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Article

Why Do Words for Space and Words for Time Converge in Languages? Answer: Space and Time Are Both Children of Movement

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Abstract

The convergence of words for space and words for time in languages has long been noted. Through the hypothesis of linguistic localism, authors express that space has cognitive primacy, and is used to talk about time. Based on our reflection on the (revisited) foundations of physics, we formulate a different hypothesis. We limit ourselves to an epistemological analysis, without in-depth work on specific linguistic situations. The common root of time and space is *movement*, which is also the source of language (our approach is based on embodied cognition, as well as on a relational epistemology: words are defined in opposition/composition to each other). In this understanding, there are not, in advance, words attributed to space on one side and, separately, words attributed to time on the other. *There are only words of movement*; there is a discourse of/in movement within which words, through comparisons between them, construct time and space. Following changes in context (more or less distant from our human scales, but revealing), we can imagine transformations from one to the other. We propose a graphic representation of comparisons between movements. At the heart of our article, it provides a framework for thought, to be compared with those proposed by the linguist G. Guillaume. It allows us to envisage a broad field in which to represent the different times and spaces that encompass the subject. We situate what we might call the *past past*, the *present past*, the *present present*, the *present future*, and the *future future* (the present of mountains does not have the same meaning as the present of clouds, nor as the present of mathematical physics, a simple reference point of limited material value). Some characteristics of how languages function in terms of verb aspects and tenses, and noun/verb duality, are briefly discussed in light of the proposed representation. The question of the multiplicity of spatio-temporal "strands" of the discourse, and their interweaving, alternating between visible/explicit and invisible/implicit parts, is discussed. The text proposes preliminary research directions to be tested and compared with other linguistic theories.

Keywords: space; time; movement; languages; linguistics; anthropology; prepositions; verbs; aspect (verbs); tense (verbs); linguistic localism; epistemological circularity; embodied knowledge; relational thinking; Gustave Guillaume; graphic representation

*Everything is time,
Immobile time, I call it space.
Everything is space,
Moving space, I call it time.*

Introduction

Linguists and anthropologists show us the many ways in which languages express space and time, and their interrelationships (Asic, 2004, 2008; Asic & Stanojevic, 2013a and b; Brdar *et al.*, 2011; Demagny, 2013; Geld & Krevelj, 2011; Gradecak-Erdeljic, 2011; Le Draoulec & Borillo; 2013; Le Draoulec & Stosic, 2019; Naim, 2006; Orlov, 2019; Pavelin Lesic, 2011; Rinehart *et al.*, 2018; Stosic *et*

al., 2012, among many other references¹). ... Multiple ways of expressing space and time? Yes! Or not expressing them: they are not necessarily self-evident! The Melanesians of New Caledonia have not developed autonomous concepts of time or space (Leenhardt, 1947). In concrete terms, they measure or evaluate what we call time by linking it to what we call space, in the movement of the stars and seasons, the growth of plants and vegetables, etc. The Indians of the Altiplano, for their part, have a single word, *Pachamama*, to refer to space and time, which is the entire universe (Manga Qespi, 1994).

The implicit link between space, time, and movement in various non-Western cultures is evident in the absence of specific words for time. It is also evident in what could be called an identity between words² of space and words of time. These words are similar, or even identical³. According to Haspelmath (1997), "*human languages again and again express temporal and spatial notions in a similar way.*" Table 1 provides some examples of words whose uses encompass space, time, and movement.

Table 1. A few words about time, space, and movement.

Names	niche, range, zone, region, interval, amplitude, start, departure, origin, beginning, end, arrival, continuation, figure, rhythm, on the spot (for at the moment), with the benefit of hindsight, where (relative pronoun: the moment when, the place where), progress, priority, anteriority, posteriority, odyssey, journey...
Verbs	go, come, leave, arrive, return, exit, enter, go up, go down, pass, come back, flee, sail, fly, jump, walk, run, dive, take place, be located, be found, precede, follow, coincide, progress, advance, retreat, regress, finish, begin, accomplish...
Prepositions	under, above, below, on, in front of, opposite, behind, to the left of, to the right of, since, as soon as, in, between, towards, around, in the vicinity of, across, near, far from, close to, at the moment of, during, after, before, behind, in front of, from, to, first...
Adverbs	previously, then, here, there, now, presently, yesterday, once, formerly, previously, today, immediately, tomorrow, soon, after, later, finally, never, rarely, occasionally, often, always, for a long time, already, simultaneously, elsewhere, everywhere, in front, behind, above, below, outside, near, inside, before, around...
Adjectives	greater than, less than, high, low, long, short, narrow, tight (in the sense of narrow), narrowed, limited, unlimited, finite, infinite, large, small, endless, (a duration) measured to the millimeter...
Expressions (compound: nouns, verbs, adjectives, etc.)	The revolution is underway; to fall into poverty; a difficult moment, a difficult passage; to be on the brink of disaster; distant memories; the future is ahead of us, the past behind us; to see far ahead; the moment, the time has come for...; pressed for time; the passing, the course, the passage of time; it's two hours from here; when the sun is up; sunrise, sunset; in the blink of an eye; it took us three minutes to see it; chasing time, catching up with time, turning back time; postponing, putting off until later; wandering in one's thoughts; crossing the threshold...

The distinction between three categories (space/time/movement) corresponds to a certain usage, but we do not express it in the organization of the table, insofar as we claim that everything can be traced back to the same source. We can distinguish between what relates to amplitudes of time or space (nouns); what qualifies locations and relationships along the spatial or temporal axis (prepositions; adverbs; adjectives; possibly other nouns);

¹ These references provide access to a wealth of literature.

² *Words* of space and time, we understand this in the broadest sense: words and their possible variations, phrases, collections of words, expressions, sentences, various ways of marking space and time: prepositions, nouns, verbs and their conjugations, adverbs, etc.

³ Our approach is general, and we provide these words by way of illustration.

and what refers to movement and its modes, in both time and space (verbs). We could distinguish more finely between what concerns scales of perception and speeds of traversal, notions of proximity or distance, dualities of event/process, inclusion/exclusion, interior/exterior, etc. Numerous expressions qualify the characteristics of a movement in time or space and combine expressions of various linguistic status. We have taken up the prepositions studied by Asic (2008). This list (translated from French) does not claim to be exhaustive.

And time frequently borrows its words from space. This observation applies to most languages, including those of our countries. We see it in French and English. It can be analyzed in different ways. In particular, it is the hypothesis of *linguistic localism* (cf. Jackendoff, 1985; Asic, 2008). Understood in a number of different ways⁴, it basically means that *words relating to time are borrowed from space*. How should this be interpreted? It has been the subject of much debate. A large number of linguists refer to the cognitive priority of space over time, with the latter essentially reduced to borrowing its vocabulary from space, for lack of anything better (e.g. Haspelmath, *op. cit.*). This approach remains within a framework marked by the uncontested dichotomy of space/time. Within this framework, researchers document how language facts associate space and time, and how space precedes time.

For our part, we are interested in these questions from a conceptual point of view (e.g. Guy, 2019⁵). In our understanding, the three concepts of space, time, and movement are linked and cannot be grasped separately. The convergence of words for space and time is not a kind of coincidence, a metaphor, or a mere convenience. It reveals *the functional identity of the two systems (spatial and temporal), which is rooted in their identity of nature*. In response to the question asked: - why do the words for space and time converge? we affirm: - it is because, quite simply, *space and time are the same thing: movement*.

This text focuses on a basic presentation of this point of view⁶. We refer mainly to the French language, which undoubtedly introduces a bias into the discussion. In the first part, we review how we understand the trilogy of time/space/movement. Then (in the second part), we present our thesis in relation to those found in the literature, and look at a few points in response to objections that could be raised against it. In the third part, assuming that the words for space and time are derived from movement, we use this assumption to propose original graphic representations that we compare with those of the linguist G. Guillaume. Then (part 4) we analyze some aspects of how languages work (the noun/verb duality, verb aspects, verb tenses). We then contribute some elements for discussion, raising the question of the multiplicity of spatio-temporal "strands" of the discourse, and their interweaving, alternating between visible/explicit and invisible/implicit parts (Part 5). We then conclude, after an attempt at synthesis (Part 6).

1. The Trilogy of Time/Space/Movement (Our Work)

How can we arrive at the surprising and paradoxical conclusion that space and time are the same thing? We have answered this question in our work (see, for example: Guy, 2019, 2024). Initially, we were concerned with grasping the concept of time, without resigning ourselves to trying to understand it alone (ultimately without the world), which is absurd. The separation of time from the world is the result of a process of abstraction: this starts from embodied knowledge and functions according to a relational epistemology (objects of thought are not grasped individually, but in

⁴ We take this hypothesis in a basic way. It is a gateway to presenting our understanding of the relationship between time and space. Appendix A contains some comments on the subject.

⁵ We reproduce and modify a few excerpts from it here, in an expanded text. Our text was written in French, primarily concerning the French language. In this English translation, we find ourselves in a hybrid position where both languages are involved, although the issues addressed are dealt with in different ways. Explanations of the translation will be provided where useful.

⁶ We remain at the threshold of a vast field. This text reflects only a few months of reflection accompanying its writing: we must bring it to a provisional conclusion, while the data that informs it continues to grow, along with the desire to discuss them.

opposition/composition with each other). The common root of space and time is movement, experienced first in our bodies, before the words to describe it (phenomenology also points us in this direction: Lobo, 2021; Léger, 2022). The corresponding concepts are constructed by comparing movements according to their relative speeds. In *space, movements have very low relative speeds, compared to movements with higher relative speeds, on which we construct time*. There is no ultimate meaning to the words space and time. There is no ultimate separation between time and space, but a conventional decision to divide them, depending on what interests us or what we are able to discern. Among the movements offered to us by nature, we choose one that we use as a standard, which allows us to access quantitative measurements.

