# A step-by-step introduction to Bergson's reflection on time and space

In this supplementary section, I first present a summary of Bergson's thesis with more details compared to the introduction of the main text and with concrete examples. Then, supplementary subsections 2 to 8 contain a step-by-step summary of the entire thesis developed in Time and Free Will [(Bergson 1889)](https://www.zotero.org/google-docs/?pvKu9J).

## 1. An overview on Bergson's overlooked breakthrough: time is unlike space

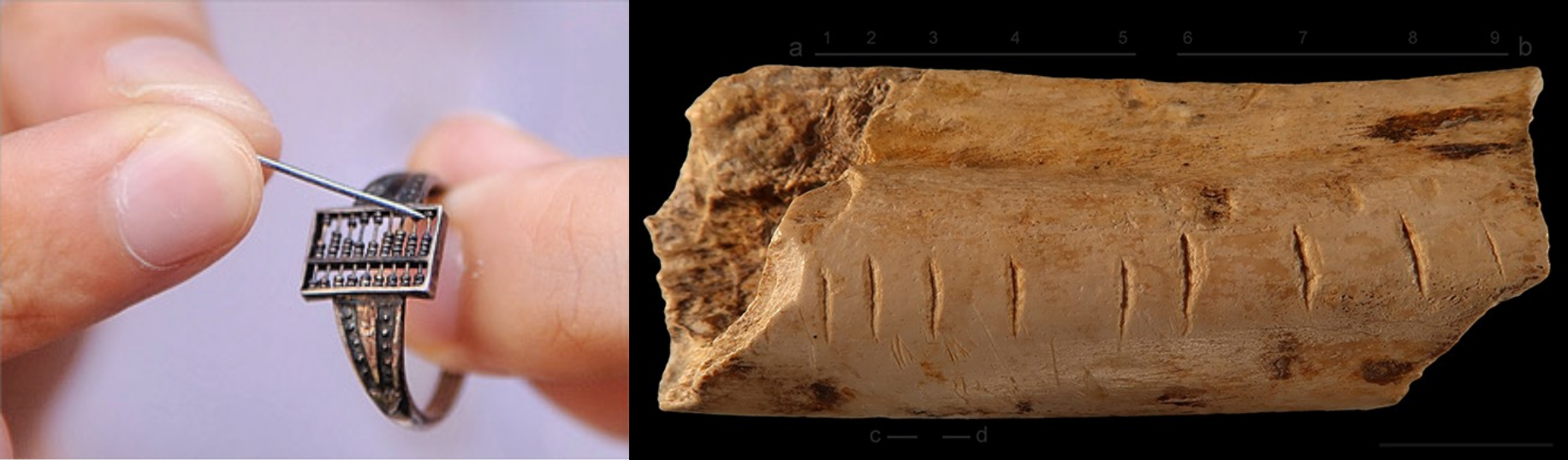
Bergson’s reflections on time and space can be found in his Ph.D. dissertation [(Bergson 1889)](https://www.zotero.org/google-docs/?pvKu9J), published in English under the name *Time and Free Will, Essay on the immediate data of consciousness*[[1]](#footnote-1). For Bergson, there are two forms of experience of duration. One that is quantitative and one that is qualitative. There is the duration that we measure or think/talk about and which is nothing but space. And there is the duration experienced by conscious beings freed of any spatial content, what Bergson calls *durée*: "*a succession of qualitative changes, which melt into and permeate one another, without precise outlines, without any tendency to externalize themselves in relation to one another, without any affiliation with number*" [p77/p104][[2]](#footnote-2). Such a sharp distinction is derived from Bergson’s consideration that our mental life is ever-changing and indivisible as it evolves in time. While I wait for a traffic light to turn green, my thoughts or feelings constantly evolve and permeate into one another. It might seem that I grow *progressively* impatient but each new moment of waiting changes entirely the quality of this experience as it unfolds itself. I cannot pinpoint the exact moment at which I become impatient or I could suddenly take an irrational decision not even envisioned a few seconds earlier (e.g., honk or scream desperately, go through the red light). In that sense, my mental life is qualitative as it unfolds while waiting at the traffic light. Later on, I could try to remember the order of the main feelings or thoughts that I went through while waiting and estimate their *duration*. Such a quantitative activity is applied to my past feelings/thoughts which, by definition, are not unfolding themselves anymore and it requires their *separation* and *juxtaposition*. As the words indicate such a quantification must occur in space (see Supplementary sections [2](#_kskqf26otqqd) and [3](#_kgrrakq1ig2f)). For Bergson, measuring how *long* I waited, as this spatial adjective indicates again, does only make sense through a spatialization of that experience after it occurred. We tend to ignore such spatialization because we have taken the habit to think that our experience of time is similar to our experience of space: we believe that our internal mental life can be divisible into equivalent temporal units. Bergson remarks that such temporal units do not exist from the viewpoint of a conscious being. They are an illusion that comes from the intrusion of regularities we observed in the world into our inner mental life. While I am waiting in front of a traffic light on a rainy day, I can see the back and forth movements of the windscreen wipers. They create distinct coincidences with my ever-changing mental life and, so to speak, slice it into equal units. It is therefore easy to confuse my experience of the passage of time for the regularity of this movement. But, as mentioned earlier, a new moment of my waiting does not equate to a previous one but changes the quality of the entire ensemble, something that does not happen when I consider the repetitive movements of the wipers (they appear perfectly identical which is why they can be used to count). The reason why we naturally attribute to our heterogeneous inner life the homogeneity of the regular movements we witness around us is that many people can relate to these external movements. While I am waiting, the large numbers of back-and-forth movements of the wipers, or the distance traveled by the secondhand of my watch, will serve as a common reference to communicate that, for instance, it took a *very long* time (many wipers movements) for the light to turn green.

