Understandings of time in complementaristic language

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1 *Time and Language*

Although we usually think of time as a *dynamic* phenomenon, a little reflection reveals, perhaps surprisingly, that, after all, we do write and communicate our ideas of time in terms of *static* sentences, like those in a paper or book. We do so by using a temporal vocabulary. Obviously, the dynamic/static opposition suggests difficulties for explanations of the temporal vocabulary.

Should we try to describe temporality, and aim at completeness, we encounter a self-referential situation. Time cannot be completely described but with some reference to time itself. In writing about time, we have to use temporal words that are already understood as such.

Notice how this self-referential situation is characteristically tied with attempts at *describing* time. This does not prevent us from communicating intended ideas of time, which we try to write down in sentences, provided that the remaining nondescribed parts of the intended ideas can be regenerated by the interpreter. This is the case if the interpreter and the writer have in common a *shared language*, L. A language, that is, *as a whole of description and interpretation processes*. Fundamental interpretations of L may then be shared (on evolutionary grounds), even if beyond complete description in the language L itself. The communicating parts may well understand each other's temporal vocabulary even if they cannot describe it completely in L. We will later explain this as a *complementaristic understanding*.

A complementaristic understanding of time is well compatible with an awareness like that in St. Augustine's *Confessiones*:

> "What, then, is time? If no one asks me, I know: if I wish to explain it to one that asketh, I know not."

In outline, time is a complex phenomenon going beyond description in the sense that there can be no complete descriptive *theory* of time. A descriptive theory is theory, with proper axioms as well as logical, in a language. Also, *logics* for time turn out to be incomplete. A *language* of time, however, becomes a proper frame of reference – provided that language is comprehended as a *systemic whole*. Beyond that, we cannot go as long as we require our knowledge of time to be *communicable* – holistic language is the ultimate prerequisite for communication.

Both time and language need complementaristic comprehension. Otherwise, we can only describe *fragmented* or *partial* aspects, and the question

arises whether the involved fragmentation into parts is justifiable or not. We touch here upon a very basic *part-whole* issue, sometimes discussed as a general *fragmentation problem for descriptions*.

In the next section, we will give some *historical* highlights, referring to this century, of the fragmentation problem for time and for language itself.

In a later section, after having presented the holistic conception of language, and of time, we shall argue that holistic language, which at first may seem similar to language as conceived in the received view of *semiotics*, in fact is more radical, with consequences for the conception of time.

In our account of language, we choose semiotics, rather than linguistics, as a first natural starting point towards holistic language. The reason is simply that linguistics is much too fragmented, whereas semiotics aims at exploring the more global features of language.

2 Historical Glimpses of the Fragmentation Problem for Time and Language

Every description, even a whole descriptive theory, is a description of something, not everything. Were it not for the remarkable property of nature that it seemingly allows fragmentation, as in our becoming conscious of a particular phenomenon as target for description, or as in the isolation of a particular physical phenomenon in an experimental set-up for measuring an observable, every attempt at describing nature would fail. We face a fragmentation problem.

> **The fragmentation problem** concerns the question if whether nature in itself is fragmentable, and thereby non-distortively describable; or if it is our linguistic description processes which make nature appear fragmentable.

In his boot-strap philosophy, Chew explains fragmentation as follows:

> Chew (1968). "A key discovery of Western culture has been the discovery that different aspects of nature can be individually 'understood' in an approximate sense without everything's being understood at once. All phenomena ultimately are interconnected, so an attempt to understand only a part necessarily leads to some error, but the error is sufficiently small for the partial approach to be meaningful. Save for this remarkable and

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far from obvious property of nature, scientific progress would be impossible."

Difficulties in describing time can be viewed as difficulties in isolating time, as concept as well as physical phenomenon. How well can time be isolated as target for description? Similarly, how well can language be isolated as target for conceptualization?

