Whitehead's construction of time -- A linguistic approach

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Leibniz built Time as simple scheduling of the moments of a static "nature", whereas the Time built by Whitehead is deeply a dynamic one. Whitehead's construction of the physical time, based on his method of *extensive abstraction*, makes Time being the extensive continuum that results of the connection of all real potentialities. The two fundamental properties of that continuum are to be indefinitely divisible and to be unbounded (PR :n°103).

In the description of verbal tenses by some linguists, the relational aspect is particularly well highlighted. Beauzée[1] was the first to argue that verbal tenses express deeply relations between temporal locations of particular events: relation between moments such as the moment of utterance, the moment of a term of comparison, the process' becoming-to-be period, … These moments have been independently rediscovered and formalized by Reichenbach[2] with its "three points of time" (speech(S), reference(R) and event(E)) and the two relations of *concomitance* and *succession*. These points are, for the indicative mood, situated in the abstract physical time, depicted as a spatial line: a linear unbounded continuum, divided by the "present" in two unbounded parts, a left part, which is the dimension of the *past*, a right part, which is the dimension of the *future*:
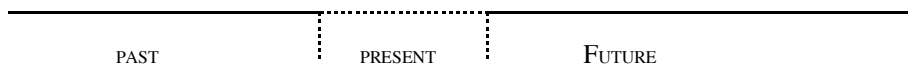

PAST   PRESENT   FUTURE

FIGURE 1 Physical time

Traditionally, the structures used for the formal representation of time are based on the sets of numbers. We argued[3] that (i) qualitative linguistic temporality does not need physical time to be expressed, (ii) for any

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[1] Nicolas Beauzée (1717-1789), a French mathematician and grammarian, In *Grammaire générale*, 1789.
[2] Hans Reichenbach (1891-1953), a German mathematician, physicist and philosopher, In *Element of symbolic logic*, New York, Macmillan Co, 1947.
[3] S. R. Schwer, Traitement de la Temporalité des Discours: une Analysis Situs, In Cahiers Chronos, to appear

aspectual values of the process concerned (punctual, periodic or iterative), calculation is always done on points or sequences of points, with the two fundamental relations of simultaneity[4] and precedence. (iii) the formalism of the S-languages[5] of Schwer (2002) is an adequate framework for such a calculation. This model is in accordance with the model of time obtained with the method of extensive abstraction by Whitehead. Note that Whitehead was only concerned with physical time theory (PNK,CN, R, PR).

Some studies in linguistics following Whitehead's philosophy have been already done[6] [7]. We follow here another way: our goal is not to provide such a study, but to propose to propose a parallelism between the philosophy of Whitehead (1861-1947) and the theory of tense and aspect of the french linguist Gustave Guillaume (1883-1960) who founded Psychomechanics of language. Whitehead is concerned with the links between mind and nature and Guillaume between mind and language. They share the same care for the exactness of reasoning, the use of proper vocabulary, the necessity of both the examination of the real facts (of the world for Whitehead, of the discourse for Guillaume). They both used the way of the abstraction in order to have a good understanding of the objects of their study, a relational and process oriented way of thinking. They also both have not a very easy temper and have endured a certain kind of ostracism[8] from their contemporaries. Because we did not find any reference about Guillaume inside the studies about linguistics in the spirit of Whitehead (Halliday, Forescue), we devote the next section to a short biography of Guillaume. Then we set out Whitehead's ideas that we have linked to Guillaume's way of thinking the linguistics and we try to outline

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[4] In linguistics, we are not concern with the problem of now and of simultaneity with respect to the theory of relativity because any related speed is far less than the light one. But there is some questions risen by the simultaneity, closed to the notion of granularity: at some given level of granularity, two processes can be viewed as punctual and simultaneous, at some finer level of granularity, one process can be viewed punctual, the other one durative, hence, simultaneity becomes inclusion of a point inside an interval, … Reichenbach used punctual formalism, but this does not induce that he thought every processes as punctual.

