motion qualia. The reasons are following:

As noted earlier, time qualia are never experienced in isolation. Experience is always accompanied by specific content p, its spatial distribution s, as well as its temporal specification t. In real-life circumstances, the experience is presented in an integrated form, denoted as Q (p, s, t). The extent to which one can appropriately extract Q (p), Q (s), or Q (t) from this holistic experience Q (p, s, t) depends on learning.

Let us consider how motion qualia are described in our notation in the following two cases, since Bergson refers to the conventional usage of the terms "movement" and "change," describing "movement" as a change in position or location, and "change" as a variation in properties.[35] In cases of locomotion, speed is the measure of spatial displacement per unit of time. Thus, motion speed would be quantified by M (s, t) and qualitatively

[35] BERGSON, *Creative Mind*, p. 17 [9]; 150 [140].

experienced by Q (s, t). In cases of change, speed represents the rate of change in the object over time. Here, change speed would be measured by M (p, t) and experienced by Q (p, t).

The forementioned *Gestalt*, which comprises both the elements and their particular arrangement in space, could be defined as Q (p, s). If we manage to isolate and learn only the spatial characteristics, we could then consider *space qualia* Q (s), allowing us to perceive spatial magnitude independent of the specific objects occupying that space. Due to these reasons, Q (t) is referred to as time qualia rather than Q (s, t) or Q (p, t), as it works as a useful discriminative factor.

7. Time Estimation

As mentioned earlier, Bergson acknowledges a certain correlation – not a reduction – between M and Q, which underpins our ability to estimate quantity based on quality. He illustrates this with the statement, "The numbers in daily use have each their emotional equivalent".[36]

> we found, that psychic phenomena were in themselves pure quality or qualitative multiplicity, and that, on the other hand, their cause situated in space was quantity. In so far as this quality becomes the sign of the quantity and we suspect the presence of the latter behind the former, we call it intensity. The intensity of a simple state, therefore, is not quantity but its qualitative sign.[37]

Inferring the quantitative properties of the external cause from the qualitative experience, while useful in practical terms, leads to the illusion that sensory qualia themselves possess quantitative attributes. In the case of time qualia, the phenomenon in question here corresponds to what is currently referred to as time estimation in the field of time psychology. Time estimation is a process in which we estimate how many minutes have passed using our internal sense of time, without using a clock. Just as in the case of intensive magnitude, our knowledge of the objective duration and our habit of estimating this duration based on our subjective experience can lead to the same kind of conflation that time qualia are inherently quantifiable and can be added or subtracted like numbers. True, we estimate the quantity of time based on the quality of time. However, this does not imply that time qualia are themselves quantitative.

To further clarify, let us introduce a new operator, E, designed for estimating external quantities. E maps elements from the codomain of Q

[36] BERGSON, *Time and Free Will*, p. 123 [91].
[37] *Ibid*., p. 224 [169].

(qualitative) to the codomain of M (quantitative). When E takes a sensory quale Q (p), it estimates the corresponding quantitative property M (p), of the external cause.

Take temperature as an example: Suppose p represents the molecular state of the air, and we experience a specific sensation of heat, Q (p). From this quale, we can estimate the temperature, E (Q (p)). A thermometer tells us the room temperature, M (p). Since both E (Q (p)) and M (p) fall within the same space that allows for quantitative discrimination, discussing how much in quantity they deviate is meaningful and enables to enhance the precision of the estimation operator E. However, even when E (Q (p)) deviates from M (p), it is a category mistake to say that Q (p) is greater or smaller than M (p).

This applies to time estimation as well. From the time quale Q (t) that we experience, we produce an estimate, E (Q (t)), of the elapsed time. This estimate may differ quantitatively from the actual measured time, M (t). While E (Q (t)) might be incorrect in relation to M (t), the same cannot be said for Q (t).

It is important to note that while M and Q produce outputs that belong to different discriminatory spaces, the operator E differs from M and Q in that it receives inputs from the qualitative discriminatory space and delivers values within the quantitative discriminatory space.