Bergson, therefore, proposes that our experience of duration can only be quantified through its externalization in objects or events that continuously move or change while time passes by. This can be understood by considering the case of a person that wants to compare the speed of two clocks (the duration of one discrete movement of their secondhands). Of course, this person can notice whether the two secondhands move at different speeds. But this will be a *qualitative* distinction that is similar to the ability to perceive that the tempo of a melody has changed or when the duration of two events is different because of their different sensorimotor content. Indeed, it is critical to remember that Bergson does not deny that we perceive changes that occur in time, on the contrary. His concept of *durée* explains why we can be emotionally touched by a crescendo (the first notes endured and melted in the final one to create a sensation that the final note alone could not have generated) or simply perceived all kinds of changes that occurs in a certain timescale, while those developing over very short and long times are simply imperceptible to our sense, as elegantly described by Oliver Sacks at the beginning of this paper [(Sacks 2017)](https://www.zotero.org/google-docs/?XOuVdd). But being sensitive to internal or external changes in time does not equate to measuring their duration, which is well illustrated by the observation that the movements of a plant can be quantified although we can't directly experience these movements. To measure the change in size of a plant, it is enough to compare two snapshots of the plant taken at the extremities of a much longer interval that our nervous system can contract in a single perceptual experience. Coming back to the example of the two clocks, *quantifying* their speeds will require the regular movements of an additional object (e.g. a pendulum that beats the time every 5 seconds or a movement that I can generate myself in a relatively stereotyped manner, such as counting on my finger until 5): I will note the positions of the two secondhands when I start counting on my fingers. Once I arrive at the 5th finger, their new positions will be noted again. Knowing each clock's speed involves measuring the distances each secondhand has covered *when I finished counting*. What happens while I was counting (the movements of the secondhands) is irrelevant to obtaining the final measure, exactly as described by Sacks when he measured the growth of the hollyhocks at several hours of interval. Those movements were perceived qualitatively through what Bergson refers to as a “mental synthesis”, a compression of sensations over a certain chunk of time and which depends on the uniqueness of my nervous system dynamics while I watched the secondhands. Indeed, the secondhands movements might have appeared qualitatively different ("faster" or "slower") depending on my internal state (was I relaxed or in a hurry?) or the type of movements of the secondhand (they could have been smooth instead of saltatory). And they might have not even been perceivable by another species or a newborn. Conversely, our nervous system limits our perception of very slow and very fast movements as noted by O. Sacks in the introductory quote. Ultimately, Bergson proposes that feeling is not the same as measuring and that it is only through regular movements occurring in the outside world (those of a chronometer, of my fingers, or the apparent one of the sun in the sky), simultaneities (cf. "*when I finished counting", "when I came back in the garden the next day*), and ultimately distance that our experience of changes that unfolded during an interval and which originally was qualitative, can be in a second step quantified.