[5] Schwer R. Sylviane "S-arrangements avec repetitions", Comptes Rendus de l'Académie des Sciences de Paris, Série I 334 261-266.

[6] Firth, John Rupert, Papers in Linguistics (1934-1951), Oxford university Press, 1957.

[7] Fortescue, Michael, *Pattern and Process. A Whiteheadian Perspective on Linguistics*, Amsterdam/Philadelphia, John Benjamins Publishing Company, 2001.

[8] Nowadays, there is a community of linguists, principally in France, Belgium, Canada who works in the framework of the Psychomechanics of language, with an association (Association Internationale de Psychomécanique du langage) and an international congress (Every three years, the last one took place in June 2006 in Montpellier (France).

Guillaume's theory of tense and aspect. We end by showing how it is possible to build the physical time starting from temporal linguistic information, that is a linguist approach of time, based on a linear sequence, in the Whiteheasian spirit.

.1   Gustave Guillaume : a short biography.

Gustave Guillaume was born in Paris on December 16, 1883. Early constrained to earn his living and to ensure the subsistence of his mother, he gave French lessons mainly to Russian emigrants. Although he had never attended to the university, he learned by himself mathematics, philosophy, physics, literature, and was very curious about the linguistic matters. In 1909, whereas he was a bank clerk, he met Antoine Meillet[9] who was impressed by him and invited him to attend his lectures. Guillaume began to publish in 1911. His first works are based on the thought that the use of grammatical forms derives from an unconscious universal mathematical logic that precedes the conscious logic. He showed later, that the unconscious logic was not the erudite logic of mathematics but a logic *sui generi.* His main theory has been revealed by the publication of his two most famous papers: *Le problème de l'article*[10] on one hand, and *Temps et verbe*[11] on the other hand. In the first one, he introduced within the "language" a clear distinction between two levels: the potential level, that is the language, and the actualized level, that is the "discourse". The *article* is a part of discourse that permits to go from the first level to second level. In *Temps et verbe*, he introduced the notion of *operating time*, the time which is necessary for the brain, to achieve the passage between the two levels, because "a psychic fact, whatever it is, requests time to achieve itself"[12]. He studied the language as a system, that he named *architecture* His theory links closely both structural and cognitive linguistics. He became lecturer in l'Ecole Pratique des Hautes Etudes in 1938, where, during more than twenty years, he explained his theory. He died on

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[9] Antoine Meillet(1866-1936), linguist, succeded to Ferdinand de Saussure at the Ecole Pratique des Hautes Etudes in 1891 and teached at the College the France from 1906 until 1932. Emile Benveniste, Marcel Cohen, Georges Dumézil, Lucien Tesnière, Joseph Vendryes were also his students.
[10] Guillaume Gustave, *Le problème de l'article et sa solution dans la langue Française.* Paris, Hachète, 1919.
[11] Guillaume, Gustave, *Temps et verbe*. Paris, Champion, 1929.
[12] *Leçons de linguistique de Gustave Guillaume*, 1939/1940. See note 15.

February 3, 1960 and was buried in the cemetery of Montparnasse in Paris. All his lessons have been preserved then published by Roch Valin[13].

.2   What makes Guillaume a Whiteheadian thinker.

In (CN:46) Whitehead argues that "the primary task of a philosophy of natural science is to elucidate the concept of nature, considered as one complex fact for knowledge, to exhibit the fundamental entities in terms of which all laws of nature have to be stated, and to secure that the entities and relations thus exhibited are adequate for the expression of all the relations between entities which occur in nature."He began (PR:3) with the following definition of *Speculative Philosophy* : "[It] is the endeavour to frame a coherent, logical, necessary system of general ideas in terms of which every element of our experience can be interpreted". "Speculative" does not remain on the level of the experiment, but uses all the resources of rationality to build a scheme to account for the essence of the universe and to reach the first principles. The same concerns are found with Guillaume, throughout his work of linguist, and which led him to a structural analysis of the language and his theory of the psycho-mechanics of the language. In his lesson of Nov 11, 1943, he explained that "the highest sciences in the hierarchy of sciences are those which can use best jointly, in any useful proportion, the attentive observation of the concrete and the abstract speculation." Just as the laws, which give account of the phenomena, are not perceived, the important relations that run linguistic operations do not have the slightest chance to be perceived by concrete observation. "The linguist must combine the fine observation of the facts and abstract thinking. The abstract thinking brings power and acuity to the observation of the concrete one[14]".