2.1 Bergson and Russell on Disciplinary Versus Holistic Comprehensions of Time

In Bergson's work on evolution, Bergson (1911), he introduces the concept of complementarity (in a weak sense, yet somewhat similar to Bohr's later use in quantum physics, and to ours). In his discussions of time, he considers complementary types of knowledge. One is the physical knowledge, namely with time described in a physical theory in terms of "moments of time, which are only arrests of our attention". The other refers to the flow of time, "the very flux of the real".

Bergson (1911, p 342). "The first kind of knowledge has the advantage of enabling us to foresee the future and of making us in some measure masters of events; in return, it retains of the moving reality only eventual immobilities, that is to say, views taken of it by our mind. It symbolizes the real and transposes it into the human rather than expresses it."

Bergson (1911, p 343). "The other knowledge, if it is possible, is practically useless, it will not extend our empire over nature, it will even go against certain natural aspirations of the intellect; but, if it succeeds, it is reality itself that it will hold in a firm and final embrace. Not only may we thus complete the intellect and its knowledge of matter by accustoming it to install itself within the moving, but by developing also another faculty, complementary to the intellect, we may open a perspective on the other half of the real. ...
To intellect, in short, there will be added intuition."

Bergson (1911, p 344). "The flux of time is the reality itself, and the things which we study are the things which flow. It is true that of this flowing reality we are limited to taking instantaneous views. But, just because of this, scientific knowledge must appeal to another knowledge to complete it.

"In our hypothesis, on the contrary [to ancient science and metaphysics], science and metaphysics are two opposed although complementary ways of knowing, the first retaining only moments, that is to say, that which does not endure, the second bearing on duration itself."

We understand Bergson's saying "that of this flowing reality we are limited to taking instantaneous views", as referring to scientific limitations, as in scientific measurements (measurements always transform even dynamic phenomena into static, readable, measurement results). The conclusion "just because of this, scientific knowledge must appeal to another knowledge to complete it", with reference to metaphysics as a complementary way of knowing, is, no doubt, an early insight compatible with the linguistic complementarity to be introduced later.

The insight that science needs a complementary way of knowing, in order to be able to cope with time (without distorting it by fragmentation) was of course a very bold thought at the time when analytic thinking was dominant – which it has also continued to be. Only recently, notably in quantum physics, non-local phenomena have been discovered which cannot be approximated with classical fragmentations into local parts.

Russell, although expressing misgivings, considered the problem seriously:

Russell (1914, p 157). "The view urged explicitly by Bergson, and implied in the doctrines of many philosophers, is, that a motion is something indivisible, not validly analysable into a series of states. This is part of a much more general doctrine, which holds that analysis always falsifies, because ... [of the following part-hole doctrine]"

Part-whole doctrine. Russell (1914, p 157). "the parts of a complex whole are different, as combined in that whole, from what they would otherwise be."

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We find Russell's formulation of this part-whole doctrine interesting in its close connection with the fragmentation problem, of whether nature can be fragmented in parts, allowing a nondistortive description. In this connection, the doctrine implies that nature is not nondistortively describable.

Russell rejects the doctrine and insists on analysis.

2.2 Disciplinary Versus Holistic Comprehensions of Language; Linguistics Versus Holistic Semiology

In a disciplinary account of logic, as in mathematical logic, the concept of language is either not defined at all, or is considered as partly outside the domain of the discipline. Compare Shoenfield's book on mathematical logic:

> Shoenfield (1967, p 4). "We consider a language to be completely specified when its symbols and formulas are specified. This makes a language a purely syntactical object. Of course, most of our languages will have a meaning (or several meanings); but the meaning is not considered to be part of the language."

Shoenfield's honest account of his disciplinary approach indicates how the fragmentation into mathematical logic "makes" language devoid of meaning. This is a clearly distortive approach, or a high price to be paid for mathematical clarity.