After this general explanation of Bergson's main views on time and his distinction between the live experience of time (durée) and the quantification of time (which requires the spatialization of time), I provide below a step-by-step introduction to Bergson's logic which he originally developed in the Chapter II of Time and Free Will (Bergson 1889)

## 2. Counting external objects

For humans, measuring the passage time is closely related to our ability to count [(Rattat and Droit-Volet 2012)](https://www.zotero.org/google-docs/?tQDAoj). Interestingly, Bergson started his analysis of the perception of time and space by examining the process of counting. His claim is that "*every clear idea of number* [as a sum of units] *implies a visual image in space*" [p59/p79]. To come to this conclusion, Bergson asks us to think of a flock of sheep. To be able to count sheep, we must first forget about their individual differences and assume they are all equal. Then, and at the difference of what happens in the process of enumeration, counting requires something *to remain* such as each new sheep is added to those already counted. The idealized sheep must be *juxtaposed*. For Bergson, this juxtaposition, as the word itself indicates, happens in space not in time. Indeed, the moments of time associated with each addition are finite (or transient) and thus they cannot remain: by definition they pass. The only comprehensible way by which sheep (or any external objects) can be separated is to fix their trace in space (imagined or real). That the process of counting is fundamentally spatial is confirmed when one examines how kids are taught to count or the first counting tools used by humans ([Figure 8](#w3xlh8vk43sp)).



*Figure 8. Left, abacus ring from the Qing Dynasty (1644-1912, http://dataphys.org) Right, markings made on a hyena bone by a Neanderthal might have recorded numerical information. Credit F. d’Errico.*

We tend to forget about the spatiality of the counting process because we learned on top of it a symbolic representation of numbers. "*What leads to misunderstanding on this point seems to be the habit we have fallen into of counting in time* [using symbols] *rather than in space*" [p58/p78]. Because it takes some time to count, we have the illusion that we can add identical units of time on top of each other. But fundamentally those units need to be separated in space to be counted.