For Whitehead, "nature is a process"(CN:53). Nature is always moving on but the principles and the rules are eternal. As Hirtle summarized it[15], according to Guillaume: "language is a process" in one hand and a "system of systems"[16] and the other hand. The language is both "inherited from the past

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[13] *Leçons de linguistique de Gustave Guillaume*, 19ab-19a(b+1). Québec, publiées sous la direction de R. Valin, W. Hirtle et A. Joly, Québec, Presses de l'Université de Laval, et Lille, Presses universitaires de Lille. The lessons are now available from
 http://nlip.pcu.ac.kr/gustave/

[14] *Principes de linguistique théorique de Gustave Guillaume*, Recueil de textes inédits préparés en collaboration sous la direction de Roch Valin, Presses de l'Université Laval, Québec, p. 101. Referred as PLTGG.
[15] Hirthe, Walter H., *Time, aspect and the verb*, Cahiers de psychomécanique du langage, Presses Université Laval-Québec, 1975:4.
[16] PLTGG:25.

and a human and transcendental organization of the heritage"[17]. The whole system has its image inside each subsystem, and the same is true at any level of the hierarchy. The "word" is a system, the "article" is a system, the "verb" is a system,…

On the basis of the fundamental distinction between the thought and the power that the thought has to understand itself, Guillaume identifies the language with the power that the thought has to understand in itself its own activity. The though is free, but the means which it has to operate its own understanding are systematized means, organized in a restricted number, of which the language in its structure offers a faithful image. What the attentive observer discovers in the language, considered in oneself, are these mechanisms. This is the set of means that the thought has systematized and instituted in it to give to itself the permanent possibility to operate a fast and clear understanding of what is developing in it. The *psychosystemic*[18], as denoted by Guillaume, studies these mechanisms. It has two aims: an aim of potentiality or conceivability, that creates the *tongue*, and an aim of effects, that creates the *discourse*. In his Lesson of Nov 26, 1948, he argued that "the tongue is the result of constructive operations whose goal is to divide the thinkable into a finishing number of representations bringing with them, by their division, the power to return, to express every thought. This division is oriented from the particular to the universal. The universal is here forecast of all the conceivable. The discourse is the result of operations of thought that consists in making use of the resulting representations of the tongue, which all are parts of the thinkable in order to provide a momentary expression of a narrow and singular thought". Hence, the fact of tongue is a formal instituted representation, the fact of discourse is a free running of what is instituted inside the tongue. Thus fact of discourse is associated with one fact of tongue. The fact of discourse should never transgress the definition of its corresponding fact of tongue that allows it with a whole freedom of interior play[19].

.3   Guillaume's theory of mode, aspect and tense.

Time representation cannot be represented from itself but need the space to be represented. The representation of time differs with the tongue used. German tongues (like English) do not have the same representation than Roman tongues (like French) have. The expression of the time is more recent than its representation. The verb is of course a part of the system but is also a

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[17] Lesson of Nov 11, 1943, cf note 15.

[18] *Psychosystemic* to gether with *psychosemiotic* is *psychomecanic* of the language.

[19] *PLTGG*, p. 171.

system in its own. It is associated to a notion with duration that is called an process. A process can be situated in the time and has its proper time. The path from the mental notion of a process to the word employed needs also some time duration. We get then three types of time. Guillaume claims that these three types of time refer to Mode, Aspect and Tense. In other words, Mode, Aspect and Tense refer to the same phenomenon: a stretch of time which is the *extension* of some events or acts, with a *duration* and some temporal relationships. But they are related to different kinds of temporality.