What linguistic consequences can we draw *a priori* from this thesis? That of a multiplicity of spaces and times and an identity of temporal and spatial relationships; that of the relational nature of the meaning of words, to be understood in a certain context. Time is not hidden. It is marked by the movements of objects in space, whether those of the sun and the stars, or those of the subject himself as he moves, identifying different elements of the spatial framework during his journey. At a given moment, it is necessary to connect the points of view, that of the stationary observer and that of the moving observer⁷. We are not going to use new vocabulary to order the positions in space of distant objects, which are moments in time on the journey to encounter them. If we are nomadic, or simply take a few steps, we classify events by space, directly linked to time. When we stop and want to talk to sedentary people, how do we change our repertoire? "Go *further*, after the river, you will see the big rock." Events are then marked by places.

In saying all this, we are linking time and movement, or change⁸ and movement, as many authors have already noted (e.g., Radden, 2011; Stanford, 2011). What is new⁹? We would insist that *space is also affected by movement (and not time alone)*: there is a degree of freedom on this side, resulting in elasticity and variability in what we call space, depending on exchanges between space and time. This degree of freedom will be illustrated by all kinds of comparisons of the movements associated with the different objects of the discourse.

2. The Words of Space and Time

2.1. Epistemological Analysis

Without attempting to comment in detail on the work on the alliances between time and space in languages, let us focus mainly on the logical and epistemological coherence of what is said about them, in the spirit of the analysis just mentioned.

When we say "*words of space are used for time*," there is a sense of unease¹⁰. If these words are used for time, it is because they are also words of time! Why restrict them, in their supposed primary

⁷ What is important is relative movement, whether it is attributed primarily to the observer or to the landscape that comes toward him. Linguists (cf. Guillaume, 1947) have distinguished between two registers for time itself: ascending (from the past to the future, I am moving towards the future), and descending (from the future to the past, the future is coming towards me) depending on whether or not the observer is the hand of the clock, i.e., whether it relates to his own movement (*moving-ego*) or to that of the objects he sees passing by (*moving-time*) (cf. Sadoulet, 2010).

⁸ For us, change is resolved into movements, however microscopic they may be.

⁹ From mountains to photons, including the pieces of a table being assembled! There is no need for extreme speeds (neither in terms of light nor geological relief). The cessation of movement in what is called space (as opposed to time) as associated with a given object is subject to convention: see below what we have called "spatio-temporal pragmatics."

¹⁰ This discomfort is implicitly acknowledged by Haspelmath (op. cit.; S. Naïm, pers. comm., 2016), who emphasizes both the independence, and the relationship, between space and time: "*space and time are the two important basic conceptual domains of human thinking. Neither space nor time are part of a more basic conceptual domain, and neither can be reduced to the other. But space and time seem to show a*

definition, to space? The same applies to words of time, which would be used for space. *There is a form of logical inconsistency.* In both cases, space and time have been separated in advance. The existence of neither has been questioned; we could at least have done so for time, which is the subject of so many questions, from philosophy to physics, and which is absent in so many cultures.

Based on the above considerations, we are tempted to say: these words are not in themselves words of time, or words of space. They are *both* words of time and space. They are *spatio-temporal words* (Bakhtin, 1978, already proposed the term *chronotopes* to designate them), and some are used *more* for space (or function to construct what we call space; these are what we call words of space), and others are used *more* for time (or function to construct what we call time; these are what we call words of time). The question then is to study why and how, in relation to a given situation, we use some rather than others.

We can take this analysis further and, rather than spatio-temporal, say more clearly that words of space and time are *words of movement*. This is the crux of our argument. It then *brings us back to the origins of language and psychic life*, which the authors see in movement, in movements. Movement is expressed first and foremost in the literal sense through gesture, through the whole body; the link between gesture and language can be seen in sign language. Movement can also be found in the role of images and the imagination, and even in the cognition of mathematics¹¹. Psychomotricity and neuroscience affirm that there are real movements in the brain (ideas, understanding, language) that correspond to the movements of the body¹². There is a considerable amount of literature on all these aspects. Among the many works on the subject, we can cite Wallon (1959), Laplane (2001), Guy L. (2001), Fusellier-Sousa and Leix (2005), Teissier (2006), Rossi (2010, 2013), Weinberg (2010), Mondala (2014), Virole (2014), Rochat (2015), Girel (2016), Bara *et al.* (2020), and Dahan Gaida (2020). According to this view, we are led to ask why, for certain words, we have stopped movement in what we call space, and why, for others, we have allowed them to continue in what we call time. This requires us to uncover contexts that often remain implicit. If we modify these contexts, we can imagine that, as they vary, words can transform into one another, words of time into words of space, and words of space into words of time. In doing so, it is not only the words that transform into one another, but also the physical quantities, the very concepts of space and time, which support these words¹³.

But what movements are we talking about? We have mentioned the subject's body, its gestures and signs, waving arms and hands¹⁴. Yes, but just as much the movements related to the objects of our world. By object, we mean all the opportunities to talk about the world, humans and their groups, their constructions. We have talked about "spatio-temporal pragmatics" (Guy, 2015) to refer to the relationships that an object has with the rest of the world: this object is not defined in itself, indifferent to other objects, once and for all. It is defined by a multitude of movements that bring it into contact with others, another name for the relationships it has with them¹⁵. Is this a way of understanding

peculiar relatedness that is perhaps not evident to a naïve philosophical observer." See also Asic and Stanojevic (2013a).

¹¹ This is particularly true when it comes to understanding the sequence of numbers by "moving" along the line of real numbers in our minds.

¹² In terms of communication, it is also said that nonverbal communication (gestures, facial expressions) dominates verbal communication by 80%, given that words account for only 7% of the latter, with the rest residing in intonation, tone of voice, silences, etc. Words are only the tip of the iceberg of movements in the broadest sense...

¹³ We can distinguish between exchange between time and space through a change of context, and transformation from one into the other through continuous variation of context.

¹⁴ Movements in the environment are the primary source of attention to that environment, as studies on the gaze of animals, small children, etc. attest.

¹⁵ Material "particles" in the broad sense, which serve as a support for spatial and temporal relationships, have, through their respective "weights" in a particular context, more spatial than

how, for example in Latin, places or movements are marked, not by verbs or prepositions, but by the cases of nouns (locative or ablative for a place; accusative for a movement towards; genitive for a movement from...)? This is to say that words change according to the relationships (movements) we have with them, their fundamental relational nature disappearing into the seemingly substantial nature we give them when they are no longer declined. In ethnology and anthropology, authors document the links between space and time and various aspects of the lives of social groups¹⁶.

Without getting into a discussion of endless circularities and regressions at this point, it should be noted that, in the context of relational epistemology, movements are understood, at a second level, as comparisons of movements, or, one might say, comparisons of speeds¹⁷.

The measurement of time and space has long been based on the movements of the stars, particularly those of the sun in relation to the earth. Today, we rely on the photons of the atomic clock (and the standards of space and time are linked to each other via the postulated constancy of the "speed" of light). There is no denying the need for a social group to have shared references, referring to a single space and a single time¹⁸. Today, we choose those of physicists, not because they are the right time and space, but because everyone conveniently relates to them (without necessarily being aware of it). We also see in this matter the role of social conventions.

The transformations of space into time, or time into space (discussed in part 3), are achieved by changing the scales of speed, more or less implicit and given from outside the discourse, which govern our representation of the world: they are *a priori* related to what we are capable of measuring, experiencing, and observing at our human pace. But we can vary the "speed of time" that passes by placing ourselves, for example with the geologist, on timescales of thousands to millions of years: we then talk with him about the rise of a granite massif in the Earth's crust. Here we can distinguish the temporal relationships between rock sub-assemblies of different compositions. On a human scale, these rocks are perfectly immobile and ordered in space, rather than time. By changing the relative speed scales, mountains, which usually serve as spatial landmarks, are transformed into clocks. Space is transformed into time.

In short, what questions arise *a priori* in the epistemology of current linguistic presentations of the relationship between space and time? - It is the oversight that, in movement, space is there, and not only time, and that it can become time. It is not a simple receptacle for movement, independent of it. Its very definition involves movements, as Poincaré (1902, 1905) clearly pointed out¹⁹. It is not every day that we allow ourselves to move mountains like waves in the sea, but this thought experiment renews the whole and reveals a fundamental functioning²⁰. - It also highlights the neglect of relational epistemology in the construction of our knowledge: space and time are understood as opposites, and the boundary between them is not imposed by reality. The metaphor "*time is space*" no longer applies. Or rather: it is no longer a metaphor! It is the truth of an identity of nature. We can

temporal meanings. Thus, the Eiffel Tower is both an object and a place, while a simple flower does not have as much spatial value (where am I? near a rose?).

¹⁶ Leblic (2006) documents the links between space, time, and kinship in New Caledonia. Chetcuti (2012) shows how a particular animal (a deer) "engenders" time and space. See also Calame Griaule (1970).

¹⁷ But the relationship between these speeds is not necessarily secondary to the speeds themselves: we are faced with the same epistemological subtlety, see Guy (2024): we call the relationship between two terms (we separate them into two) what was initially only the result of a single measurement.

¹⁸ For Leblic (2006), this unique reference point for a society is related to the relief of its place of residence, the mountain range of New Caledonia.

¹⁹ Pierre Sadoulet (2010): "in order to represent space, the semiotic subject does not seem to be able to do without temporal succession." Is this the reciprocal of linguistic localism? See also Depaule (2006).

²⁰ See also the summary in section 6.

imagine ways (some more surprising than others!) of resuming the movement of space in time, or of stopping the movement of time in space.

