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Mechanisms of cognitive change

CONSTRUCTING THE VANISHING PRESENT BETWEEN THE FUTURE AND THE PAST

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Abstract. Development is a process of creating actual time-course of movement out of possible ones—both of the future and of the past. This focus was central for the original notion of "zone of proximal development" (ZPD– Vygotsky) – yet it has not been developed further since 1930s. Human beings operate in-between the constructions AS-IS, AS-IF, AS-COULD-BE and AS-I-WANT-IT-TO-BE. Developmental psychology has mostly dealt with the first two of the constructions (AS-IS <> AS-IF), avoiding the set of possibilities (AS-COULD-BE) and desirables (AS-I-WANT-IT-TO-BE). The recently introduced Trajectory Equifinality Model (TEM) created by Tatsuya Sato and his colleagues makes it possible to consider both imaginary, possible, desired, and real components of the developing structure in its progression. In this article I give a theoretical account of the process structure of such coordination of the past and future and of the possible and the actual.

Keywords: time, development, process, possibilities, desirables, zone of proximal development, TEM, ZPD

A major ontological problem exists in the sciences that consider time as central to their inquiries—by focus on time the nature of the reality may disappear! In an axiomatically time-free universe the ontology of objects is given within the classical-logical scheme of the law of excluded middle: if object A exists it is not true that object A does not exist; and if object A does not exist it is not true that it exists. All is clear—and the sciences that treat their objects in time-free ways have only to study the existing (or not existing) objects as these are.

Enter the notion of time—and all that simplicity vanishes. What can be said to exist now (here-and-now) need not exist in the past—nor in the future. What existed in

the past need not exist now (disappearance in time) and what might exist in the future need not exist now either. Furthermore— in the separation of "the now" (present) exists our construction of the infinitesimal time moment of "now" into an extended duration between past and future. So—any statement about "what exists now" is built upon the philosophical construction of "the now" as a time period of relative duration of sameness. That sameness is made by a comparison between the two infinities of "this instant" (ever smaller time frame, not graspable by our senses) and "that eternity" (which equals a static universe where time does not matter). There is no "being" in the infinitely instantaneous universe. Likewise, there is no "becoming" in the infinitely eternal universe. And as there is no extended present (other than in our mental construction)—there is nothing!

Yet the persons who are capable of reflecting upon "there is nothing" are not "nothing" themselves—but "somethings" (or "somebodies") who reflect upon past and future contrasts. All developmental sciences—astrophysics, synthetic chemistry, evolutionary biology, developmental psychology, social history—are all facing the problem of emergence of "somethings" that did not exist before—together with the disappearance of previously existing objects. Thus, James Mark Baldwin—developing his foundations of "genetic logic" [1](Baldwin, 1906, 1908, 1911, 1915) challenged his contemporary psychologists with a methodological imperative:

> ...that series of events is truly genetic which cannot be constructed before it has happened, and which cannot be exhausted backwards, after it has happened. (Baldwin, 1906, p. 21)

This "positive postulate" might seem to render any science of time-based processes mute. Yet it merely specifies where the investigation needs to happen—concurrently with the emerging and disappearing objects. For a committed developmental thinker of his time, Baldwin had no difficulty accepting the notion of emergence as intimately linked with irreversible time. By doing that he eliminated the use of classical (2-valent, Aristotelian, and Boole'ian) logical systems from potential use

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[1] According to Baldwin, " Genetic logic was, in my usage, the term adopted to designate the body inside or psychic process in which mental development takes place. Within this logic, all the varied special motives of adaptation, opposition, assimilation, etc. uncovered in the detailed researches, show themselves in the phenomena of personal and social progress". (Baldwin, 1930, p. 11-12)

in the developmental sciences. He was ahead of his time in the field of logic—in which various systems rejected their classical origins over the 20th century.

Of course the study of uniqueness in time—change and development—is possible only if reflections upon that uniqueness are not unique themselves. All theoretical models that capture unique processes are themselves universal and are phrased in static terminologies. For example, the *notion* of irreversible time *as a theoretical concept* is static, while it refers to the dynamic unique flow of time-bound real events. The notion of *infinity* in mathematics is finite itself.