## 3. Counting non-spatial events.

Next, Bergson examines whether a similar spatial process is at play when we count events that provoke a succession of sensations (i.e., events that, unlike sheep, do not appear directly under a spatially organized form but unfold in time). Bergson takes the example of hearing the successive strokes of a bell ringing in the distance. He distinguishes two cases. In the first one, "*I retain each of these successive sensations in order to combine it with the others and form a group which reminds me of a tune or rhythm which I know: in that case, I do not count the sounds, I limit myself to gathering, so to speak, the qualitative impression produced by the whole series*" [p64/p86]. Such an experience is similar to what happens when we're listening to music: we may have not noticed the first two strokes but the familiar quality of the flow of sounds and silences generated by the bell makes us, at some point, realize that: "Ah, it's the church's bell''. There is no counting, or quantitative perception of time, in this type of experience. Another (and radically different) type of experience that we can have when hearing the bell' strokes is the one in which we explicitly count them. To do that, as Bergson points out, "*I shall have to separate them* [the strokes]*, and this separation must take place within some homogeneous medium in which the sounds, stripped of their qualities, and in a manner emptied, leave traces of their presence which are absolutely alike. The question now is, whether this medium is time or space. But a moment of time, we repeat, cannot persist in order to be added to others. If the sounds are separated, they must leave empty intervals between them. If we count them, the intervals must remain though the sounds disappear: how could these intervals remain, if they were pure duration and not space? It is in space, therefore, that the operation takes place"*[p64/p87]*.* Once the sound and silence have been stripped of their quality and arbitrarily isolated, counting them requires storing them *separately* which must happen in space (see [Figure 8](#kix.17r3vuj3qmil) and subsection [2](#_ynhu1xpxyuqm) above). One could argue that such separation can be maintained internally through short-term memorization (stored in the brain) and for instance some form of persistent neuronal activity. There is no doubt that something is going on in the brain when we count or even remember the successive strokes of the bell. But neuronal activity and counting occur at different levels of understanding [(Krakauer et al. 2017)](https://www.zotero.org/google-docs/?tzAskw) and humans do not read their spiking activity as they count with an abacus. The fact that counting the strokes of a bell requires sustained neuronal activity does not mean that this ability is purely internal and does not exclude the possibility that counting requires a projection in space of the separated strokes and silences. For instance, if I had to count the strokes of the bell in my head and without the help of numerical symbols or my body, I would probably use an imaginary abacus and thus return to space as the fundamental form of counting. Of course, I can memorize and recall the "melody" of the bell's stroke but this does not mean that I am counting the strokes. Counting will require the additional separation of the strokes and silences in space.

## 4. Time looks like space

The above analyses led Bergson to distinguish two kinds of multiplicity: the multiplicity of objects that comes to us directly in a spatial form (the flock of sheep) and the multiplicity of our conscious or affective states, which takes the form of succession in time. It is in this context that Bergson placed himself to analyze more carefully the ideas of our perception of time. The first observation of Bergson is that when we think or speak of our experience in time, "*we generally think of a homogeneous medium in which our conscious states are ranged alongside one another as in space, to form a discrete multiplicity*" [p69/p90]. I underlined the "*as in space"* to remind the reader of the way neuroscientists describe the perception of time (*space is a good analogy for time*) and illustrate the prescience of Bergson on identifying this tendency. Thinking that our experience of time and space are alike is derived from the impression that both objects (e.g., a ruler) and events durations (e.g., a movie) can be arbitrarily divided into portions of equal length. Bergson raises the following question: could our unconscious habit of seeing our mental life as a *discrete multiplicity* occurring along a line (a spatial representation of discrete and successive events) affect our perception of the flow of our sensations and thoughts? Bergson asks us to try to abstract ourselves from our habit to decompose and align, to verify if the way our conscious states appear to us in time, *as we live,* is a discrete multiplicity. He anticipates that this is not the case. Indeed, for Bergson, if on the one hand, we have the tendency to discretize and align our feelings and ideas as they occur in time, and if on the other hand, the process of counting successive events (here ideas and sensation) requires a form of spatialization, it is to be presumed that such view of our inner life in time is nothing but space. Bergson felt encouraged in this conclusion because if "*we are compelled to borrow from space the images by which we describe what the reflective consciousness feels about time* [e.g., this movie was too long] *and even about succession* [e.g., he left shortly after the snow started falling]*, it follows that pure duration must be something different* [than space]".[p68/p91]