2.2. Examination of Some Objections

Strong objections to the previous thesis come to mind. To show the relevance of our proposal, let us examine a few of them on a case-by-case basis. It can be argued that certain words used for space *cannot be used* for time, and vice versa. This is particularly the case for prepositions, or what serves as prepositions. Many of them mark space and are also used for time, such as the prepositions *avant* (before) and *après* (after) in French. However, according to Asic (2008), certain expressions such as *au-dessus de* (above), *au-dessous de* (below), *sur* (on), *sous* (under), *à côté de* (next to), *à droite de* (to the right of), and *à gauche de* (to the left of) are purely spatial and cannot be used for time. In line with our understanding, we hypothesize that all words can be used in both registers. When faced with the temporal question, "When did it happen?", we can easily answer using any of the spatial expressions mentioned above. Here are some examples.

- When did it happen? Was the sun to the right or left of the church steeple? (for a small community in a specific space). Or for a larger community, a village: was the sun to the right or left of such-and-such peak²¹ ? Or again: was the store of this brand on your right or left (while walking around town)?
- Answer: *on the right*
Or, for expressions *above*, *below*:
- When did it happen? Was it above or below your camp? (for mountaineers climbing a difficult rock face over several days). Or for cavers descending into a chasm: was it above or below the hall of gours? Or, for passengers on an airplane taking off: was it above or below the cloud layer?
- Answer: *above*, *on*.

It seems quite simple, and it is central to our understanding of time: time refers to the position of a moving marker in space that serves as a frame of reference for determining the position of stationary objects. In one case, the clock is the sun; in another, the position of the climbers, cavers, or airplane passengers, the subject of the journey himself.

It is true that humans generally move horizontally, going forward, rather than up or down vertically, or sideways. Linguists and anthropologists have noted that the body defines three spatial axes: front to back, top to bottom, right to left; and that the passage of time can be based on one or another of these axes, primarily the front-to-back axis. In some cultures (Aymara, Yupno, ancient Greeks), the polarity is reversed: the future, which we cannot see, is behind us, not in front of us. We could use these three axes to define one or more times (even if we only choose one for the entire community)²² .

Other objections come to mind in the other direction, i.e., regarding words of time that could not be used for space. Do we say "once upon a time"? Yet we can reveal an implicit context spanning a large time scale, that of the movement of the solar system around the center of the galaxy. The "once upon a time" is then a point on this large orbit: we are then placed in a movement in space where we show a place, the location of this *past* (for the Hebrew people, the past refers to the exodus from Egypt, or the exile to Babylon). Or can we use *sudden* for space? Yes, again through movement and imagining two trajectories intersecting abruptly and defining a shock that we would consider equivalent to *sudden* (two people meeting in the street).

²¹ The zenith of the sun's course at noon is a position: it divides two times, morning and afternoon.

²² Leblic (op. cit.) tells us about Melanesian communities where time is also marked by the top and bottom of the Caledonian central mountain range. Chen (2021) tells us about a vertical metaphor of time in China, where the upward direction refers to the past and the downward direction to the future. The image of water falling from top to bottom is a justification for this.

If words that are *a priori* considered to be solely spatial, or words that are *a priori* considered to be solely temporal, can be used for the other side, we can look at the question from a different angle: what causes an uncategorized word, which could in advance be used on both sides, to be used on one side rather than the other? As we have said, it is the relational framework, or the relationship to the context (sometimes implicit), that decides. Let's take the word *length*. When talking about a film, we think of the time it takes to watch it (space doesn't matter, we stay in the same place). When talking about rolls of wallpaper to buy, the word refers to *the space* to be covered by the plasterers and painters (the time it takes to hang the wallpaper is irrelevant).

So here we have words of space that are also used for time, or words of time that are also used for space, or even "spatio-temporal" words that switch from one side to the other. But didn't we say earlier that all these words relate to movement? Do the ones we have just examined relate to it? We would answer yes: *above*, *below*, express movement: they suggest the idea of an obstacle or a boundary to be circumvented (upward or downward) in one's thoughts and/or accompanying actions²³. In English, this movement is particularly contained in the corresponding prepositions *up* or *down* (more so than in verbs, that describe the manner of movement). And what movement in *the "once upon a time"*? We have already answered: that of traveling a portion of the Earth's or solar system's trajectory in space to reach that distant time. Yes again for *length*, which applies to a journey and combines the duration of the trip and its mileage, two sides of migration. We will not go into the vast subject of movement, which languages have a wide variety of ways of expressing: think of the verbs indicating the manner of movement, which can, in a more or less metaphorical way, be used for both space and time (see Table 1).

As a provisional conclusion to this section, we hypothesize that the game we have just played with a few expressions (giving a single spatio-temporal or movement value to words classified *a priori* on one side or the other of the space/ time duality; and its reciprocal: giving a word without a label, or marked as movement, its meaning going towards space or time) can be generalized to all forms of expressions considered specifically spatial or temporal, or of movement.

3. Comparisons of Movements: A Graphical Representation

Assuming that the connection between the words of space and time and movement is accepted, let us now use it to analyze some aspects of how languages work. The spatio-temporal properties attributed to elements of discourse result from comparisons of movements. This can be illustrated geometrically in a diagram. Let us use it as a tool for reflection²⁴. It requires at least two axes, placing one scale of movements in opposition to/composition with another, within the multiplicity of times and places (Figures 1 and 2). It forms the core of our argument: its understanding will be consolidated throughout the text through its applications.

²³ So much so that we could have referred in the title of the article to the convergence of the words time, space, and movement, highlighting, with this expanded title, a circularity (movement is defined by movement) specific to relational epistemology.

²⁴ G. Guillaume (op. cit.) speaks of "schemes in which complex movements of thought lend themselves better to graphic representation than to verbal description." We are talking here about a representation with two axes; we could consider three (as Guillaume discusses), or even more...

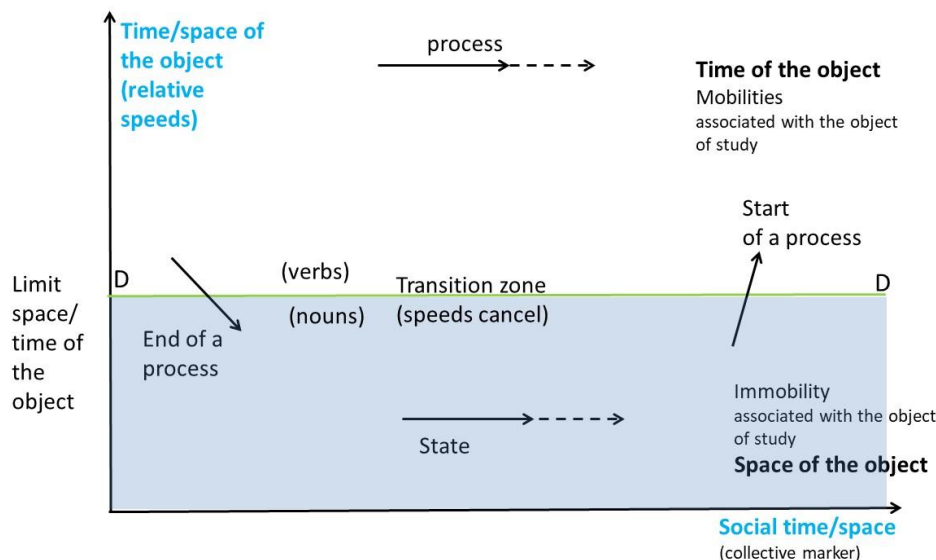


Figure 1. Characterization of words in a space of comparative movements. Words s.l. (the objects of the discourse) can be represented in a two-dimensional space. On the x-axis, the horizontal axis represents social time from which we view all objects from a single perspective. On the y-axis, an axis associated with each object of study represents the composition between, at the bottom, its spatial aspect, which is fixed, and, at the top, its temporal aspect, which is mobile by comparison (to speak in this way is to use a shortcut, as the object is seen globally, but it is the comparison of different points of view on this object that allows us to position ourselves along the vertical axis). The horizontal line DD' is a transition zone, depending on the precision of the measurements of time and/or space along the x-axis, or on choices specific to the object. Crossing it upwards sets things in motion, breaks them down, disperses them; crossing it downwards stops them, stabilizes them, aggregates them. The lower part represents states, the upper part processes, all of which can continue in collective time for an indefinite period (indicated by the extension of the dotted arrows). The word "process" conceals a set of movements compared to each other and would therefore merit several arrows (the expressions "end" and "beginning" of a process warranting nuances developed in the following figures). Adapted from Guy (2019).

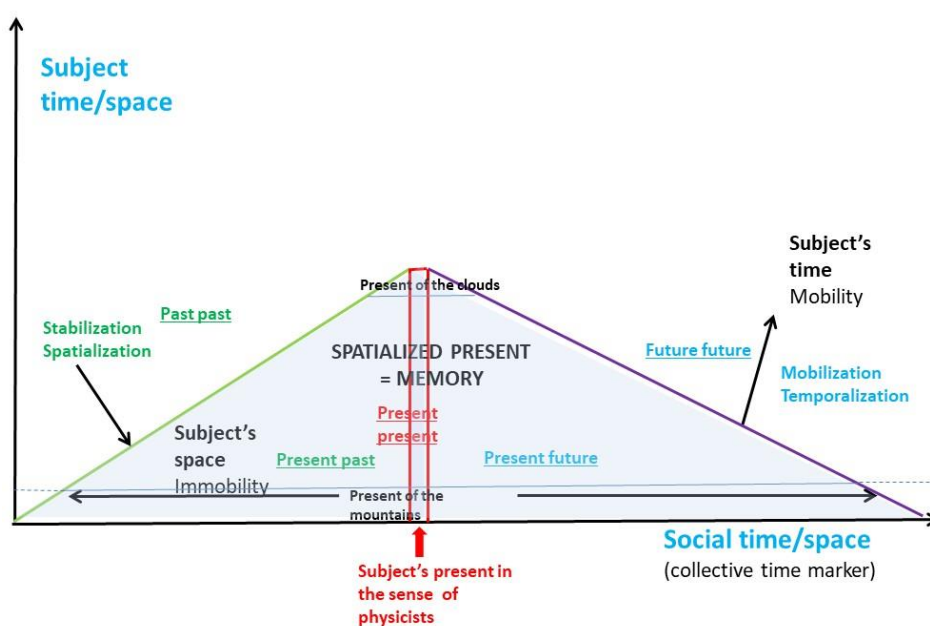


Figure 2. Spatio-temporal environment of the subject. This representation focuses on all the objects in the subject's environment, each of which is represented by a horizontal band. Each has a part located inside the

"pyramid": this is the spatial, "frozen" part of this object (in the sense given in the text); and a part located outside, which is the temporal part of the object, corresponding either to the upstream part of the spatial part (before the object's stabilization boundary) or to its downstream part (where the object will be destroyed). The different horizontal lines are like "strands" woven together (see Figures 6 and 7).