Asymmetry of past and future

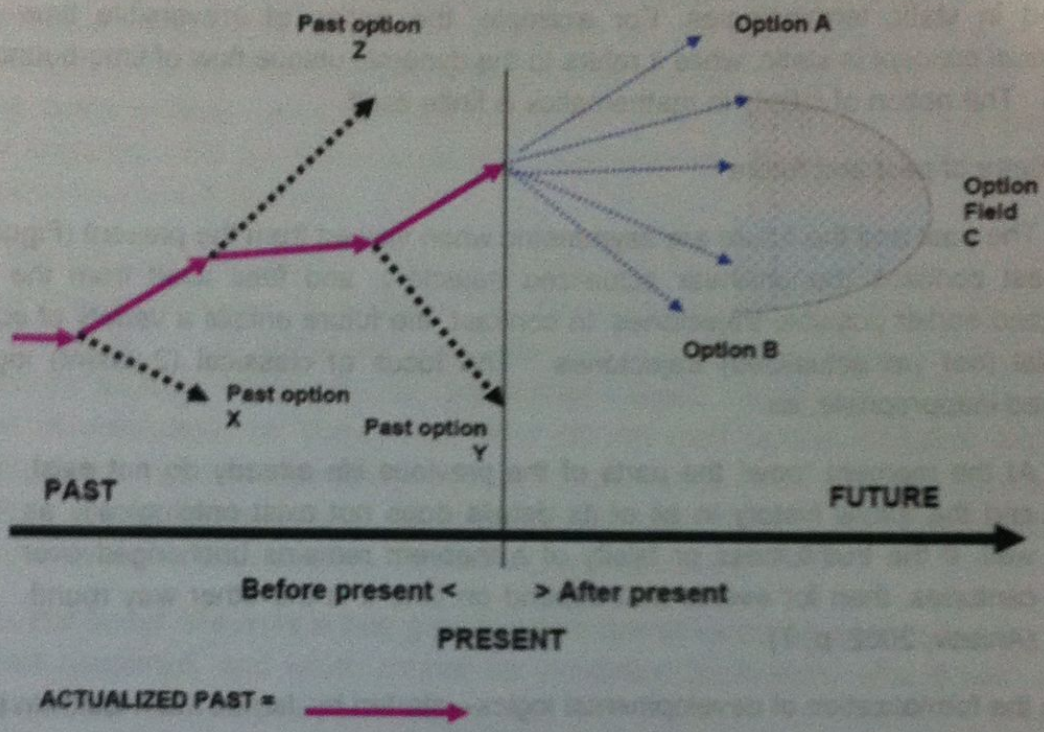
The past and the future are asymmetric when viewed from the present (Figure 1). The past contains the unilinear actualized trajectory, and fees itself from the non-actualized earlier possible trajectories. In contrast, the future entails a variety of equally potential (not yet actualized) trajectories. The focus of classical (2-valent) logic is rendered inappropriate, as

> At the moment "now" the parts of the previous life already do not exist, and the future history in all of its details does not exist ontologically as well. If the truthfulness or falsity of a theorem remains unchanged over centuries, then for events that depend on time it is the other way round. (Anisov, 2002, p, 7)

Hence the formalization of developmental logics—started by James Mark Baldwin but not finished by him—is necessary (Valsiner, 2009). Obviously this would not come from accumulating empirical studies, but calls for theoretical innovation. The starting point for such innovation is the recognition of unity of irreversible time and uncertainty of both the not-yet-actualized future (A,B,C.) and the left-unactualized past (X, Y, Z) in Figure 1.

This scheme is in some sense deceptive—while illustrating the contrast between options of the future and actualized sequence of past options, it leave the impression of the special moment nature of the bifurcation points. Furthermore, the scheme seems to indicate that the different options at a given time are discrete mutually distinguished choices—rather than emerging differentiation of trajectories. Therefore, a micro-view if a bifurcation point is given in Figure 2. The flowing process involved becomes constrained—generating a condition of "bounded randomness" (Weissert, 1995, p. 122) that proceeds to create a new trajectory (and not others).

Figure 1. The past as an actualized trajectory and the future as set of multilinear possibilities



The "option fields" in Figure 1 operate as "attractors" that "pull towards them" the emerging course of movement in the current moment. Yet such "attractors" are set up by the past-present trajectory by projecting into the future the set of potentialities.

The ambiguity of the future

It is the asymmetry of developmental time that creates the inevitable ambiguity of existence (Abbey, 2007; Valsiner, 2006). At every moment there is uncertainty about the continuity of the immediate environmental conditions—leading to the pre-adjustment to the organism's *Umwelt* (Chang, 2009). In the human case—thanks to the use of signs--such pre-adjustment entails the construction of a set of reflections about the link of the present and the future. First, there is the reflection upon the present state—the AS-IS world. It is a relatively stationary view of the present—extended in time—that actually is an abstracted synopsis of the irreversible flow of events. In this respect, the

AS-IS world—or personal ontology of "being"—is an illusion constructed by way of signs. Some of such AS-IS constructions are assumed to be stable over long time—such as "personal identity", "personality traits" etc. These constructions have no reality—yet they are functional in organizing the fluidity of human lives.