Also in a wider, philosophical linguistic context, admitting meaning as part of language, the fragmentation problem is apparent:

> Putnam (1975, p 215). "Analysis of the deep structure of linguistic forms gives us an incomparably more powerful description of the *syntax* of natural languages than we have ever had before. But the dimension of language associated with the word 'meaning' is, in spite of the usual spate of heroic if misguided attempts, as much in the dark as it ever was."...
> In my opinion, the reason that so-called semantics is in so much worse condition than syntactic theory is that the *prescientific* concept on which semantics is based – the prescientific concept of meaning – is itself in much worse shape than the prescientific concept of syntax."

In semiotics, sometimes referred to as the science of language, there is an explicit recognition of syntax and semantics, as well as pragmatics. This

emphasis on very central parts of language, is no doubt a step towards a general understanding of language – taken without explicitly recognizing a lurking fragmentation problem. In our opinion, the following quote from Carnap, where he clearly proposes that the whole science of language can be fragmented into three individually understood parts, is to be conceived as a *fragmentation hypothesis* for language.

> **Carnap's fragmentation thesis**. Carnap (1968, p 9). "If we are analyzing a language, then we are concerned, of course, with expressions. But we need not necessarily also deal with speakers and designata. Although these factors are present whenever language is used, we may abstract from one or both of them in what we intend to say about the language in question. Accordingly, we distinguish three fields of investigation of languages. If in an investigation explicit reference is made to the speaker, or, to put it in more general terms, to the user of the language, then we assign it to the field of **pragmatics**. (Whether in this case reference to designata [what the expressions refer to] is made or not makes no difference for this classification.) If we abstract from the user of the language and analyze only the expressions and their designata, we are in the field of **semantics**. And if, finally, we abstract from the designata also and analyze only the relations between the expressions, we are in (logical) **syntax**. The whole science of language, consisting of the three parts mentioned, is called **semiotic**."

Carnap here seems to take it for granted that the three parts mentioned can be individually understood – at the same time that they, as individually understood, constitute the whole science of language (recall Russell's part-whole doctrine and the fragmentation problem).

We want to mention that semiotics itself has not escaped the scientific drifts towards fragmentation. For example, in Nowakowska (1982) there is a distinction between global semiotics and local, or formal, semiotics.

After having outlined the holistic conception of language, we will at the end of the next section return with a critical comparison between this general understanding of language and Carnapian semiotics.

3 *The Complementaristic Comprehension of Language*

Phenomena of language are at the bottom of all human activity and are, indeed, at the roots of all forms of life as genetic processes. The phenomena are extremely rich, and exceedingly difficult to conceptualize without distorting them in the act. Yet, at the same time, our communication languages are so natural and easy for us to use that we hardly notice them. It is as if they were universal, as if what we are saying had an absolute meaning which were independent of the language in use. As if the language could be detached from the ideas we are talking about. Such impressions fade away, however, when we try to objectify, or conceptualize, language.

On the basis of several earlier investigations of language phenomena, from genetic language, through programming language, formal language, observation language, inner cerebral language, to external communication language, we have come to the conclusion that there is a common concept of language, of which all these phenomena are species. That is language as a *whole of complementary description and interpretation processes* (cf Löfgren (1979, 1981, 1984, 1988, 1992, 1993, 1994, 1998)).

Involved is a *linguistic complementarity*, to be formulated below. In Löfgren (1992) we have argued the validity of the linguistic complementarity out from the functional role of any language, namely to admit communication or control. This requires that the descriptions are *finitely representable*, as well as *locally independent of time* (static). It is the contrast between these conditions and the fact that descriptions in a language, L, can be interpreted in L as nonfinite phenomena, as well as dynamic, that are behind the nondescribability in L of its interpretation processes (which is one view of the complementarity).

More detailed arguments for the complementarity of specific languages, like programming and formal languages, are naturally developed in terms of the available metamathematics for these languages. Compare arguments in Löfgren (1992, 1998).