3.1. Horizontal Axis

As we have said, we certainly need a scale that refers to the space and time common to all. These are useful for the functioning of society and are always present, even implicitly. They result from an initial comparison of movements that made it possible to separate space and time. This separation makes sense in the particular world we inhabit, marked by a minimum of geographical stability, in relation to which movements considered regular can be defined²⁵. Common space and time are now labeled by the rulers and clocks of physicists. The possibility of making quantitative assessments refers to the postulate of constant speed of the standard (that of the relative movement of the sun and the earth, or that of the photon in the atomic clock²⁶). We represent this common time (also referred to as the external temporal dimension) along the horizontal axis, oriented in its progression from left to right (from the past to the future; it is also a spatial reference, with the different times corresponding to the position of the standard of movement²⁷). The scale is marked in seconds, hours, days, months... (or meters, kilometers, astronomical units...), as needed. The polarity of the axis, marking the irreversibility of time, is also an important feature (which can influence the choice of words).

3.2. Vertical Axis, First Step

Having established a collective reference point, we must now locate the object of the discourse (whether it be a person, a group, an object in nature, a collection of objects, an event, the subject's environment, etc.). We will proceed in two steps, depending on whether we consider the object as elemental (Figure 1), or whether, on the contrary, we consider from the outset a set of objects with different speeds (Figure 2). To characterize the specific functioning of an object, we distinguish between its different constituent movements, as we discussed in section 1: they are compared to each other and allow us to distinguish between what we call the mobility of the object and what we call its immobility; or, with a certain degree of abuse, the time ("internal" time) of the object and the space of the object²⁸. In the context of relational epistemology, it makes no sense to talk about the object in itself; it is the endless sum of all the relationships (all the movements) it had, has, and will have with the rest of the world²⁹. We represent the different corresponding speeds along the vertical axis, increasing upwards.

For a single object, we decide on a horizontal limit DD' (this is a transition zone) between what we no longer consider to be mobile (negligible speeds), which is the "spatial" part of the object (below), inseparable from the temporal part (above, speeds taken into account). We can also talk about a separation between states and processes associated with the object.

²⁵ This possibility is not available to the inhabitants of the planet described in the novel *The Three-Body Problem*.

²⁶ This is a way of expressing the second postulate of the theory of relativity.

²⁷ The horizontal time axis therefore also has spatial value: events can be ordered in space using prepositions, which are essentially equivalent to classification by verb tenses.

²⁸ The "temporal" part above the DD' limit (see below) is not empty space, but the speeds associated with movements there are not negligible, and we do not construct *space* there in the sense separate from *time*.

²⁹ We can therefore associate *several* movements with the same object (Figure 1). Without mentioning any possible sub-parts of this object, which may have different relative speeds (Figure 2), we can at least refer to the multiple movements of the human subjects who perceive it.

Let's give some examples. A bird, motionless in its nest (spatial part, below) or in flight (temporal part, above) provides a simple model. If the object of the discourse is the action of setting the table for a meal, we can place above the DD' line everything related to the movements required to do so; while below, the table is frozen in its set or partially set state. The word "table" itself has a mobile aspect, linked to its manufacture from different pieces, its transport, its cleaning (but also its disintegration, destruction, combustion); whereas to characterize its immobile aspect, we slow down (or decide to slow down) all these movements to see it as standing there, inert. The table has a different meaning for the carpenter who makes it, for the cook who cuts food on it, or even for the children who play under its shelter (we could treat the example of a house in the same way, considering its construction and the movements we make within it on the one hand, and its immobile contemplation on the other).

3.3. Interlude: Changes in Speed Scales

The ordinate of the DD' boundary may vary depending on the speed scales that interest us, or that we are able to see. Overall, the two axes of our representation are not both strictly homogeneous at speeds, even if the horizontal axis hides this. A displacement, represented by an arrow in this plane, represents a movement: this is clear on the horizontal level, where we move in common space and/or time. This is also the case on the vertical level, where a change in speed, marked by acceleration or deceleration (vertical displacement in the diagram), also refers to comparative movements. The temporal functioning of verbs cannot be reduced to the trilogy of past/present/future: how, then, can we distinguish between the preterit and the progressive preterit (in French: *le passé simple* and *l'imparfait*)? This is where the notion of aspect comes in: we will mark it with vertical movements (which will be associated with horizontal movements), doing justice to the vertical dimension of our representation (a perfect tense will express a movement which, at a given moment, will have a downward vertical component, to freeze in space: marking a result still visible at the moment of speaking. We will come back to this in a moment).

By changing the scales, or by broadening the comparisons between objects of the discourse, we can change the compared sequences of past/present/future (see also below), and change the altitude of the DD' limit. From a relational point of view, the speeds associated with the objects of study (vertical axis) are defined by comparison with the standard speed that allows the measurement of social time (horizontal axis). Not to mention a more or less hidden circularity: the standard speed does not exist on its own, but itself incorporates comparisons with other speeds (see Guy, 2024). A change in the range of spatio-temporal scales considered lowers or raises the horizontal limit DD' between time and space of the objects of study; we freeze movement, or, on the contrary, we make stability mobile. This transforms times, even exchanges nouns and verbs... and the perfective/imperfective aspects of verbs. Thus, the opposition between "*he prepared the meal*" and "*he was preparing the meal*" can be understood in a certain way of measuring time. If we look at it on a daily scale, the preparation of a meal is not seen as taking place. We envisage a result that translates into food being laid out on a table in space (time is as if absent). If, on the contrary, we look at it on a second-by-second scale, we envisage the meal being prepared.

3.4. Vertical Axis, Second Step: The Subject's Environment

The previous representation can also be used to discuss the spatio-temporal qualities, not of a single element of the discourse (a single object), but of the human subject, speaking, referring to his entire environment, both internal and external: this consists of several objects connected by the subject³⁰, whose relative speeds we will classify. Thus (Figure 2), we describe the subject as a kind

³⁰ The scope of this section is as much anthropological as it is linguistic. It takes advantage of the possibilities of our graphic representation. In his book *Le passé à venir* (such as translated into French), anthropologist Tim Ingold (2025) challenges the representation of the succession of generations as a

of pyramid. Its apex shows the tip of its present, where the "spatial" part is smallest. This sinks beneath its feet. The lower flare corresponds to all the elements of the subject's environment that were in place prior to his most reduced present: they occupy the left side. They continue on the right side, where they will be able to untangle themselves later. There is no reason to observe symmetry between the two slopes of the pyramid. The obliquity of the boundary between the spatial (slower speeds at the bottom) and temporal (relatively faster speeds at the top) parts can be explained by the fact that the slower speeds refer to processes that began earlier in the collective past (horizontal axis). The elements on the left part of the pyramid are frozen in the past, but still very much present today, like these mountains. We can talk about them as *the present past*. An even more distant past, of which no trace remains, is the *past past*. The present past is all the memory that this subject carries within him and around him. It will continue for some time to come; it is the *present future*. In the distant future, or *future future*, this memory may fade away. If the mountains form the base of the pyramid, it is because they were formed in the most ancient past; and they will also disappear in the most distant future. In contrast, the clouds that form and dissipate above the subject's head have a much smaller spread; they are located near the top of the pyramid³¹. The present, in the physicists' sense, is reduced to a point without thickness: the top of the pyramid. It is a useful mathematical reference point, but it "does not count" in relation to the concrete present inside the "building." Such a representation can also be useful, not for the speaking subject, but for an object of the discourse, by looking in a differentiated way at the various movements that define it (in the sense we mentioned above) or the various pieces or "atoms" that constitute it (each of which has its own history in terms of its creation and/or destruction).

3.5. G. Guillaume's Representations

It is interesting to compare our graphic representations with those proposed by the linguist G. Guillaume in his *Architectonique des temps dans les langues classiques* (1945). Without seeking to analyze his work in detail (note that this author does not dispute the existence of time or space, which he considers separately from each other), we can find a similarity between the two-dimensional layout of our Figure 1 or 2 and the vertical sections of the three-dimensional structure proposed by this author (Figure 3). The horizontal axis of the vertical planes orders the past/present/future succession of collective social tracking; it is the same in our representation and that of Guillaume. G. Guillaume's vertical axis contrasts two horizontal levels, at two different altitudes, namely that of *the present of current consciousness* and that of *the present of memory*, also called *present of the perfect tense*. This configuration is similar to our Figure 2, where the upper part of the pyramid refers to Guillaume's present of consciousness, while the lower area brings together the present of memory (which we extend to the future), or Guillaume's present of memory (the word memory is there on both sides). The term *perfect* is used by Guillaume (he speaks of "semantic birth at the perfect level") in reference to these Latin or Greek tenses, translated into French in the present tense, but whose source refers to the past: *memini*: I remember (now) what I (formerly) introduced into my memory ; *oida* (οἶδα) : I know (now) what I learned (in the past). We do not have the equivalent of Guillaume's third axis (a horizontal transverse axis, perpendicular to the previous plane), which the author calls the (dynamics of) *spatialization*. This axis sees the status of time change: it contrasts *lived time*, known as *operative time*

stack of watertight strata. For us, this point of view is a way of revisiting, as we do here, the relationships between time, space, and movement.