## 5. Time and space while we experience the world, the discovery of durée pure

Bergson proposes the following definition of pure duration which will refer to *durée* to distinguish from the duration measured by clocks: "*the form that the succession of our states of consciousness takes when our ego lets itself live, when it refrains from establishing a separation between the present state and previous states. It does not need, for that, to be absorbed entirely in the sensation or the idea which passes, because then, on the contrary, it would cease to last. Neither does he need to forget the previous states: it suffices that by remembering these states it does not juxtapose them with the current state as a point to another point, but organizes them with itself, as it happens when we remember, melted together so to speak, the notes of a melody"* [p74/p100]. So durée is possible because our nervous system allows merging our most recent sensation in the ongoing one. Our durée is therefore limited by our short-term or working memory and perceptual system. On the one hand, we can't witness the opening of a flower and hardly notice it moving in the sky. On the other hand, we can't perceive the exact movements of the hummingbird’s wings. To illustrate the idea that we can perceive successive sensations in an intermixed or overlapping manner, Bergson takes the example of what happens if the length of a single note is changed in a musical motif. It is the different quality of the motif that will be noticed immediately, not the long note in its isolation. Similarly, the same note will be perceived differently if played in isolation or at the end of a crescendo. *"We can thus conceive of succession without distinction, and think of it as a mutual penetration, an interconnexion and organization of elements, each one of which represents the whole, and cannot be distinguished or isolated from it except by abstract thought. Such is the account of durée which would be given by a being who (...) had no idea of space"* [p75/p101] *.* Indeed, according to Bergson, we are so familiarized with the idea of space that we can't refrain from introducing it in our conscious perception: "*we set our states of consciousness side by side in such a way as to perceive them simultaneously, no longer in one another, but alongside one another; in a word, we project time into space, and succession thus takes the form of a continuous line or a chain, the parts of which are contiguous without penetrating one another*" [p75/p101]. This view is extremely different from the one of durée. To take another example, if someone plays in reverse order the first 8 notes of a well-known musical motif, no one will say: "oh sure this is the beginning of the Cello Suite of Beethoven in reverse". In other words, the qualitative experience of the reverse musical motif does not provide any clue about the quality of the original order. This quality results from the overlapping or merging of the past notes into the present ones. Moreover, each time we listen to this melody, our qualitative experience will be somehow distinct, up to the point that we can become bored by a tune we've listened to too many times. On the contrary, when the melody is discretized in separate notes, the reverse order can be recovered from the original one. But for such reversion to be possible, the song had to be spatialized into a sheet of music. Thus, for Bergson, when I experience a series of sensations or ideas, either I experience them in their *durée* in which their succession is indivisible because they truly penetrate each other, or I distinguish an order. But it is important to recognize that the latter is dependent on having an idea of space and the possibility of elevating oneself above time to embrace simultaneously the moments that composed the durée. The observation that the musicality of a short tune cannot be retrieved by playing that tune in reversed order illustrates the famous motto of Bergson: time (durée) is not space.

## 6. If durée cannot be measured, what do clocks measure?

Time seems to be something that can be regularly divided exactly like space (aren't clock dividing time), which makes Bergson's motto counterintuitive. It is critical here to remember that for Bergson, the time that is not space is the one that is qualitatively experienced. Bergson then asked what happens when we measure the passage of time with clocks. How do we achieve a quantitative assessment of a time interval while looking at them? Bergson remarks that when I look at the running secondhand of a clock, I believe that I measure the passage of time but I am primarily experiencing discrete simultaneities, or coincidences. My first look at the clock defines a simultaneity between the position of the secondhand at that moment and my conscious state. A distinct simultaneity occurs the second time I look at the clock at the end of the interval. My perception of what happened *between* these two events (during the interval) is the result of a mental synthesis which will be different if the secondhand moves in a saltatory or continuous manner or if I was in a hurry or about to fall asleep while watching the clock. The quantitative estimation of how much time elapsed will be necessarily derived from the distance traveled by the secondhand in the space of the clock’s face at the end of the interval. The observation of the discrete positions of the running hand in the clock's face might give us the impression that our internal life can be divided into equal units. From there comes the erroneous idea of time being analog to space. But the only homogenous process was the repetitive movements of the running hands in the circular *space* of the clock. Two successive moments of our inner life are never the same, in line with the fact that we can fall asleep or become impatient while watching a clock.