To any extension, three epochs can be elected: the beginning, the end and a middle point. The beginning is characterized by the fact that the act is about to be realized, the middle by the fact that the act has a part realized and a part not yet realized (and perhaps will be not realized) and the end by the fact that the act is done. This epochal theory of time is applied first to the mental operation of drawing the time-figure, that is the physical time, whose usual representation is the linear line. This line is cut in two parts: the past and the future, that meet in the present[20] as Figure I depicts.

There is no expression of time in the tongue, only a representation. This representation allows an expression in the discourse. The passage from the representation in the tongue into an expression in a discourse needs some time that Guillaume named the *operating-time* which supports the process of *chronogenesis*: "Mind needs time to think time"(Lesson, 4 mars 1939). The first epoch (the beginning) of the chronogenesis is named *time in posse*, an indivisible time-figure, it is the moment where the mind is about to draw the time-figure. At this moment, the verb is very closed to the noun. The second (middle) epoch is the *time in fieri*, it is the moment where the mind is drawing the time-figure, there is not yet the division Past/Present/Future. For the French representation of time, the line drawn at this level is like an eternal present, without past or future. The third epoch is named *time in esse*, it is the moment where the mind has achieved its time-figure in the state shown in figure 1. These three epochs are related to the verbal mood: quasi-nominal mood for the first one, subjunctive mood for the second one and indicative mood for the third and final one. This last epoch is the only one that inserts the cut of the present, that divides the physical time in two unbounded periods: the past and the future. Hence, the mode refers to the stage where the speaker has stopped, inside the chronogenesis, when he enounced.

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[20] Gustave Guillaume, Temps et verbe: 9. The present has a duration but can be very narrow, and contains a past part (accomplished) and a future part (to become). In French language, tenses are related to these three periods: Past/Present/Future. In English language, there are only two periods: Past/non-Past, this last one covers present and future.

The second type of time is the *process' time*. A verb need also a temporal extension, which can be named[21] process's coming-to-be. There is two positions for the speaker to look at the process: from its outside, which is the the *transcendent aspect* or from its inner, which is the *immanent aspect*. The immanent aspect has three divisions, depending of the position inside the process's coming-to-be: at its beginning; in the middle, that cut the process's coming-to-be in two parts: an already achieved one and a remaining to be achieved one; the end of the process's coming-to-be. Hence, with respect to process's time, the immanent aspect consists in viewing the process as a transparent box, whereas the transcendent aspect consists in viewing the process as a black box. Figure 2 summarizes the situations[22].
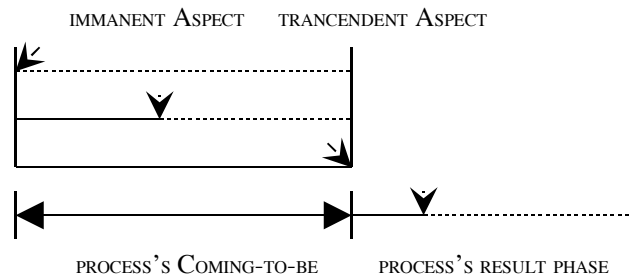

FIGURE 2 immanent/transcendent aspect

The third type of time is the physical time, that corresponds to tenses. The process is then situated inside the time-figure (in posse, in fieri or in esse) with respect to some other process(es) : the point of speech and/or an other process's coming-to-be.

We argue that these times[23] are just a support for a linear ordering of the different epochs - that are points on the line - situated with respect to some vision intercepting points, using the two fundamental qualitative – that is without measure of any duration - temporal relationships: precedence and simultaneity. We do not get all the nature (potential and actual) because we are not able to speak about all the processes. We only get a portion of the nature. The equivalence classes of the simultaneity relation over epochs are "perceptible" instants of the physical time, they are ordered by the precedence relation. The order is not linear when future or potential processes are refers

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[21] We follow for the description of time event, W. H. Hirtle opus cited, p.26.