> **The linguistic complementarity**. In general, complementarity refers to holistic situations where (a classical) fragmentation into parts does not succeed. In its complementaristic understanding, the phenomenon of language is such a whole of description and interpretation processes, yet a whole which has no such parts fully expressible within the language itself. Instead, within the language, the parts are complementary or tensioned

(rather than classically contradictory). There are various related ways of looking at the complementarity:

(i) as descriptional incompleteness: in no language can its interpretation process be completely described in the language itself;

(ii) as a tension between describability and interpretability within a language: increased describability implies decreased interpretability, and conversely;

(iii) as degrees of partiality of self–reference (introspection) within a language: complete self–reference within a language is impossible;

(iv) as a principle of "nondetachability of language".

Languages may change and evolve, and with them their capacities for describing and interpreting. Yet, at each time that we want to communicate our actual knowledge, even on the evolution of language, we are in a *linguistic predicament*, namely to be confined to a language with its inescapable complementarity.

The linguistic closure. Our thinking abilities are usually looked upon as free and unbounded. But when it comes to *communicable thought*, we are confined to some shared communication language. The systemic wholeness, or the complementaristic nature, of this language implies a closure, or circumscription, of our linguistic abilities – be they "pure thoughts" communicable in a formal mathematical language, or constructive directions for an experimental interpretation-domain of a physics language. The nature of this closure is not that of a classical boundary of a capacity, like describability, or interpretability. It is a *tensioned and hereditary* boundary of the systemic capacity of *describability-and-interpretability* admitting *potentialities* in two directions:

(a) The closure is **tensioned**. Within the language there is a tension between describability and interpretability (view (ii) of the linguistic complementarity), whereby it may be possible to

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increase the describability at the cost of a lowered interpretability, and conversely. In other words, what the closure bounds off is neither describability, nor interpretability, but their interactive whole as a linguistic unit of *describability-and-interpretability*.

(b) The closure is **hereditary**. Languages may evolve, and at a later time we can have access to another shared communication language of greater capacity for communication. However, we are then back to the *linguistic predicament*: at each time that we try to communicate thoughts – even introspective thoughts about language and their evolution – we are confined to a shared language, however evolved, and the linguistic complementarity of that language restricts our communicability in the tensioned way according to (a).

In order to emphasise, and further clarify, the concept of complementarity in the holistic conception of language, let us compare with *semiotics*. Holistic language consists of description and interpretation processes as complementaristic parts. Semiotics ("the whole science of language"), is fragmented into parts, namely syntax, semantics, and pragmatics. In a comparative understanding, the static descriptions are the objects for syntax, the interpretations the objects for semantics, and the processual nature (of the description and interpretation processes) the objects for pragmatics. There is, however, in this comparison *a fundamental difference*, namely concerning the fragmentability.

> **Incompatibility between complementaristic language and Carnapian semiotics**. According to the linguistic complementarity, classical fragmentation of wholistic language does not succeed. According to Carnap's fragmentation thesis, semiotics allows classical fragmentation.

By way of further comments, let us recall the previous quote of Carnap (1968, p 9). Here Carnap suggests that the whole science of language, semiotics, really can be fragmented into three parts, syntax, semantics, and pragmatics, which are abstracted in the analysis of language as individually understandable. Now, consider the language in which this whole science of language occurs (cf the linguistic predicament in the linguistic closure). By the linguistic complementarity for that language, it consists of description

and interpretation processes that are complementary in the language. This contradicts the assumption that syntax, semantics, and pragmatics can be isolated as individually understood disciplines – if their union shall constitute the whole science of language. *What is missing is the complementaristic interaction between the suggested parts.* In other words, if Carnapian semiotics is considered the whole science of language, it is distortive of language.

Now, with the holistic concept of language delineated, we are in a position to explain, or comment on, conceptions of time which, as outlined, needs holistic language as a frame of reference. This is what we will do in the following sections.