Since 1911 – Hans Vaihinger's publication of the ***Philosophie der Als-Ob*** (in English– Vaihinger, 1935) we see in the social sciences slowly growing interest in the AS-IF world construction. Theatre and children's play are the realms where AS-IF constructions are most visible—yet in every next moment's action that is oriented towards the future we act in some novel form—which is an example of AS-IF. As we live in irreversible time, the contrast between AS-IS and AS-IF is inevitable. It guarantees constant ambiguity of being.

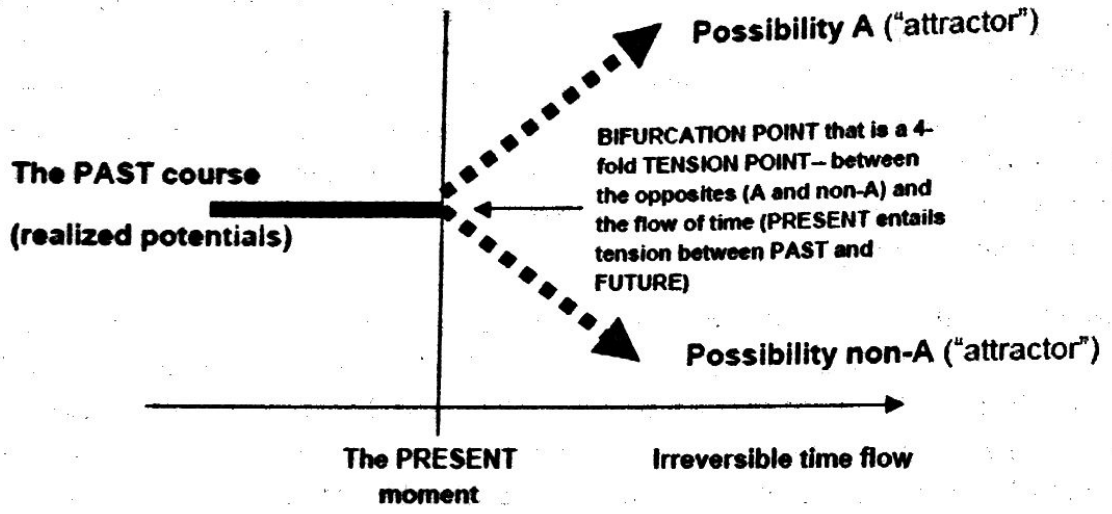
Based on that contrast, other semiotic constructions emerge. These are reflections of the possibilities in the future (AS-COULD-BE) as well as in the past (AS-COULD-HAVE-BEEN). Both fortune tellers (Aphek and Tobin, 1990) and historians work with these realms. Finally, in the human case we have the socially prescribed orientations AS-SHOULD-BE and its internally reconstructed reflection upon one's will—AS_I-WANT-IT-TO-BE.

All these realms make the movement in a bifurcation point very complicated (see Figure 2). The move into future is regulated by a complex of all of the constructed meaning realms as the movement forward occurs.

Figure 2 is also scheme of "Buridan's ass[2]" –set into motion under context of the pressure of the irreversible flow of time. While the actual contents that is captured by the Basic Unit is unique—given the irreversibility of time and constructivity (semiosis) of humanbeings It is the birthplace of the interpretants (in C. S. Peirce's terms— Rosa and Valsiner, 2007). The "classic" situation of Buridan's donkey—dying of hunger in between two equally appealing piles of hay—is not applicable in the human meaning-construction situation where **over**-determination of meaning is going on.

[2] This notion—of a donkey starving oneself to death by being unable to choose which of the two equidistal and equal size piles of hay to approach—narrated by Vygotsky—has been the usual introductory point of the role of signs in the human psyche. Semiotic mediation is the means for temporarily solving the 4-fold tension.