## 7. Duration, movements and simultaneity

Bergson then applies his discovery of the durée to the perception of movements, *"the living symbol of this seemingly homogeneous duration"* [p82/p110]. "*It is most often said that a movement takes place in space, and when we declare the movement homogeneous and divisible, it is the space traveled that we think of, as if it could be confused with the movement itself. Now, on thinking more about it, we will see that the successive positions of the mobile do indeed occupy space, but that the operation by which it passes from one position to another, an operation which occupies time and which has reality only for a conscious spectator, escapes space.*" [p82/p110]. When science deals with the successive positions of a moving object, it does so by systematically leaving a gap between them, a gap that can have an infinitesimally small size but that is irreducible. Indeed, "*when the astronomer predicts an eclipse, for example, he engages in precisely an operation of this kind: he infinitely reduces the intervals of duration, which do not count for science, and thus perceives in a very short time - a few seconds at most - a succession of simultaneities which would occupy several centuries for a consciousness obliged to live the intervals.*" [p87/p116]. Consequently, during the mathematically defined interval between two discrete positions of a moving object, the qualitative perception of duration and movements requires the mental syntheses of a flow of stimuli. Such a synthesized perception should be considered as an indivisible progress rather than a thing, otherwise, it loses its fundamentally dynamical nature (see [Nicholson and Dupré, 2018](https://www.zotero.org/google-docs/?EYV5vm) for an extension of the concept of progress to all aspects of the living). To summarize this part, Bergson makes (again) the distinction between two ways of experiencing movement. One can experience a movement as an indivisible unit. This is what happens when we see a shooting star or a pole vault athlete performing a successful jump at 6.15 meters. Like for the perception of music, the qualitative aspect of such movements only emerges from experiencing them dynamically as a whole but will be lost when the movement is transformed in cartesian coordinates to be experienced quantitatively. The qualitative experience of watching Armand Duplantis establishing the new world record at 6.18 meters is not captured by the height of his jump which is an external measurement useful to compare the performance of distinct athletes.

## 8. Two forms of multiplicity, two forms of the self

So far, Bergson has established a distinction between two kinds of multiplicity of conscious states in time: i) a qualitative version that is experienced when there is no intention to measure or count, and ii) a quantitative one in which sensations or cognitive states are separated and ordered/projected in space. The problem arises from the fact that we use the latter to speak of the former, which ends up confusing the two phenomena. Language fuels this confusion by using fixed labels to describe our dynamical internal state. The idea of *internal states permeating each other* is already treacherous because it implies the existence of distinct fixed internal states. Still, Bergson recognizes that both qualitative and quantitative multiplicities go hand-in-hand and his reflection does not aim at disqualifying the latter. When we are explicitly counting the successive strokes of a bell, which is important for obvious practical reasons, we are in parallel touched by its musicality that develops in time. Each additional stroke changes the meaning and quality of the series. "*Hence it is through the quality of quantity that we form the idea of quantity without quality*" [p92/p123].

Bergson proposed that it is the alignment of the continuous and ever-changing stream of our internal states with the homogenous movements of external objects that causes our illusion of thinking that our experience of time is homogenous and divisible. Why does this alignment cause such an illusion? This is by looking more carefully at what happens when one observes an object moving regularly (e.g., a clock, the sun) that Bergson makes an important breakthrough: " *Here we certainly have a series of identical terms, since it is always the same moving body; but, on the other hand, the synthesis carried out by our consciousness between the actual position and what our memory recalls of the former positions, causes these images to permeate, complete, and, so to speak, continue one another. Hence, it is principally by the help of motion that duration assumes the form of a homogeneous medium, and that time is projected into space. But, even if we leave out motion, any repetition of a well-marked external phenomenon would suggest to consciousness a similar mode of representation*" [92/p124]. Thus, although our successive sensations are dissolved into one another, they retain the regularity of the movements of external objects that cause them. I hear a sound progressively louder and louder and this progression gives me a feeling of continuity in time. But what is homogenous here is the movements that cause the sound. "*And thus our superficial psychic life comes to be pictured without any great effort as set out in a homogeneous medium*" [p93/p125]. Bergson therefore concludes that we can divide our conscious life into two trends. In the first one, we are paying attention to the outside world and are impressed by the regularity and homogeneity of the changes that occur there. We feel that we endure time like these objects. In the second one, we can get absorbed in our feelings, actions, or thoughts that are intimately intertwined and ever-changing. "*But because this deeper self forms one and the same person with the superficial ego, the two seem to endure in the same way. (..)That our ordinary conception of duration depends on a gradual incursion of space [through the regular movements of objects] into the domain of pure consciousness is proved by the fact that, in order to deprive the ego of the faculty of perceiving a homogeneous time, it is enough to take away from it this outer circle of psychic states which it uses as a regulator*" [p93/p125]. This exact situation happens when we dream, as in this state our interaction with the external world is extremely limited. In such a state, our qualitative sensations are not constrained by the regularity of the world and this can lead to wild variability (hence surprise) in our perception of time. Similar variations in our sense of time happen under the influence of drugs, in extraordinary life-threatening experiences, or even in pseudo-experimental conditions in which a subject is deprived of external cues that classically mark the passage of time (prolonged stay in a cave). It is therefore essential to distinguish two types of duration. One that is qualitative and fundamentally internal, the other that is quantitative and fundamentally external.