³¹ Ph. Coueignoux (pers. comm. 2025) proposes an image to capture the variation in speeds and the stacking of scales along the vertical axis: the temporal quality upwards becomes spatial downwards, with speeds decreasing. One can think of a train journey where the passenger sees objects passing by at a very high angular velocity (this is the temporal part); in contrast, objects located further and further away eventually come to a standstill and appear fixed, with an angular velocity tending towards zero (spatial part).

(with a certain spatial amplitude in Guillaume's diagram³²), with *represented* time, where the present shrinks, to be reduced, at the limit, to a point on a line; this is what is known as spatialized time (admittedly, the representation of operative time is already spatialized in Guillaume, at least in his diagram!). For us, the word *spatialization* refers to a separation between space and time: part of the movements freeze in space, time is left aside (associated with other movements), we enter the pyramid (Figure 2) or we pass under line DD' (Figure 1).

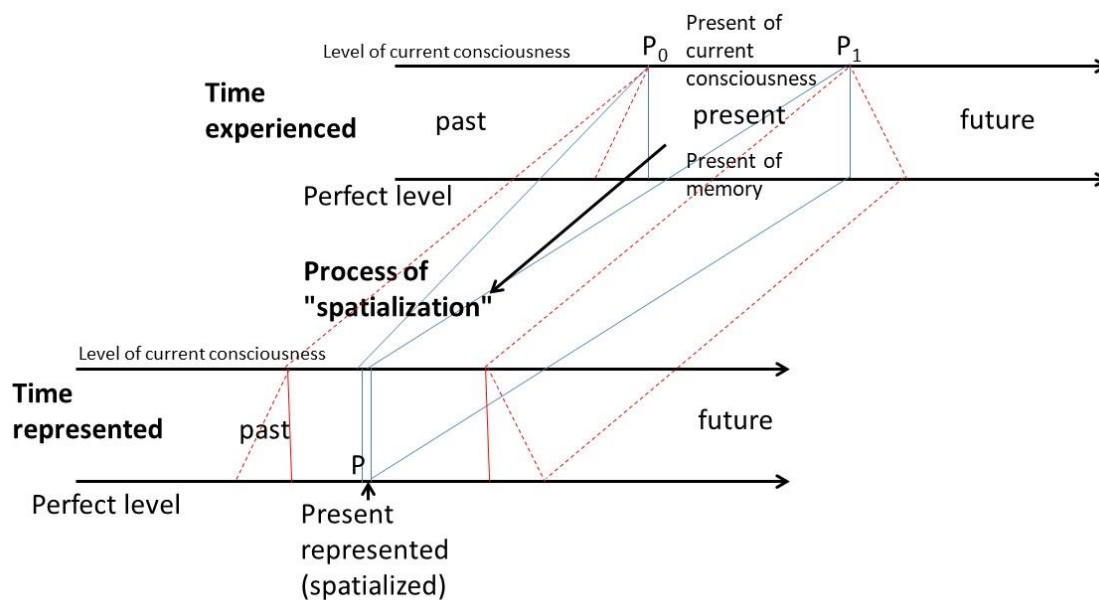


Figure 3. Three-dimensional thought model for linguistics, according to Guillaume (1947). This is our understanding of Guillaume's proposal. Two vertical planes are represented, one called lived or experienced time (behind), the other represented time (in front). The transverse horizontal axis (underlined by a long black arrow) is called "spatialization." It contrasts lived time, where the present unfolds (between the vertical lines marked by points P_0 and P_1 , with represented time, where the present is reduced to a point (a vertical line) without thickness, marked P (blue vertical lines at P). The two horizontal levels marked in the vertical planes correspond to the level of current consciousness (at the top) and the level of the perfect tense (at the bottom), which brings together the contents of memory. Contrary to what Guillaume represents by narrowing the whole {current consciousness/memory} as it progresses forward (represented time), it seems to us that memory does not narrow (red dotted lines; we have also included a widening of memory in the plane of lived time). The horizontal axis of the two vertical planes (common to both levels of current consciousness and perfect tense) contrasts the three terms of the past/present/future trilogy.

3.6. The Light Year: From Geological Time to Astronomical Time

It is interesting to use the previous diagram to compare two contrasting situations in relation to the past. In geology, the traces of events that took place a billion years ago, are beneath our feet: they appear when we sink vertically into memory at a given moment (plane of our Figure 2). Space and time are then separated. This billion of years takes us back in time to the birth of this "stratum." In

³² This operative time could be compared to *the instant* in A. Jacob (2016), or *duration* in H. Bergson (1938). In our works, we have contrasted lived time ("primary," associated with movement) with time represented spatially, from the moment it is separated from space! T. Brachet (pers. comm. 2025) points us to another work by G. Guillaume: *La mécanique intuitionnelle*, in which the author addresses the relationship between time and space. We leave its examination to future research, as well as the re-examination of the works of Kant, Humboldt, Hegel, Schelling, Heidegger, Kojève, etc., in addition to Jacob, cited by T. Brachet, which would support our thesis.

astronomy, we also talk about billions of years, but we do not know whether they correspond to time or space separating us from our object of study: the two are linked. In contrast, we could trace a downward and backward oblique path on the diagram of our representation (Figure 2), combining the space/time of the object and the calendar time of the subject. This leads us to the boundary between the mobility and immobility of the object in a time prior to that of the observer. The task may then consist of reconstructing a local pyramid whose apex is located in this distant past. This requires articulating times and spaces separated from each other, perpendicular to the astronomer's line of sight toward distant stars, which, for its part, combines space and time inseparably. The phrase "light year" synthesizes, in its own way, the intertwining of the notions of duration, space, and movement (Ph. Dujardin, pers. comm., 2025).

4. Aspects and Tenses of Verbs

4.1. The Verb/Noun Opposition

Depending on the language, the opposition between words of stability (Figure 1, below DD') and those of process (above) is expressed differently; every object of thought has two such sides (more or less composite), even if one or the other is implicit. In French, the opposition is between nouns, which have the apparent solidity of space, and verbs, which we use for what unfolds in time³³. Depending on the language, the latter are sometimes replaced by the former, or by words from other categories, such as prepositions. While some verbs express states, nouns are also used for processes. It should be noted that the word "time" is a noun: it certainly supports thought, with all the necessary stability, but its traditional role in the Western world prevents us from seeing its malleability and its relativity to space!

The possible movements in the diagram in Figure 1 allow us to consider the different functions of language expressions in terms of space and time. Two main types of movement can be distinguished: - horizontal movements in relation to common time give access to temporal qualities (in the sense of the past/present/future trilogy), marked in French by verb tenses; - vertical movements, understood in relation to the duality of mobility/immobility associated with the object of the discourse, give access to aspectual qualities (marked in various ways, in particular by verb forms). The interplay of movements, with oblique parts, allows for a nuanced interpretation.

4.2. Verb Aspects (Figure 4)

The aspect of a linguistic element (particularly verbs) contrasts the unfolding of an action, in its incompleteness (imperfective aspect), with its result or conclusion (perfective aspect); see, for example, Stanojevic (2024), Stanojevic and Asic (2010), Asic and Stanojevic (2013b). For Marcolongo (2018), aspect may have preceded tense in the evolution of languages: what matters in the unfolding of an action, relates to the action itself (its progress, completion, success, or failure) as much as to when it occurs. Crossing the DD' boundary along the vertical axis reflects aspect: by diving downwards, we immobilize the result of the process in space (perfective; see the S-shaped line in the figure), while it can continue in time (upper part, imperfective; horizontal path). The Russian language particularly highlights this duality. In Ancient Greek, the indicative aorist³⁴ refers to a one-off action, in a perfective sense, as opposed to the imperfect tense (progressive preterit or *imparfait*), which envisages an indefinite sequence of events (imperfective); the use of the aorist apparently restricts it to the past. These aspects are found in French in the contrast between the *passé simple* and the *imparfait* (this contrast, which depends on relative speeds, can change; the conjugated tenses are discussed later/below). The pluperfect (*passé composé*) expresses the present result of a past action. In

³³ Inflected languages express this duality in their own way: noun cases refer to spatial relationships, while verb conjugations refer to temporal or aspectual relationships.

³⁴ There is then an augment that marks a past reference point. But in other moods, the aorist has no augment. The perfect tense in ancient Greek also expresses an aspect (the *passé composé*, in French).

the present tense, the expression "*être en train de*" can emphasize an imperfective aspect. The clearly vertical crossing of the horizontal border allows us to speak of inchoative, marking the beginning of a process and its initial developments (we speak of ingressive to mark its particular severity). Note that there is no aspect (or tense) representing a symmetrical path of the perfective sigmoid relative to the horizontal line DD': it would be rooted in the space below the line and rise above it, spreading out in time. This would correspond to the disappearance, the more or less sudden disintegration, of an object that leaves no trace in the present (it never stops leaving no trace)! It is annihilation³⁵, the appearance of absence!