Figure 2. Tension at the here-and-now bifurcation point

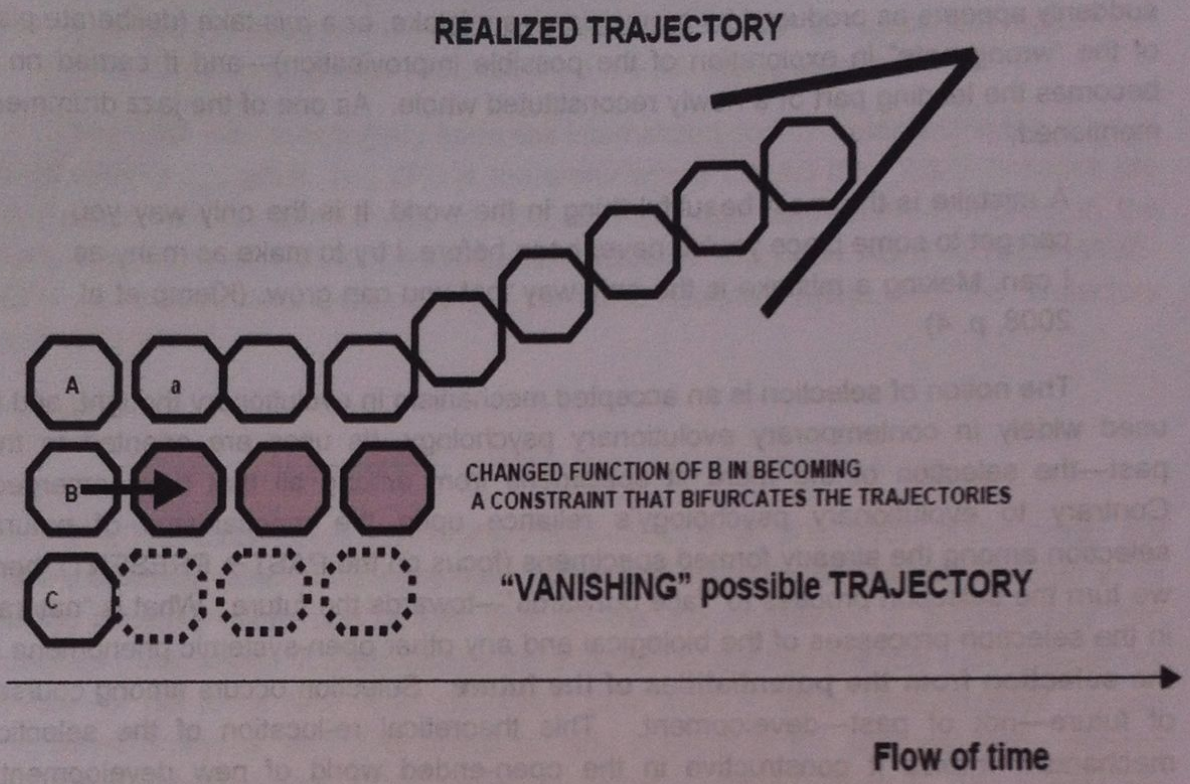


How do we move towards the future?

That projection is set into motion by way of constraints that create distinctions (Figure 3). The flow originally similar units of the flow of the process (A,B,C) becomes changed if one of the units (B) transforms into a regulatory role over the others (A, C). It becomes a constraint (Valsiner, 1987) for further separation of the actualized trajectory from the potential one that is not given the opportunity to grow into an actual trajectory.

Figure 3 alerts us to another aspect of asymmetry of the future and the past—distinctions that organisms make are *forward-oriented*, as these organisms move towards their next future moment. When I exclaim "*oh, that is beautiful!*" I am making a distinction between something I am at this moment about to consider beautiful, and conversely I am about to lose the non-beautiful something else out of my focus—at the *next time* moment. All our sign-making is that of creating semiotic constraints to guide us in the immediate future—even if the manifest claim ("that *is* beautiful") seems to be pertaining to the present.

Figure 3. What happens at a bifurcation point?



A part of the field becomes a regulator for the rest of the field. The crucial feature of the making of the constraint is its emergent function from the past to the future. This is the moment of establishment of a barrier—a divider—into the flow of the process—it becomes a **bifurcator**. (the **move B→** in Figure 2) As such, it establishes itself as belonging to the control level in the emerging hierarchy of parts of the system: by becoming different from A and C, B acquires control over the further progression of A and C. Here is the beginning point of hierarchical integration (Werner, 1948)—but, more importantly, that integration takes place in a relationship of what already has emerged (PAST extension → PRESENT moment) and what could emerge (selection of FUTURE possibilities). In a time-freed depiction this amounts to the making of a tool to achieve some goal.