[22] The arrow reprensent the location of the interception (the speaker position) inside the process'coming-to-be or outside, in the reseult phase.

[23] We here are interested only in the indicative mood, the other moods can be formalized in a similar way and are related to the notion of "point of view" or "reference universe".

to, but there is only one effective linear order. Between two perceptible"
instants can be inserted as many instants as they appear in the discourse. A
line can be drawn from one perceptible instant to its follower. Hence the
physical time-line can be rebuilt from these perceptible instants, whatever is
their number.

.4   Guillaume'stheory inside Whitehead's construction of time.

Whitehead had, by 1914[24], applied the *method of extensive abstraction* to
Time, presented first in RTS and developed in PNK and CN. He showed how
a bridge could be constructed between the data immediately given to sensory
awareness, that is all the world through a slice of time — no one, of course,
can experience the full scope of the passage of nature, rather, what we
experience are temporally (and spatially) thick chunks of this passage, what
Whitehead calls events — which Whitehead called *durations* and the
temporal moments of conceptual awareness. This method consists in using
the relation of inclusion between durations, particularly on some family of
durations, named an *abstractive class of durations*, which is such that (i) of
any two of its members one includes the other, and (ii) there is no members
that is included in every duration of the collection. Hence, an abstractive set
provides the meaning of convergence to an ideal limit (which is not a
duration) that yields to the fundamental conceptual temporal components: the
moments.
We claim that the construction of the present, as a separation between the past
and the future, obtained by Guillaume at the end of the chronogenesis follows
such a method of ideal convergence. We claim also that each point of
interception, related to the aspectuality, corresponds to a moment that
contains the simultaneity of the perceiver event with the chosen part of the
perceived process. Hence, the physical time can be constructed from those
significant moments, ordered by all the temporal information conveyed by
linguistic marks: verb forms, some nouns (predecessor, day), adjectives
(earlier, next), adverbs (yesterday, twice), prepositional phrases (at 5:00 pm,
for two days), and subordinate clauses (while I was waiting for them), and
also with the help of some world knowledge (a cause always precedes its
effect). These moments forms a linear sequence, which is a chronology,
among which any other event can be inserted: either inside an already given
moment (in the case this event is simultaneous to one inside this moment) or
between two already given moments. We can iterate this insertion of events *at
libidum*. Hence, the physical time is obtained by an iterative procedure of

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[24]Hurley, Patrick, "Time in the earlier and Later Whitehead", In *Physics and the Ultimate
Significance of Time*. Edited by Griffin, David, SUNY Press, (1985) :93

inserting new elements inside a sequence which can begin with only one moment, which is naturally the moment associated with the event of speech, as far as we presuppose a linear ordering of all the moments. Any other moment, determined by a temporal relation with the speech, will be either before, after or itself. Two moments of the sequence determine a *duration* they bound. These durations are qualitative until a system of measurement is given. We have then built the time from the events described, the way that Whitehead did in CN and in PNK.

Our claim is that this construction has built a linear unbounded dense time, fitting the definition required by Whitehead for the Ether, which is a continuum, but that it is not a necessity to get the mathematical continuous set of the real numbers, since the rational numbers set is enough to model it. More fundamentally, I think that, the reason why Whitehead stayed inside Weierstrass' theory of convergence is the non-existence of a strongly satisfying theory of infinitesimal, in the sense of Leibniz. This theory has been developed just a century after the birth of Whitehead, in 1961 by Robinson, and is named *non-standard analysis*[25]. In this theory, every standard numbers, those we know, are surrounded by a halation of infinitesimal small numbers. An infinitesimal small number is smaller than any positive real numbers. The multiplication of a small infinitesimal with any real, as big as it can be, is a small infinitesimal. This theory, thus provides a notion of moment which is neither punctual nor durative (its diameter is not a real number) but has a thickness. I believe that this point of view provides a new fruitful reading of Whitehead's work on time and space.

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[25] Robinson, Abraham, Non-standard Analysis, Princeton University Press, 1996 (1966 for the first edition).