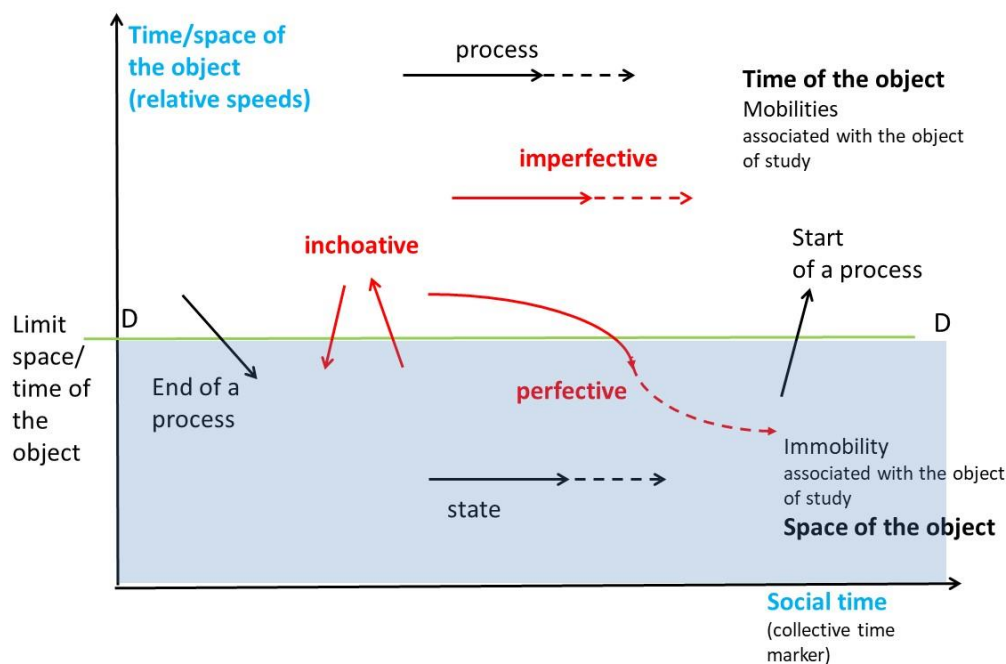


Figure 4. Characterization of verb aspects in a space of comparative movements. The meaning of the axes of the diagram and the horizontal line DD' is given in Figure 1. The inchoative aspect (beginning/end of a process) is visualized by crossing the horizontal boundary in one direction or another; depending on how steep the line is, the corresponding change is more or less abrupt (it is very smooth for a line that tangents the straight line DD'). The perfective aspect is visualized by a path beginning in the temporal part (process) and ending in the spatial part (stop, state; for an indefinite duration – dotted lines); the imperfective aspect is visualized by a horizontal path in the temporal part, also continuing indefinitely (taken from Guy, 2019, modified).

4.3. Verb Tenses (Figures 5a, b, and c)

Let's talk about verb tenses, in the sense of conjugation. We will first look at those of the French indicative mood³⁶. To position them, Figures 5a, b, and c use the same representation space as above (Figures 1 and 2). In our understanding, tenses are still grasped through comparative movements. With Reichenbach (1947), we distinguish three points along the horizontal axis, named respectively S (the moment of utterance), R (the reference point) and E (the event that interests us). A large number of relative positions of S, R, and E can be considered. Asic and Stajonevic (2013b) provide an inventory of these (see also Fournier, 2013). - The positions may coincide, which these authors indicate with a comma, as in R, E (R and E are synchronous). - One position may precede another along the horizontal

³⁵ An "anti- or a-perfective" (we do not say imperfective), such as the effect of an atomic bomb on a Japanese city (which it is better not to have to describe too often)?

³⁶ We are not discussing the wide variety of possible tenses, including in French, nor specifically the duality of simple and compound tenses (in French, there is a past perfect tense and even a double compound past tense: "*nous l'avons eu fait*" [we had it done]).

time axis, which is marked by a dash, as in R-E (R precedes E). Thus, for past tenses, R and E will precede S, while for future tenses, R and E will follow S. Here we will take three examples corresponding to (R, S), which encompasses E-(R, S) and (R, S)-E, then to (S-E-R) and finally to (E-R-S).

Figure 5a. (R, S). The time of utterance or position of the speaker is the present, separating the past from the future, the field where we will position E. In the past, we note the opposition between the preterit, the progressive preterit, and the present perfect (in French: *le passé simple, l'imparfait et le passé composé*) (see the aspects discussed in Figure 4): - preterit, where crossing the horizontal boundary in one direction or another is more or less abrupt, without horizontal spread in social time (the action has stabilized and stopped; we do not specifically consider its present repercussions). - progressive preterit, where the action is ongoing, continuing over a certain period of social time without ending. - Present perfect, where we see, in the present, more or less directly, the result of a completed action: this is marked in space, i.e., below the DD' line. The future corresponds to a crossing of the DD' boundary in a social time posterior to the present time.

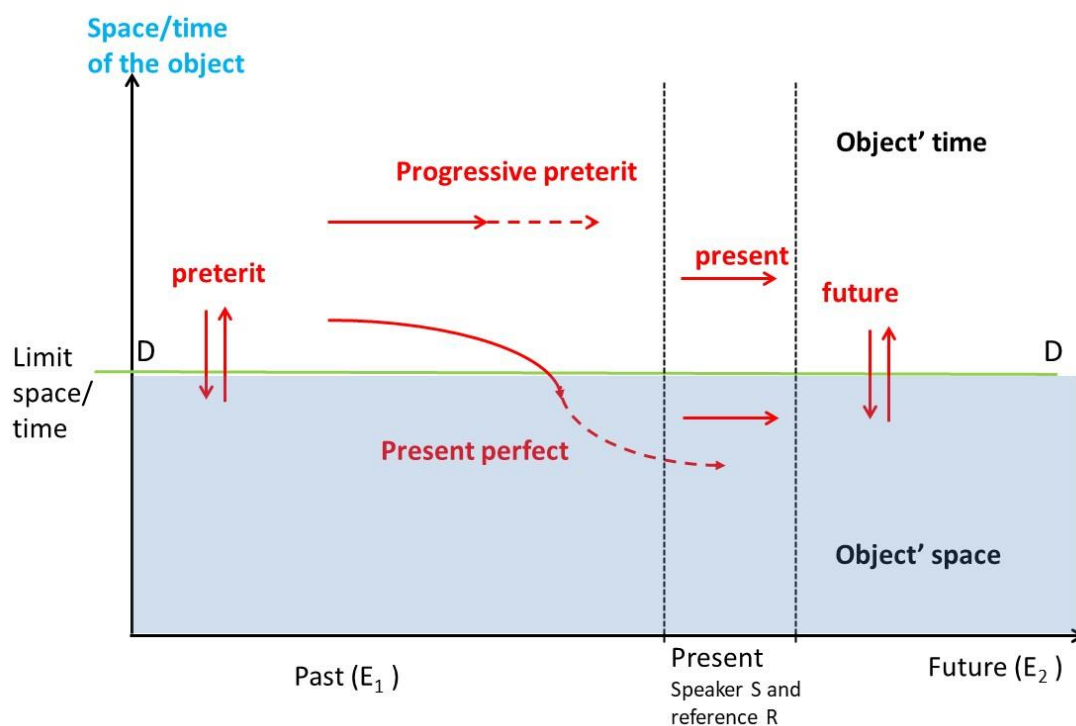


Figure 5a. Characterization of verb tenses in a space of comparative movements. We rely on the relative positions of three points: S (utterance), R (reference), and E (event), see text. The reference point R is identified here with the position S of the speaker, both in the present tense. The point E can belong to the past (E_1) or the future (E_2).

Figure 5b (S-E-R) The future perfect tense is shown; it is a past tense of the future.

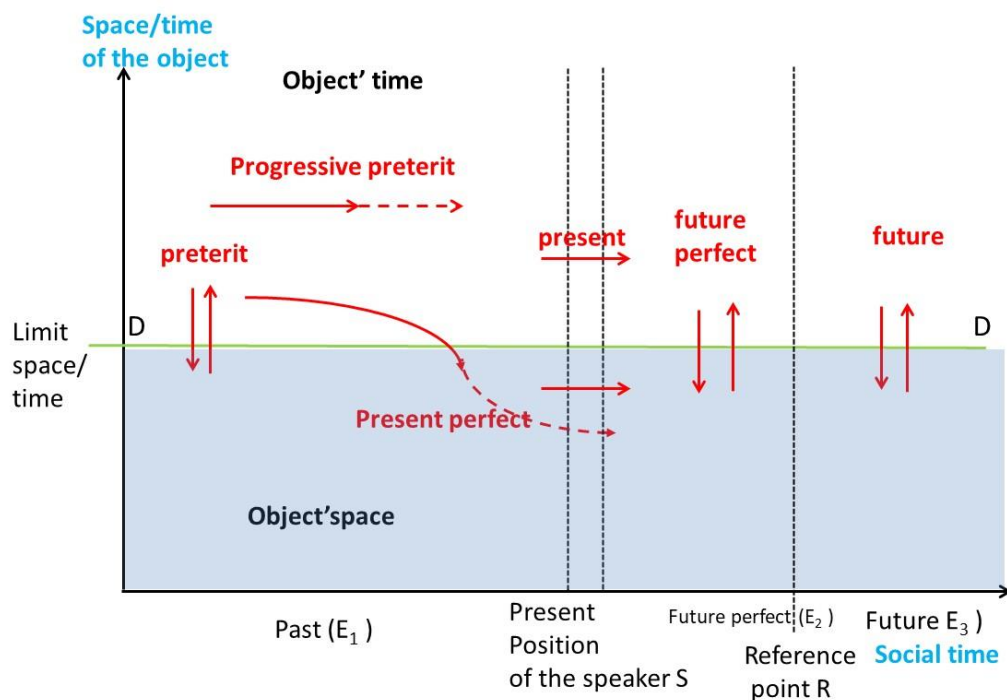


Figure 5b. Characterization of verb tenses in a space of comparative movements. The reference point R does not coincide with that of the speaker S; here, it is located in the future. The future is now divided into a future perfect part (in French: *future antérieur*; before the reference point, E_2) and a simple future part (after the reference point, E_3). The future perfect acts as a past of the future. The past is not fragmented (E_1).