The existence of this operator E is of particular importance because it is involved in the complementary connection between internal durée and external space. To learn an appropriate E, one must learn to extract time qualia from one's own holistic experience. The experience itself changes due to various factors such as contents and spatial configurations. If one merely enjoys the overall qualitative change Q (p, s, t) without analyzing it, one may not even consider distinguishing whether the object has changed or time has changed. To reiterate, we are not denying the importance of this undivided whole which is certainly the starting point of experience. This is why Bergson speaks of the "substantiality"[38] of change itself and states, "There are changes, but there are underneath the change no things which change".[39] However, without the ability to focus on changes based on temporal variations within the whole, one would not be able to make appropriate time estimations in general situations. In other words, learning E requires becoming able to appropriately extract qualitative changes Q (t) that respond to quantitative changes M (t) from the overall experience Q (p, s, t). The fact that the behavior of qualia is not entirely random and that there is a shared foundation suggests that it cannot be dismissed as a

[38] BERGSON, *Creative Mind*, p. 16 [8], 35 [27], 87 [80], 151 [141], 175 [165], 177 [167], 184 [174].
[39] *Ibid*., p. 173 [163].

mere illusion. Our complex behavior is based on the quantitative estimation, which is, in turn, based on the quality of experience. The refinement of qualia has real consequences in our daily behavior.

8. Why Time Intervals Cannot Be Measured: Bergson's Theory of Measurement

What is, then, measurement? Bergson describes it as an operation of 'superposition'. He states, "all measurement implies superposition".[40] Measurement involves comparing the two concrete objects. One is considered as a unit of measurement and the other is the object being measured. Measurement seeks a ratio of these two; the absolute magnitude of the object's quantity itself is not in question. This is why measurement is inherently relative knowledge.

This principle also applies to time, where measured values are derived by dividing the duration of a motion by a predetermined time unit. In the case of time, this limitation becomes critical because the interval duration, which is abstracted away through this process, is precisely where changes and motions occur. Bergson emphasizes the importance of referring to the interval, not just the endpoints: "The measuring of time never deals with duration as duration; what is counted is only a certain number of extremities of intervals, or *moments*, in short, virtual halts in time".[41] This signifies that the essence of time, which cannot be captured by measurement, correlates with consciousness and is thus defined qualitatively rather than quantitatively.

Considering time units further elucidates this point. Time measurement often utilizes a uniform motion body, such as a clock, as its unit. Although analogous to spatial measurement, Bergson argues that this convention leads to misunderstandings. Unlike spatial comparisons, where repeated applications of a unit can be simultaneous in principle, in the case of time, each application passes before the next can occur.

> Its essence being to flow, not one of its parts is still there when another part comes along. Superposition of one part on another with measurement in view is therefore impossible, unimaginable, inconceivable.[42]

How can one add a past unit to a present one? If one uses memory, this presupposes conscious experience and leads to the qualitative multiplicity.

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[40] BERGSON, *Time and Free Will*, p. 71 [53].
[41] BERGSON, *Creative Mind*, p. 11 [3].
[42] *Ibid*., p. 10 [2].

If memory is not used, this involves a spatialization of time, replacing the successive moments with coexistent symbols, which enables addition and enumeration. Bergson contends that duration cannot be "superposed." Since measurement requires superposition, duration eludes measurement.

While the idea that time intervals are immeasurable may sound counterintuitive, it can be illustrated through everyday concrete examples. Consider measuring a runner with a stopwatch. Measurement, in this case, is to compare the runner's time to the stopwatch's unit time. Therefore, the intervals of travel time appear to be thoroughly measured. However, are the intervals of the unit of time being measured? In other words, how can we confirm the consistency of the time unit itself during measurement? Is it possible to objectively verify that the second hand of the watch moves consistently from one second to the next? Upon reflection, this requirement is revealed to be unattainable through measurement alone. Even using another clock more precise than the original one, the same problem applies to the new clock, and then ad infinitum. Consider the most advanced clocks, such as optical lattice clocks, which are reputed to err by only one second in 30 billion years. By assumption, it is impossible to verify the length of the 1-second interval indicated by this clock using a more accurate clock. In this case — and in any other case —, "error" can never mean a deviation from "the objective time[43]." Measurement is ultimately confined to a circularity of relative ratios.