4   *McTaggart's Time-Concept as Germ for a Time-Language Fusion*

McTaggart (1908) reveals two sides of our conception of time with such a clarity that a similarity with the interpretation and description sides of language becomes transparent. It has been suggested that McTaggart's clarification of the two sides of time is a predecessor of what we today call semantics and syntax (in a semiotic sense) for temporal language. In our view, McTaggart's conception is, furthermore, compatible with a development from (Carnapian) semiotics to complementaristic language. It is suggestive for a time-language fusion in complementarity.

The two sides of time, that we refer to, are McTaggart's A and B series of time, outlined as follows.

Positions in time, McTaggart argues, are distinguished in two fundamentally different ways. On the one hand we conceive of time in a dynamic way, where we look for each position either as past, present, or future. This dynamic conception is associated with an *A series*. On the other hand we also conceive of time in a static or tenseless way, where each position in time is earlier than some and later than some other position. This static conception is associated with a *B series*.

Notice that if an event, for a given observer, is conceived as earlier than another event, it is always conceived as earlier, which indicates the static nature of the B series. But an event which is now conceived as present, was future, and will be past, which indicates the dynamic nature of the A series.

McTaggart argues at length that it is essential to the reality of time that its events form an A series as well as a B series. We never observe time except as forming both series.

It is the dynamic A series that offers considerable problems, and which makes McTaggart conclude the "unreality of time".

In Löfgren (1984) we have analyzed McTaggart's reasoning from the perspective of our complementaristic conception of language. In distinguishing between descriptions and models (interpretations) of time, we find that the static B series qualifies as a proper description of one of the properties of time. In contrast, the intrinsic dynamic nature of the A series reveals that it is not a description but an interpretation. A description is always, like a sentence, something static, timeless, something that does not change as long as it is a description. This does not prevent a description from describing a dynamic phenomenon in a shared language. In this way the dynamic A series is a model, or interpretation, of time.

In our comparison, with the A series an interpretation, and the B series a description of time in a time language, view (i) of the linguistic complementarity for this language suggests that the A series cannot be fully described in the language.

In Löfgren (1984) we have sharpened this suggestion into a a general time-description incompleteness theorem.

> **Time incompleteness theorem**. In no time-language L can there be a sound complete time-theory T, i.e., a T in which all true temporal L-sentences are provable.

The proof is based on Gödel's revised conception of a formal system, where the concept of Turing machine replaces his earlier "finite procedure". Accordingly, a rule of inference, even within pure syntax, has to be interpreted (whereby syntax cannot be understood as isolated from semantics – in opposition to Carnap's thesis). This admits a temporal interpretation of the proofs in the formal system, which is a key point in our proof of the incompleteness theorem.

At the time of McTaggart (1908), however, the metamathematical understandings of incompleteness phenomena were in the future, and his conclusion about the unreality of time may have been understandable. Today, our conclusion is that time is to be complementaristically conceived, beyond complete describability.

5 The Bergson-Russell Time Discussion Revisited

Let us recall from subsection 2.1 how Bergson argues that time needs to be understood beyond a mere scientific account, and that scientific knowledge of time must appeal to another knowledge to complete it. Russell, on the other hand, insists on a pure scientific account of time, and provides in his arguments an interesting formulation of a philosophical part-whole doctrine. Russell rejects the doctrine and insisists on analysis.

Although Bergson never discusses his term "complementarity" in relation to language, but rather with intuitive appeal to different kinds of knowledge, as in science and in metaphysics, we have in Löfgren (1992) found Bergson's complementarity compatible with the linguistic complementarity. We accept Bergson's complementaristic view on time even though his arguments lack support in an explicit recognition of knowledge to be comunicable.