Figure 5c. (E-R-S) The pluperfect is shown; it is a past of the past: it expresses an action that is past in relation to another past action, completed at the moment of speaking.

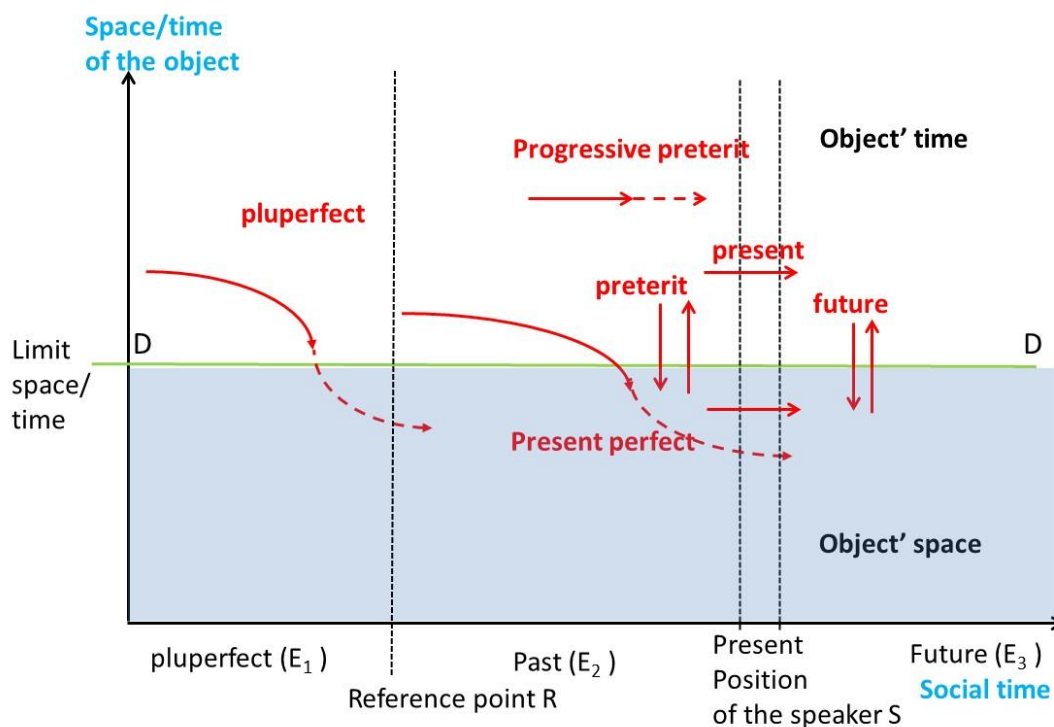


Figure 5c. Characterization of verb tenses in a space of comparative movements. The reference point R does not coincide with that of the speaker S; it is located here in the past. The past is now divided into a pluperfect

part (before the reference point, E_1) and a preterit part (after the reference point, E_2). The pluperfect acts as a past of the past. The future is not fragmented (E_3).

4.4. Tenses and Aspects

Tenses represent aspects; tenses and aspects are complementary and are represented at the same time. Note that, as we have represented them in Figures 5a, b, and c (and without necessarily thinking about it), the future and future perfect have a perfective/inchoative aspect (we consider the result of an action without dwelling on its unfolding), while the pluperfect has a more clearly perfective aspect (it is a kind of past perfect: we have considered the course of the action before its completion and its subsequent repercussions). These choices of aspect for the future tenses certainly deserve specific discussion. Can we consider an imperfective for these tenses? Can the treatment of the future as perfective be attributed to the asymmetry between the past and the future: considering the future is like placing oneself mentally before an achieved result? It should be noted that in Russian, the perfective has no present tense; it represents the future, which is in line with our choice. To support this research, we could generalize what we have done for the perfective and formalize paths associating the upward/downward vertical part of crossing the DD' boundary with more or less long horizontal pursuits, expressing more or less abrupt changes related to their result still acquired in the present. That is to say, associating with the vertical ascending/descending part of the inchoative, a branch attached to the imperfective/perfective aspect of the verb. Hence hybrid names such as "imperfective inchoative" or "perfective inchoative" (we have pronounced the latter).

In the same vein, the question could arise of giving different altitudes to the three points S, R, and E in our representation. This would be another way of bringing together the aspects and tenses of verbs. This would be useful if there were special verbal forms for the relationship between relative motion reference points (a conveyor belt, an elevator, an airplane, etc.), provided that the effects of loss of simultaneity or contraction/dilatation of space and time play out as they do in physics (see Guy, 2020).

4.5. Verb Moods

Our thinking on the subject of verb moods remains limited: is an original discussion possible within the framework of our approach? G. Guillaume positions the subjunctive in his three-dimensional structure: he places it in an intermediate vertical plane between the broad operative experienced present and the narrowing of the "spatialized" present³⁷. For our part, we can assume that the moods function in our diagram with the same space-time relationships as for the indicative, namely as comparisons of movements. The difference with the indicative lies in the status of the plane, referring to a hypothetical world (subjunctive), subject to a condition (conditional), or to an order (imperative). In terms of verb tenses, the personal moods (subjunctive, conditional, imperative) have (in addition to the present) several past tenses, although fewer than in the indicative moods: subjunctive progressive preterit (we are principally speaking of French language where it is a simple tense: *l'imparfait*), perfect and pluperfect (compound tenses); past conditional and pluperfect. In ancient languages, Latin and Greek, there is also a past imperative (perfect, without augment). The impersonal modes (infinitive, present participle (or gerund) and past participle) can express the present or the past. The past participle is used for the compound tenses we have already discussed. Outside of the indicative, the different moods do not have a future tense (in ancient Greek, the optative, infinitive, and participle have future tenses). Given that the future does not yet exist, it is interesting that Spanish translates it as a conditional, and that English uses a modal such as *will*, which is not unrelated to the subject's will (also found in the Chinese "yao," which expresses both strong will and future). This again shows the links between tenses, modes, and aspects.

³⁷ At this stage, we are not sure we have understood this point.

5. Elements for Discussion

5.1. *The Thread of Thought/Language Has Several Strands*

We can talk about the movement of thought along a discourse. Mathematical cognition tells us this in its own way, with regard to the representation of a sequence of numbers, by traversing the real line (Teissier, 2006), illustrating the thread that is being unraveled. The different words of a message are woven together to produce the meaning of a statement. But not everything is explicit when it comes to the spatial and temporal framework, nor the scales of speed adopted: to clarify these, we can rely on pieces of the discourse adjacent to the present one (we saw this in an example concerning the spatial or temporal meaning to be given to the word *length*). Thus, we can say that the thread of thought does not have a single strand: there is the visible strand in the foreground, and other strands in the background. Asic and Stanojevic (2013a) have postulated this duality (or multiplicity) of strands. This can be seen in the diagrams above, where the speed scales, both for the horizontal and vertical axes, are not always made explicit in the discourse and must be sought elsewhere. The stacking of horizontal ribbons corresponding to processes of different speeds (Figure 2) can be considered as an association of as many strands.

5.2. *The Words and Silences of Language; the Blacks and Whites of Writing*

The multiplicity of strands of thought, and its counterparts in language, is one avenue of investigation. Another avenue is linked to this: it is the inevitable association of the known and the unknown in any formulation of knowledge, whether expressed in words or mathematical symbols, whether it comes from sensory data, physical measurements, or theoretical constructions. In language, translated into words written on paper, this is revealed by the black of the letters and the white space between them (or, orally, by the alternation of sounds and silences). This association of fullness and emptiness is a condition for being able to report something of the world³⁸, but it is also a limitation: part of it escapes us. To give the illusion of movement, cinema projects a series of images with a pause between them; during this pause, nothing is shown, while another image is put in place, waiting to be revealed. The filming system is identical, and part of the filmed scene is missing. This nothingness, or this blank space between letters (this silence between words, this gap between two images), represents a lack of knowledge. It varies in size depending on the type of the discourse. It can be found in historical reconstructions, whose constructed continuity hides moments and places about which we know nothing. It is this unknown part that counterfactual history exploits by constructing a time that it claims to be truly "alive" (Raymond and Hallier, 1982). It is also what seems to disappear when we move from the present of perception to the spatialized present of G. Guillaume.

This shortfall is never filled. The objects of the discourse are translated into pieces of space or time that we want to break down into smaller pieces in order to understand or say more: these will be other black spots between which there will be new gaps. The continuity of the actual discourse bridges these gaps and allows it to hold together. Concrete functioning, effectiveness in the sense of Vaudène (2019), plays the role of an implicit thread that ensures the solidity of the whole. Detours in the time and space of words may be hidden there.