To be clear, this argument does not aim to foster skepticism about the consistency of time units akin to Descartes' evil demon hypothesis, which suggests that unit lengths could change undetected. It is crucial to recognize that the situation is quite the opposite. Acknowledging the purely relative nature of measurement ensures that such skepticism cannot even be formulated as an argument in the first place. Conversely, such skepticism can be possible only when it assumes the existence of an absolute length of time.

From a Bergsonian perspective, this entire confusion stems from the assumption that measurement is the only way to access time. If we can somehow confirm that the movement of the second hand earlier is the same as that of the present, it can only be through relying on time qualia. Of course, this depends on learning, and due to the holistic nature of time qualia, it can never be completely fixed once and for all. As seen in the previous argument, the very act of extracting time qualia as such from the

[43] Instead, the error is determined by comparing multiple identical or functionally equivalent clocks, or through theoretical evaluations of the clock's operating principles. See BLOOM, B. J. et al. An optical lattice clock with accuracy and stability at the 10-18 level, in *Nature*, v. 506, n. 7486, p. 71-75, 2014. More generally, AUDOIN, C.; GUINOT, B. *The Measurement of Time: Time, Frequency and the Atomic Clock*. Cambridge: Cambridge University Press, 2001.

overall qualia of experience is made possible by aligning it with the time of measurement. However, it is also true that we are often able to notice a malfunctioning clock or an engine problem through these experiential qualitative differences. It is interesting to see the interdependence of measurement and experience at the very fundamental level of the constancy of time units.

9. Internal Conditions of Time Qualia

An important question remains: How is it possible for time lengths that are measured as the same quantity to be experienced as *different* qualities? It is in such cases that we speak of the speed of time. If this were entirely random, there would be a certain rationale for the reductionist approach. However, this is not the case. As seen above regarding time estimation, although not infallible, time qualia function as a rational clue for inferring the measured length of elapsed time.

What exists here is not a simple correspondence where the same external cause produces the same qualia. And there consists the core idea of the pluralism of durée, according to which, the speed of time varies greatly between humans, various animals, and even matter.

> In reality there is no one rhythm of duration; it is possible to imagine many different rhythms which, *slower or faster*, measure the degree of tension or relaxation of different kinds of consciousness, and thereby fix their respective places in the scale of being.[44]

It is fascinating to note that the temporal specifications of different organisms, defined here in terms of the tension and relaxation of consciousness, are also linked, at a more fundamental level, to the physiological conditions of the intensity of coupling in the sensory-motor system. The breadth of the present of biological system is defined by its temporal radius: "My present is, in its essence, sensori-motor."[45] Bergson points out that while the sensory-motor system of simple organisms operates within a short time scale with almost no delay, humans, who possess a higher degree of tension, maintain more of the past and consequently have a broader "present" that can reach into more of the future in response. He states: "In the case of a rudimentary organism, it is true that immediate contact with the object which interests it is necessary to produce the stimulation, and that reaction can then hardly be delayed".[46] This idea has significant

[44] BERGSON, *Matter and Memory*, p. 275 [232], emphasis mine.
[45] *Ibid*., p. 177 [153]. See also HIRAI, *Made Out of Time*, p. 101-102.
[46] *Ibid*., p. 22 [28].

implications for understanding the relationship between time, consciousness, and embodiment. The varying degrees of tension and relaxation in consciousness, which manifest as different speeds of time, are thus grounded in the specific ways in which an organism processes sensory information and generates motor responses.