We do not accept Russell's rejection of the part-whole doctrine. The doctrine, namely that "the parts of a complex whole are different, as combined in that whole, from what they would otherwise be", is in fact affirmed by the wholistic concept of language. Its constituting interacting description and interpretation processes, producing descriptions and interpretations, are intuitively clear in a classical global perspective (with descriptions as finitely representable, static, objects – with meanings, or interpretations, beyond any such restrictions; cf section 3). However, when these parts are made objects for investigation in the language itself, they become nonclassical tensioned objects (cf the linguistic closure).

If Russell's "analysis" is viewed as a description procedure within a language, aiming at complete description, we see from the linguistic complementarity how analysis either fails, or has to be paid for by noninterpretability. It should be noticed that this latter possibility has been hinted at by Russell himself in his witticism: a mathematician is a person who does not know what he is talking about, and does not know if what he says is true.

We find Russell's formulation of the part-whole doctrine interesting in its close connection with the fragmentation problem, namely whether nature can be fragmented into parts, allowing a nondistortive description. Our affirmation of the doctrine will mean that if "a complete description of time" is generally accepted, it will be distortive of a holistic conception of time, like Bergsonian time.

6 *Time for Reference, and for Unfolding of Self-Reference; Time and Type*

We will here consider a partial property of time, namely the property that our clocks produce. Such a property is usually extended to a noun, clock-time, and we can then both say that our clocks measure clock-time, and that clock-time is what our clocks produce. The latter aspect comes from our linguistic view of a measurement process as a constructive kind of interpretation process, explained in Löfgren (1993).

Clock-time is what is used *for reference* in coordinating events in virtually every natural description. We do describe – and measure – in terms of space and time. Compare, for example, our symbolism for a physical state, $\psi(r, t)$, parametrized as it is in terms of a space vector r and a clock-time t.

In going from a measurement of a quantity, *in terms of time*, to a measurement of time itself, we face a *self-referential* situation, namely of measuring time in terms of time. (In the previous sections on complementaristic language, we have explained a more general self-referential situation, that of conceiving language in language.)

At instances, such self-reference may be explained by an *unfolding* in terms of *levels* of reference. By way of an elementary example, consider the unfolding of the behaviour of a circular feed-back circuit (a possible clock) in terms of levels of reference – which here are themselves times. Instead of saying that a state s at a node in the circuit is the cause of itself, we say that $s(t)$ is the cause of $s(t + T)$, where T is the cycle time of the circuit.

By way of another, but similar, example, consider Russell's unfolding of self-membered sets, $S \in S$, in terms of levels, or types, t. If a set S is a member of a set R, i.e., $S \in R$, the type t of R is one unit higher than the type of S. Hence, for typed sets, S^t, we cannot have $S^t \in S^t$ but well $S^t \in S^{t+1}$. If the hierarchical domain of typed sets is projected down on a nontyped domain, self-membership problems arise – which are unfolded in the hierarchical domain. In this example the types are tenseless – unless we consider the formation of $\in$-chains as explanation *processes* for sets.

In typed explanations of biological evolution processes, which may become self-referential in a nontyped perspective, the types are associable with times.

These examples support the idea that time has a coordinating function, not only on a primary descriptive level. Time can also have a coordinating function over types in an unfolding hierarchical description process. Time

then obtains a *direction* from the hierarchy.

7 *On Gödel's Space-Time Model for Einstein's General Relativity Theory*

Gödel (1949a, 1949b, 1995) develops a space-time model for Einstein's general relativity theory with remarkable properties. The interpretation allows closed time-like lines, whereby it is possible to send a light signal along a line running back into itself. This means that the light signal will come back at exactly the same moment at which it is sent. Moreover, the model allows lines such that a light signal, sent along such a line, will return earlier than it was sent. Accordingly, it is possible to send light signals into the past. What is more, since a light path can be approximated as closely as one wishes by a path of a material particle, one can travel into the past on a rocket ship of sufficiently high velocity.

These illustrations of Gödel proves that general relativity theory has unexpected interpretations, and the question is, as Einstein suggests, "whether these are not to be excluded on physical grounds".