Importantly, the dichotomy between these quantitative and qualitative views of our internal/mental life that develop as time passes by does not exclude that they can inform each other. Bergson illustrates this point using for the last time the image of the bell's strokes. "*As I write these lines, the hour strikes at a nearby clock; but my distracted ear only notices it when several blows have already been heard; I therefore did not count them. And yet, it only takes an effort of retrospective attention to sum up the four knocks already struck, and add them to those I hear. If, returning to myself, I then carefully wonder about what has just happened, I realize that the first four sounds had struck my ear and even moved my consciousness, but that the sensations produced by each of them , instead of being juxtaposed, had merged into each other so as to endow the whole with an aspect of its own, so as to make it a sort of musical phrase. To retrospectively evaluate the number of blows struck, I tried to reconstruct this sentence by thought; my imagination struck once, then two, then three, and as long as it did not arrive at the exact number four, the sensibility, consulted, replied that the total effect differed qualitatively. She had therefore observed in her own way the succession of the four strokes struck, but quite differently than by an addition, and without bringing into play the image of a juxtaposition of distinct terms. In short, the number of strokes struck was perceived as a quality, and not as a quantity; duration thus presents itself to immediate consciousness, and it retains this form as long as it does not give way to a symbolic representation, drawn from extension*." [p94/p127]. Bergson's analysis yields therefore to a dualistic view of our mental life which is separated into two trends: a superficial one that he called homogeneous duration with well-defined and impersonal mental states and that serves as a symbolic representation of a deeper heterogeneous conscious flow or pure *durée*, in which the succession of states implies fusion and organization. While Bergson only briefly touched upon the question of the interaction of these two views of our mental life (one external and quantitative, the other internal and qualitative; see the previous quote), he warned us that his point is not to duplicate the subject. " *It is the same self which sees distinct states, and which, then fixing its attention more, will see these states melt together like snow needles in prolonged contact with the hand.*" He introduces here his method of the *intuition* that he will develop later [(Bergson 1934)](https://www.zotero.org/google-docs/?sT3g9M). Our social life requires us to consider primarily our mental life as distinct well-separated states and an effort is required to get the intuition of its deeper nature, free from the practical and efficient symbols derived from the outside material world and that our intelligence is naturally prompt to grasp. It is in his next book (Matter and Memory, Essay on the relation of the body to the mind; [Bergson, 1896](https://www.zotero.org/google-docs/?I29wR6)) that Bergson will attempt to overcome the difficulties associated with this dichotomy between internal spiritual life and external material world, by considering the body as a point of junction between matter and mind allowing life to strive in a fundamentally temporal world.

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1. Essai sur les données immédiates de la conscience. [↑](#footnote-ref-1)
2. Page numbers inside brackets refer to the French’s edition of Bergson first book on time and space (Essai sur les données immédiates de la conscience, édition Quadrige, PUF) followed by the comparable section in the english translation (Time and Free Will: An Essay on the Immediate Data of Consciousness, trans. F. L. Pogson, New York: Dover Publications, 2001) [↑](#footnote-ref-2)