Furthermore, Bergson also points out that even within the same human being, the sense of time's passage differs significantly between the waking state and sleep, stating that we sometimes perceive "in ourselves, in sleep, two contemporaneous and distinct persons of whom one sleeps a few minutes, while the other's dream fills days and weeks".[47] This text suggests that the unfolding speed of duration is strongly influenced by physiological conditions. During sleep, consciousness is freed from the constraints resulting from the necessary coordination with the physical environment, which governs our experience of time during waking hours.

These considerations suggest that time qualia, in Bergson's view, are not determined solely by the properties of the object and the time conditions; there are also internal conditions. Even if the same object is experienced for the same measured duration, if these internal conditions differ, the qualitative experience of time can vary.

Recent empirical research increasingly demonstrates that the subjective perception of time is significantly influenced by a confluence of factors. Among these, attentional allocation is pivotal; heightened focus on a task tends to contract the perceived duration of time.[48] Furthermore, physiological arousal — such as that induced by caffeine — tends to extend the subjective experience of time.[49] Emotional states also play a critical role in modulating time perception, with positive emotions typically compressing perceived time, whereas negative emotions appear to elongate it.[50] Age-related variations in time perception have been observed as well, with older individuals often experiencing a more rapid passage of time compared to younger ones.[51] Physiological states also affect time perception; for instance, an increase in body temperature is associated with a perceived lengthening of time.[52]

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[47] *Ibid*., p. 275 [233].
[48] ZAKAY, D.; BLOCK, R. A. Temporal cognition, in *Current Directions in Psychological Science*, v. 6, n. 1, p. 12-16, 1997.
[49] GRUBER, R. P.; BLOCK, R. A. Effect of caffeine on prospective and retrospective duration judgements, in *Human Psychopharmacology: Clinical and Experimental*, v. 18, n. 5, p. 351-359, 2003.
[50] DROIT-VOLET, S.; MECK, W. H. How emotions colour our perception of time, in *Trends in Cognitive Sciences*, v. 11, n. 12, p. 504-513, 2007.
[51] BLOCK, R. A.; ZAKAY, D.; HANCOCK, P. A. Human aging and duration judgments: A meta-analytic review, in *Psychology and Aging*, v. 13, n. 4, p. 584-596, 1998.
[52] WEARDEN, J. H.; PENTON-VOAK, I. S. Feeling the heat: Body temperature and the rate of subjective time, revisited, in *Quarterly Journal of Experimental Psychology Section B*, v. 48, n. 2b, p. 129-141, 1995.

Michael Thaut, the founder of Neurological Music Therapy (NMT), has conducted research of paramount importance in this regard[53]. According to his findings, the accuracy of rhythm perception, particularly the perception of periodicity, is remarkably high, with the ability to consciously detect errors of 5%. Furthermore, the capacity to follow changes in periodicity surpasses the threshold of consciousness, demonstrating even greater proficiency[54]. From a physiological perspective, the ability to detect temporal information resides at an exceptionally deep layer, as evidenced by the direct projection from the auditory cortex to the motor cortex[55]. This deep--rooted nature of temporal perception makes it robust and, consequently, suitable for application in physical rehabilitation.

These diverse findings illustrate the intricate interplay among cognitive, emotional, physiological, and environmental factors in shaping our subjective experience of time. This complexity highlights not only the multifaceted nature of time perception but also underscores its susceptibility to various internal influences.

Attention, arousal, emotion, age, and physiology. It would also be permissible to add memory, which Bergson emphasizes, to this list[56]. These are the varying conditions on the side of the experiencer. Let us now denote this as b. Then, our complete experience becomes Q (p, s, t, b), and time qualia become Q (t, b).

With this modification, as long as the internal conditions b remain the same, Q can be considered a function solely of t, which enables the learning of E (the learning of extracting Q) based on correlation as we have assumed thus far. Conversely, with potential variations in b, it becomes possible to explain why time qualia (and consequently the time estimation based on them) vary, even when t remains constant[57]. In such cases, one would voice the discrepancy between M (t) and E (Q (t, b)), in terms of speed of time.