In commenting on Gödel's interpretation, Einstein writes as follows after having recalled that, in the sense of thermodynamics, the sending of a signal is an irreversible process whereas "according to our present knowledge, all elementary processes are reversible":

> Einstein (1949): "If, therefore, B and A are two, sufficiently neighbouring, world-points, which can be connected by a time-like line, then the assertion: "B is before A", makes physical sense. But does this assertion still make sense, if the points, which are connected by a time-like line, are arbitrarily far separated from each other? Certainly not, if there exist point-series connectable by time-like lines in such a way that each point precedes temporarily the preceding one, *and if this series is closed in itself.* In that case the distinction "earlier-later" is abandoned for world-points which lie far apart in a cosmological sense, and those paradoxes, regarding the *direction* of the causal connection, arise, of which Mr. Gödel has spoken.
> Such cosmological solutions of the gravitation equations (with not vanishing Λ-constant) have been found by Mr. Gödel. It will be interesting to weigh whether these are not to be excluded

on physical grounds."

We find this an interesting illustration of the fragmentation problem. Even if time is not fragmented from space, and instead a whole of space-time is considered according to Einstein's theory, we seem to face a further problem of fragmentation. If no physical ground is found for excluding Gödel's interpretation, then a still more holistic view needs to be taken for space-time. Perhaps a linguistic view, where description and interpretation are not separated as in the above example. (Cf. Löfgren (1994) for a similar holistic view on quantum mechanics.)

We have a somewhat comparable situation in the Skolem-Löwenheim theorem of metamathematics for first-order predicate languages. Accordingly, a theory, if it has a denumerable model, must also have a model of any higher cardinality. It is not possible to prevent these further models by some describable restriction. Instead, the usual procedure in a case where one wants to describe, say, *precisely* the denumerable set of natural numbers, is to talk of this set as a "standard" model of the description. That is, with some intuitive appeal to an undescribed shared language.

In the Gödel-Einstein case we do not know whether a comparable principally clear incompletability situation exists. But already at this stage of development, it seems plausible that the above quest for a describable *physical* exclusion of unwanted models will turn into a quest for an exclusion which is describable in a broadened framework. A framework of a more introspective physics that objectifies also *linguistic* processes of certain basic levels of constructivity.

8 *On Interdisciplinary Approaches and "Strangification"*

As we have argued, time needs to be conceived in a framework of holistic language. Attempts at relativizing time in specific disciplinary contexts, although quite natural for increasing our understandings of time, are not without problems. Since there can be no complete descriptive theory of time, in spite of all elaborate theoretical achievements, there is always the fear that some such theory will be taken as definition of time. Fear, that is, because it is bound to be distortive with respect to the prescientific holistic nature of time which needs complementaristic comprehension.

In this situation, an interdisciplinary approach, in the form of a collection of disciplinary accounts of time, may be illuminating. It may allow the reader to find out contextual assumptions, even if not fully understood

within the individual approaches. Actually, there is a general procedure, called "strangification" (Verfremdung) to this effect. It is proposed in Wallner (1992, p 95):

> "**Strangification** (Verfremdung). Strangification is a central concept (or even method) in Constructive Realism. Simply speaking it means to transfer a certain system of (scientific) sentences from one context (of scientific theories, paradigms, etc.) into another system of sentences. The aim is to "detect" and reveal "hidden" structures and implicit presuppositions in the system of scientific sentences; i.e., to make explicit the implicit assumptions of the set of sentences, of theories, or even paradigms. These implicit assumptions can be seen quite well, if the set of sentences is taken out of its original context into a completely different field, discipline, etc., because these structures become explicit, if one uses them in a different context."

Our own contribution, which can be referred to the field of global semiotics, has suggested views of time, in particular its sensitivity to fragmentation, that may help reveal fragmentability presuppositions for studies of time in other fields as well.

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