This feature is important for understanding **processes of selection** in the framework of development. There are very few empirical examples of such transformations in psychology (differently from embryology—Beloussov, 1998) since psychologists in recent decades have rarely looked at transformation processes. It is in the study of music (Klemp, et al, 2008) where we can find definitive examples of how a novel element in a fixed structure (jazz music script) leads innovation. A "wrong note" suddenly appears as produced by a musician—a mistake, or a *mis*-take (deliberate play of the "wrong note" in exploration of the possible improvisation)—and if carried on it becomes the leading part of a newly reconstituted whole. As one of the jazz drummers mentioned,

> A mistake is the most beautiful thing in the world. It is the only way you can get to some place you've never been before. I try to make as many as I can. Making a mistake is the only way that you can grow. (Klemp et al, 2008, p. 4)

The notion of selection is an accepted mechanism in evolutionary thought, and is used widely in contemporary evolutionary psychology. Its uses are oriented to the past—the selection of the more fit specimens from among all that have emerged. Contrary to evolutionary psychology's reliance upon the mechanisms of natural selection among the already formed specimens (focus on the PAST→ PRESENT), here we turn the selection process to "face outwards"—towards the future. What is "natural" in the selection processes of the biological and any other open-systemic phenomena is **the selection from the potentialities of the future**. Selection occurs among courses of future—not of past—development. This theoretical re-location of the selection mechanism makes it constructive in the open-ended world of new developmental trajectories. It relies heavily on the assumption that organisms anticipate changes within their environments. Such anticipation may produce adaptation errors as well as successes—as the distinction between the two becomes known only after the development has taken place.

The "zone of proximal development" and Trajectory Equifinality Model (TEM)

Developmental psychologists have tried to struggle with that issue in the context of the notion of Zone of Proximal Development (Valsiner & van der Veer, 1993). It is clear that Vygotsky saw the process of development as a coordination of the imaginary and the real—first in child's play:

> The relationship of play to development should be compared with that of teaching-learning [obuchenie] to development. Changes of needs and consciousness of more general kind lie behind the play. *Play is the resource of development and it creates the zone of nearest development. Action in the imaginary field, in imagined situation, construction of voluntary intention, the formation of the life-plan, will motives– this all emerges in play* and...makes it the nineth wave of preschool age development (Vygotsky, 1933/1966, pp. 74-75, added emphasis)

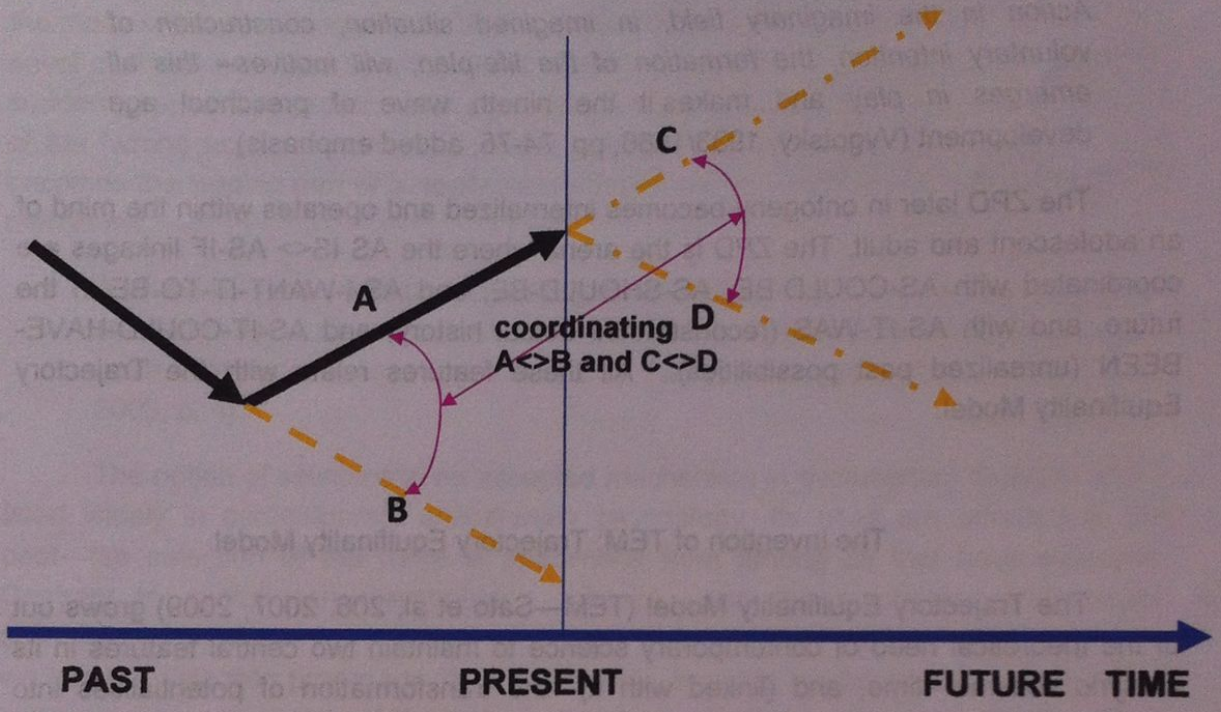
The ZPD later in ontogeny becomes internalized and operates within the mind of an adolescent and adult. The ZPD is the arena where the AS IS<> AS-IF linkages are coordinated with AS-COULD-BE, AS-SHOULD-BE, and AS-I-WANT-IT-TO-BE in the future, and with AS-IT-WAS (reconstructed actual history) and AS-IT-COULD-HAVE-BEEN (unrealized past possibilities). All these features relate with the Trajectory Equifinality Model.