10. Two Types of Time Speed

One final, important consideration remains: there are two types of speed of time. The case previously discussed is based on the duration of

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[53] THAUT, Michael. *Rhythm, Music, and the Brain: Scientific Foundations and Clinical Applications*. 1st ed. London: Routledge, 2013.

[54] THAUT, *Rhythm, Music, and the Brain,* Chapter 5.

[55] *Ibid*., p. 57.

[56] In particular, the issue of memory will likely play a crucial role in elucidating Bergson's acceleration thought experiment.

[57] At this point, considering Q (b) becomes particularly intriguing. It might closely relate to what Bergson often describes as "the uninterrupted humming of life's depths" BERGSON, *Creative Mind*, p. 167 [176]) or "the continuous melody of our inner life". BERGSON, *Creative Mind*, p. 166 [176].

time intervals. It concerns the evaluation of the amount of time that has elapsed. On the other hand, there is another type of speed involving the perceived speed of an *imperfective*, ongoing process[58]. In this case, discrepancies between measured time and time evaluation are unavailable due to its imperfective nature. Therefore, the unusual speed is supposed to be detected from the direct conflict between past qualia and current qualia, not from a comparison of M and E (Q), both quantitative.

For example, thinking that about 2 hours have passed when in fact 3 hours have elapsed is a case of the former, while perceiving the same motion as quicker than usual is an instance of the latter. Bergson's pluralism of duration relates to the latter. Some psychological experiments also pertain to this latter type. An even more significant example is Bergson's thought experiment on the acceleration of the universe, which was cited in the introduction. In this scenario, the gap between measurement and estimation cannot be utilized[59]. Nevertheless, consciousness is said to detect the difference in time speed as a *qualitative* difference. Let us call the qualia defining this new type of time speed *flow qualia*. Thus, we can refer to the two types as time-qualia-based time speed (TQTS) and flow-qualia-based time speed (FQTS).

Both can be rightly expressed as "time passes quickly," but using our notation, we can differentiate between the two descriptions, and in response to the above critique, maintain the meaningfulness of both. In the first case (TQTS), the discrepancy between the estimated time (2 hours) and the actual measured time (3 hours) gives rise to the judgment of time passing quickly. This can be represented as $E(Q(t, b)) < M(t)$, where the subjective estimation of the duration, based on the time qualia experienced, is shorter – which is quantitative difference -- than the objective measurement of time. In the second case (FQTS), the perceived speed of an ongoing motion is faster than usual. This can be described as $Q(s, t, b)) \neq Q'(s, t, b')$, where b and b' denote different internal conditions. Here, the comparison is not between subjective estimation and objective

[58] I systematically demonstrated that grammatical aspects, such as imperfective and perfective, are beneficial as a framework for characterizing Bergson's philosophy of time, in contrast to the tense-based philosophy of time by McTaggart and others. HIRAI, Yasushi. McTaggart vs. Bergson: The Temporal Scope of Tense and Aspect. In: HIRAI, Y.; FUJITA, H. (ed.). *The Power of la durée: New Horizons in Bergson's Time and Free Will*. Tokyo: Shoshi Shinsui, 2024. The following study shows that the temporal context, distinguished by whether events are anticipated in the future or recalled from the past, significantly shapes our estimation of duration, with future events typically perceived as longer. See CARUSO, E. M., et al. The temporal Doppler effect: When the future feels closer than the past, in *Psychological Science*, v. 24, n. 4, p. 530-536, 2013.

[59] Let us now quote from *Time and Free Will*: "if all the motions of the universe took place twice or thrice as quickly, there would be nothing to alter either in our formulae or in the figures which are to be found in them. Consciousness would have an indefinable and as it were *qualitative impression of the change*". BERGSON, *Time and Free Will,* p. 116 [87], emphasis mine.

measurement, but rather between the current experience of time qualia and the usual or expected experience. By using this notation, we can clearly distinguish between these two types of "time passing quickly" and provide a more precise description of the underlying temporal experiences.