Figures 6 and 7 illustrate all this. In Figure 6, the time and space of the different strands of the discourse (whether they relate to different ongoing processes or to elements of the subject's cognition,

³⁸ Our senses function thanks to biological cells; our measuring devices function thanks to sensors. Information is acquired in a discrete manner: the cell or sensor must reach a state of saturation, triggering a switch: the information is then sent to a "central" memory and the cell or sensor, once emptied, is ready for another acquisition. During unloading, there is a gap in recording (this type of behavior is exemplified by the functioning of visual cells). The size of the different pieces seen/forgotten depends on the physical characteristics of the cells or sensors. The quantum of acquisition is a way of seeing a piece of the present as it is experienced (before it dies in the past: we tell ourselves that something has changed and that it is no longer the present).

partly in the form of memory) are represented as straight lines with increasing slopes (the processes associated with the formation/destruction of mountains are slower than those relating to clouds). These slopes are quantified by relative speeds v_i in relation to each other (each marking a "clock" in its own way). They are approximated by stair steps with increment Δx on the ordinate, assumed to be normalized for the whole: it is as much the value that counts for seeing "time pass" as the quantum of measurement we have just mentioned. This allows for each strand to be divided between the present (finite), the past, and the future (infinite). Let p_i be the horizontal width of a step associated with v_i . If α_i is the angle of the line of velocity v_i with the horizontal, we have $\text{tg}\alpha_i = v_i = \Delta x/p_i$. If we compare p_i and p_j to Δx itself, we get: $p_i v_i = p_j v_j$. We can therefore see that p is smaller if v is larger. An oblique ascending journey (see the arrow, Figure 6) on this set of lines will compress time. Guillaume talks about the contraction of the represented present in relation to lived time. For our part, the contraction is related to the choice of an increasingly rapid standard (change of point of view, change of strand). There is no dichotomy between a broad lived time and a contracted represented time. There is a collection of presents of varying relative amplitudes, to be compared with each other (this is one way of escaping the fictional punctual present of physicists, which is certainly useful for representation). This representation is another way of looking at the pyramid of the subject: the oblique strands in Figure 6 are represented in Figure 4 by horizontal ribbons. Every subject hosts spatio-temporal processes of different speeds (day-to-day activities, or others spanning several years; and in its environment, from the movement of clouds to that of mountains). The base lines of the pyramid in Figure 4 correspond to the lines with the most modest slope in Figure 6.

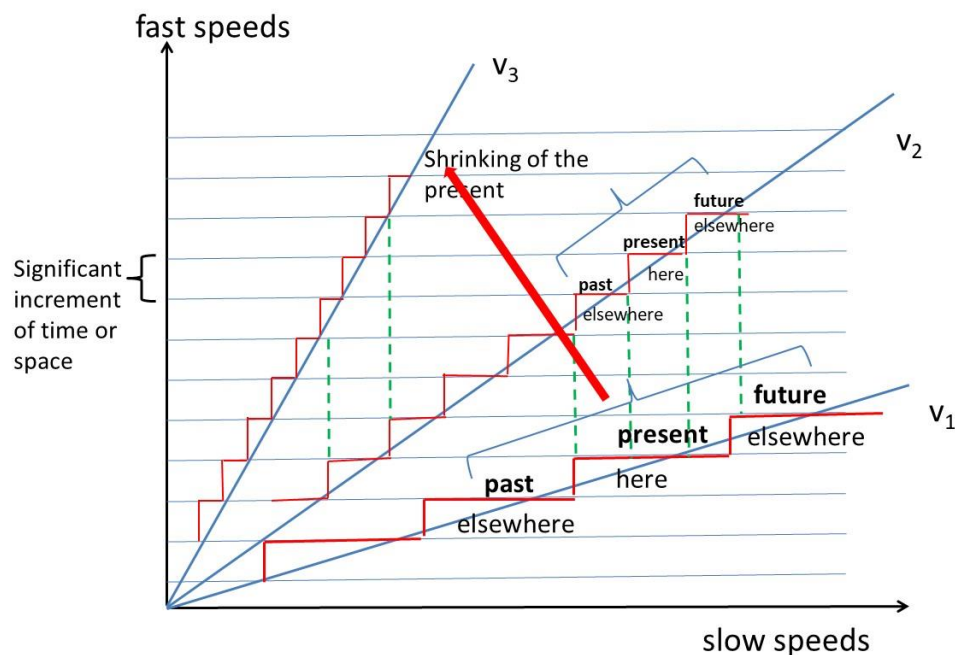


Figure 6. Correspondence between the past/present/future trilogies and elsewhere/here/elsewhere for various "strands" of different speeds v_i . The straight lines represent various processes (internal or external to the subject) of different relative speeds; only the relative speeds have meaning (they express the more or less rapid pace of construction/destruction of the corresponding processes). The lines are approximated by stair steps, where the increments correspond to quanta of knowledge, linked to the mode of acquisition of knowledge and its transcription into language (see text).

Figure 7 shows a magnification of one step in Figure 6: the vertical part connecting two horizontal plateaus is actually oblique and covers a certain time span. It corresponds to an absence of recording, an absence of knowledge. Varying in size, these gaps mask unexplained detours, which are somehow smoothed over in the discourse. They are reflected, for example, in the use, not necessarily assured, of a perfective or imperfective verb, a preterit tense, a progressive preterit tense,

or a perfect tense. This could be partly clarified by an enlarged view. Thus, the multiplicity of strands in the discourse ties in with the question of hidden parts: a strand in front masks another behind it, which nevertheless ensures the fabric's cohesion.

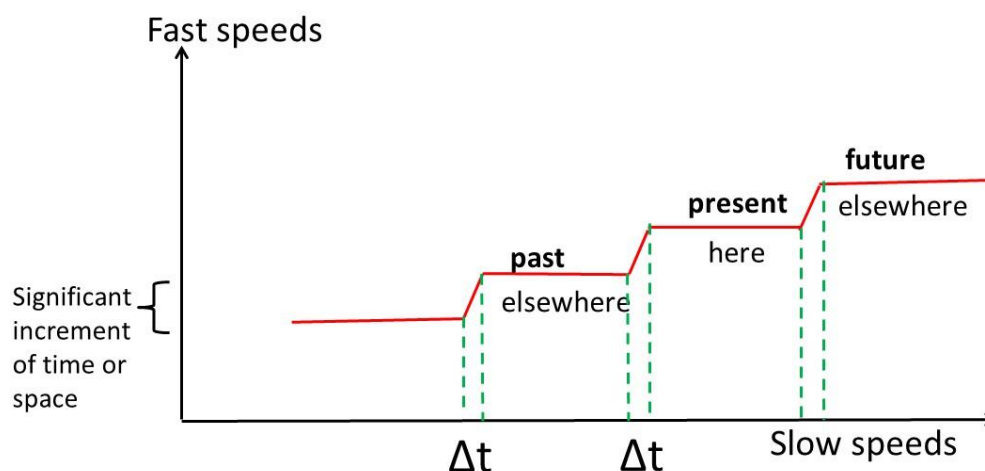


Figure 7. Temporal spread of recording gaps. The recording gaps shown in Figure 6 as small vertical segments actually show a certain temporal (or spatial) spread Δt , during which we do not know everything about the spatio-temporal unfolding of the language object. The intervals Δt can be of variable dimensions.

Other avenues of study

We can already guess at other avenues for further study. For example, the link between body, cognition, and language: research in this field is active and concerns all stages of life, from its very beginnings, showing the essential role of movement in language acquisition. Finally, we could return to the study of questions that are, at first glance, further removed from cognition and the person, showing the specific functioning of words of time and space: could our shifted gaze be applied to them? We have already devoted some work to these areas: history and geography, psychoanalysis, dance, among many others (Guy, 2016a; Guy and Brachet, 2023; Guy, 2016b).

6. Conclusions

As we bring this research to a provisional conclusion, the question arises: what is the point of taking a detour via movement if, in the end, we return to "normal" space and time? Even if it does not shed light on any particular problem, the interest seems at least conceptual. It is an opportunity to reiterate that neither space nor time are self-evident and are given to us by nature: a way of honoring cultures that have not abstracted the concept of time (or space), without preventing them from talking about the world. It lays the groundwork for a research program: how is the co-construction of the concepts of time and space accompanied by words, in the comparative diversity of languages, or in the evolution of a single language? It also emphasizes the importance of a relational epistemology in which the sharing between space and time is understood, which must take into account contexts that are often in the background. It then means being ready to name the transitions between the two: we could not do so if the two were already given independently. We can conceive of situations where a multiplicity of spaces and times coexist: their temporal or spatial values are defined by a whole set of comparisons, without any of them being given in themselves. Are there so many such cases? The tool is there to study them, and its relevance will be judged on the basis of the evidence.

In conclusion, we have proposed here to shift our understanding of the functioning of time, space, and movement in languages. We propose to divert the solution to the question of linguistic localism, which we started with and which is still under debate. However, as remains on the threshold of the extensive literature devoted to the "intersections between these conceptual universes" (Naïm, 2006),

questions remain: will our proposals find their way among the many linguistic theories? Will they lead to interesting and useful insights? To what extent can they be refuted?

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Appendix A. Linguistic Localism: Some Comments

Our thesis is supposed to compete with that of linguistic localism, but our analysis of the latter remains virtually non-existent. Let us make a few comments here. The essential role of movement in the early genesis of language is affirmed by linguists. However, for them, space then takes center stage, even if they occasionally recognize the role of movement in the perception of space. This neglect of movement, initially declared to be fundamental, and of the time that goes with it, seems contradictory. In her thesis, Caroline Rossi (2010) provides a brief overview of various theories of linguistic localism. Depending on the author, different stages are distinguished in language acquisition, starting with early childhood learning. For some, movement is effectively limited to the earliest forms of perception and cognition; space is revisited at a more advanced stage of conception and language. Jackendoff's (1983) experiments "prove" localism, with space playing a fundamental role in everything related to vision, touch, and action. A circular reinforcement effect is at play, with the organization of thought and language being structured by spatial cognition, which in turn structures them. According to other authors, a distinction should be made between the internal representation of space and the spatial vocabulary used. For Rossi, linguistic pluralism, even if it is the majority view, remains debated in its details, with a variety of experiments being proposed by authors to promote one theory or another.

For us, saying that it is possible to describe the semantics of words of time using spatial predicates at any level (verbs, prepositions, etc.) does not mean that one takes precedence over the other. There is no order relationship (see also Asic and Stanojevic, 2013b³⁹, citing Vandeloise, 1999 and Asic, 2008). In short, we are simply offering our thesis for debate among specialists, without being familiar with all of their work. We emphasize the role of relational epistemology: it does not allow for separate definitions of space and time. Space always has a temporal aspect, and time has a spatial aspect; the link between the two is provided by movement.

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³⁹ These authors challenge the generality of localism, based on an analysis of how verbs work.

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