The invention of TEM: Trajectory Equifinality Model

The Trajectory Equifinality Model (TEM—Sato et al, 206. 2007, 2009) grows out of the theoretical need of contemporary science to maintain two central features in its analytic scheme—time, and (linked with it)—the transformation of potentialities into actualities (realization). It is the latter—the inclusion of the hypothetical (not real—or not yet real—or not to be real)—that separates TEM from all other time-inclusive models (time series analyses, etc). The kernel of TEM is given in the scheme of the generic "cell" of the processes that in their reality are hyper-complex (Figure 4). Structural units like the one in Figure 4 enter into variety of configurations, yet—like the minimal unit of any complex whole—the one depicted in Figure 4 is the core "minimal gestalt" we need to consider.

The unit of analysis presented in Figure 4 includes three imaginary (B, C, D) and one real (A) part. This dominance of the imaginary over the real is crucial for understanding cognitive functions and their development—cognition is needed for creating meaningful thought basis for the construction of the future (Figure 3) rather than merely serve as a factual commentary about the reality of the world. Secondly, it is not the presence (and nature) of these four components, but their **relations** (A<>B, C<D>) as well as their **meta-relation** ({A<>B} <> {C<>D}) that is the structural unit of analysis.

Figure 4. The minimal structural unit of constructing the vanishing present



Contemporary developmental psychology through the lens of TEM

TEM breaks up the backbone of contemporary psychology—its reliance upon inductive generalization and its practical elaboration conventionally called "measurement." It replaces that practice by careful investigation of relevant phenomena and our basic assumptions about them. TEM brings—on deductive grounds—the focus on time into the center of empirical studies. It is an abductive orientation—starting from general premises it connects with the phenomena. In a way, it is the reverse of the widespread inductive generalization method of the Grounded Theory—instead of "working upwards" from the phenomena towards creating a theory, it "works downwards" from basic assumptions, linking those with phenomena, and developing both theory and methods at the intersection of that juxtaposition.

TEM is not quantifiable. Hence it has the advantages of introducing into the science of psychology new rigor of qualitative methodology that psychology has—

mostly under North-American social demands—pushed out of the focus of science (Toomela, 2007). Psychological phenomena have much to share with their biological counterparts where it is the quality—the form—that determines quantities (Beloussov, 1998). Thus—returning to Figure 4—if the four-fold tension at the intersection of time and future opposites might be quantifiable, then the framework within which that tension occurs is itself a qualitative structure. Psychology has confused the dialectical unity of quantity and quality in its wholesale acceptance of quantification as the marker of "science" (Valsiner, 2005).

Nothing can be more misleading in science than abandoning the general view on the quality of the whole as it relates with its parts. In the case of time-dependent—open—systems that relationship becomes the central target of investigation. TEM is the intellectual tool to conceptualize the variability of the trajectories in the making and re-making of these relationships. Instead of considering relationships to be linear and formally quantitative the qualitative focus through the lens of TEM allows for the study of such relationships as conditionally permeable boundaries. Relationships between psychological wholes is an analogue of membranes in biology—rather than linearly depicted forces in physics (Valsiner, 2007b). Theoretical constructions like TEM are a means for working towards turning psychology into a science which does not eliminate time, but does just the opposite—explains the complexities of the human mind by its fate of full time-embeddedness.

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