Here, an even more intriguing consequence can be derived. If we update the previously introduced *motion qualia* Q (s, t) with the internal conditions b from the last section, we obtain Q (s, t, b), which is revealed to take the same form as *flow qualia*. This suggests that *the speed of motion and the speed of time are not two separate things*.

This is a welcome development, considering that difficulties arose from appealing a second-order time. Arthur Prior has also responded to Smart's critique, stating that the speed of time is nothing other than change.[60] Our formulation provides a more rigid formulation that adds consideration of quality to his intuitive response[61]. Moreover, although identical in notation, a clear semantic distinction is maintained, assigning time speed (FQTS) a role as a real phenomenon. This distinction is as follows:

> [Semantic Differentiation of Motion Qualia and Flow Qualia]
>
> Q (s, t, b) can represent both motion qualia and flow qualia, where s denotes spatial distribution, t represents temporal specification, and b stands for internal conditions. Assuming that the internal condition b remains unchanged, Q becomes a function of s and t, as in the case of measured motion speed M (s, t): if the motion takes longer for the same spatial movement, it feels slower; if more motion occurs in the same amount of time, it feels faster. Thus, when b remains constant and Q changes in response to variations in s and t, we interpret this as a change in motion. However, if this same Q (s, t, b) changes under conditions where s and t do not vary, this change is assumed to have been induced by b. It is in such situations that we describe the phenomenon as a change in the speed of time (FQTS).

Conclusion

From the above considerations, we can conclude that the qualitative aspects of time experience have an irreducible reality, and far from being in opposition to the quantitative aspects that are measured, they are in a inseparable complementary relationship. By elucidating these complex

[60] PRIOR, A. N. Time After Time, in *Mind*, v. 67, n. 266, p. 244-246, Apr. 1958.

[61] While Markosian is sometimes regarded as presenting a compelling response against the critique (for example, by Olson), our argument has independent value in that it incorporates qualitative aspects that are not adequately addressed even there. MARKOSIAN, Ned. How Fast Does Time Pass?, in *Philosophy and Phenomenological Research*, v. 53, n. 4, p. 829-844, 1993; OLSON, Eric T. The rate of time's passage, in *Analysis*, v. 69, n. 1, p. 3-9, 2009.

mechanisms, we have been able to give distinct meanings to the two modes of time speed.

When discussing the qualitative aspects of time (Q), it is necessary to distinguish between *time qualia, motion qualia, and flow qualia*. Time qualia are fundamental in that they function as the dynamic units of experience. Their extraction from the totality of experience is achieved through correlation with measured time lengths (M), but this requires bridging by the operation of evaluation (E). The gap between M and E provides the first meaning of time speed, which is based on time qualia (TQTS).

Motion qualia and flow qualia have the same notation Q (s, t, b) but are distinguished by which conditions change. When qualia vary due to external conditions s and t, we have motion qualia, which are conventionally ascribed to the external object. When qualia vary due to internal conditions b, we have flow qualia, which provide the second, and arguably more crucial, meaning of time speed in Bergson's pluralistic conception of duration (FQTS). It is true that, when describing the acceleration thought experiment, there are texts where Bergson brings up the speed of motion where he should be talking about the speed of time.[62] However, this can be interpreted not as a mere confusion that an analytic philosopher might criticize, but rather as having an intrinsic justification. And as a result, it gains immunity to the difficulties entailed by a separation based on levels.

The arguments presented in this paper have several points that require further development. For example, as seen in Section 9, many factors are intermingled within the internal conditions. A detailed examination of these factors is yet to be conducted. Moreover, it is known that time estimation operates differently for the past-oriented and future-oriented cases. A thorough investigation of these issues must be left for another occasion. Furthermore, the acceleration thought experiment of the universe, which was only briefly mentioned, is packed with numerous intricacies, which require a separate paper to be elucidated.

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[62] BERGSON, *Time and Free Will*, p. 116 [87].

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