Reprint of / Sonderdruck aus / tiré à part de

Swiss Journal of

Psychology

Schweizerische Zeitschrift für Psychologie
Revue Suisse de Psychologie

Verlag Hans Huber
Bern Göttingen Toronto Seattle

Swiss Journal of Psychology 55 (2/3), 84–92 (1996)

Vygotsky, Piaget, and the problems of Plato

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Current Cognitive Science is struggling with problems (Plato's problems that Plato did not face) which Piaget and Vygotsky, in different but complementary ways, repeatedly addressed: (1) the problem of why (and how) proper concepts (universals, logico-mathematical or generic knowledge – high cognitive functions) can be irreducible to, yet psychogenetically derivable from, proper experiences (perceptual- motor/spatiotemporal, infralogical knowledge of particulars – low cognitive functions); (2) the problem of «continuous representation" – conceptual and experiential forms of knowing/processing that are continuously adapting to current constraints of the situation. Integration/coordination of the two masters' theories may be needed to solve the Plato problems. The paper highlights a basis for this integration by discussing issues on which the two masters seemed to agree: the principles of praxis, modular organization and equilibration (or dynamic synthesis). This discussion points to mental attention as a major organismic determinant, a dialectical constructivist model of which is introduced. These "hardware" attentional mechanisms, in interaction with two different innate learning mechanisms: content-associative (C) learning and logical-structural (L) learning, can explain Plato's problems and serve as basis for organismically combining the two masters' theories.

> *«Une expérience est une théorie mise en acte: un instrument, une théorie matérialisée; un concept scientifique (le soleil, l'atome de carbone), une théorie objectivée» (Jean Ullmo, 1967, p. 637).*

Plato is the first thinker to have formulated a dialectics of two modes of knowing/processing in humans – two distinct worlds of human existence – whose dynamic interaction constitutes conscious experience and thought. Using the words of Jaspers (1957, p. 30): "Thus Plato knows two worlds: the world of ideas and that of the senses, the world of being and that of becoming, the noetic (intelligible) world and the world of appearance." The world of ideas, or of being, categorizes the world of the senses, or becoming, making possible human knowledge. Implicit in this profound description are two problems that Plato did not solve, and modern cognitive science is now facing. One of these problems is how to differentiate two irreducible modes of cognitive processing, the *conceptual* (logico-mathematical, logological, or generic knowledge – *high cognitive functions*) versus the *experiential* (perceptual-motor/spatiotemporal, infralogical, or knowledge of particulars – *low cognitive functions*); while at the same time explaining the emergence of both modes of processing from the same origin: that is, as resulting from interactions among innateness (maturation) and experience (learning, culturally mediated or direct). The other problem is that of continuous representation: How is it that perceptual or "conceptual" processual forms (codes, schemes) can in fact adapt to the evolving constraints of hard reality (the world of the senses and of learned experience) so as to embody these constraints, even in truly novel situations, where subjects lack proper representational forms. I call these two problems Plato's problems (*although he did not face them*) because Plato's formulation, having created an absolute dichotomy between "conceptual" and "experiential", caused the emergence of these problems.

The traditional reductionist solutions to these problems, be they those of classic idealism/rationalism or of classic materialism/empiricism, attempt to reduce one mode of processing to the other: either interpreting the coding of experience as conceptual and the concepts/codes as perhaps innate (idealism/rationalism), or interpreting what is properly conceptual as being simply learned or experientially given (materialism/empiricism). They also tend to ignore the problem of continuous representation by assuming that adaptive change is self-explanatory. That these extreme positions are inadequate is clear from a philogenetic and/or ontogenetic developmental perspective. Perhaps for this reason, to resolve this dichotomy, developmen-

tal psychology has always tended to be both interactionist (formulating the organism's adaptive external dialectics vis-à-vis its physical or sociocultural context) and constructivist (sketching adaptive internal dialectics among functional components of the organism). In developmental psychology, Piaget and Vygotsky initiated respectively the constructivist and interactionist theories best known in human science. To reach a dialectical synthesis of Piaget's and Vygotsky's ideas is important, to advance the solution of Plato's problems. This is the general aim of the present essay.

That Plato's problems are still problems in our time is shown by a number of paradoxes, such as the learning paradox that assail our best theories (Juckes, 1991; Pascual-Leone, 1987, 1991a). The learning paradox results from the claim that very abstract and context-specific processual forms (i.e., schemes, conscious or unconscious mental codes) such as those underlying linguistic grammar, or Piaget's conservations, or formal reasoning, may simply be acquired from everyday life, and the culture, via learning without further ado. This raises a paradox, because to learn these very abstract and context-specific processual forms, the learner should either imitate and produce in his/her mind spontaneously the corresponding processual forms, or he/she must produce spontaneously the performances from which direct learning results. Consequently, if the theory lacks separate mechanisms for dynamically synthesizing the production of suitable performances in the absence of processual forms or schemes, prior availability in the subject's repertoire of the processual forms in question should be needed for learning to take place, since without these processual forms performance is not possible. This is a learning paradox, unless one assumes innateness, for it has as condition for learning the prior knowledge of the thing to be learned.

A common solution to this learning paradox is to assume, as current neo-nativists tend to do (e.g., Pinker, 1994; Spelke, 1994), that the processual forms are innate. But then there appears, in cases such as conservations, grammar or formal reasoning, an evolutionary paradox (Johnson & Pascual-Leone, 1989). This paradox consists in the fact that lesser animals do not have lives, nor exhibit performances, from which the processual forms of these complex, abstract processes might emerge in a neoDarwinian way. The usefulness of Piaget and Vygotsky, with reference to the problems of Plato (and of classic rationalism or empiricism), stems from the fact that their theories, when dialectically combined, (cf., Moll, 1994), yield a solution to Plato's problems and inaugurate dialectical constructivism – a "middle way" epistemology congenial to, and complementary with, the non-linear dynamic systems approach (e.g., Molenaar & van der Maas, 1994; Thelen & Smith, 1994; van der Maas, 1993; van Geert, 1991, 1994). In the language of dynamic-system theories, a dialectical-constructivist theory (i.e., a functional substantive theory of hidden organismic processes – a scientific "ontology") may serve to explain "how new growers emerge or how they are created, thus accounting for new equilibria" (van Geert, 1994, p. 329). And the emergence of new equilibria (new developmental stages) is the key causal problem of human development. To investigate this Vygotskian/Piagetian dialectical constructivism I examine three principles on which Piaget and Vygotsky agreed, albeit with differences that enrich our understanding. I refer to the principles of praxis and modular organization of the psychological system, and to the less understood principle of equilibration (or dynamic synthesis) in the high cognitive functions.

Principles of praxis and of modular organization

For both Piaget and Vygotsky, knowledge is the product of *praxis*, (i.e., the person's goal-directed activity addressed to the environment in order to obtain desired results). They pioneered the current trend in psychology towards seeing goal-directed action (both the subject's and the mentor's) as the origin of mental activity. In both, Vygotsky and Piaget, praxis is internalized and schematized into psychological units – semantic-pragmatic functional systems that in interaction produce the (overt or covert) performance. Piaget calls schemes these psychological units. Schemes are dynamic systems of organismic-sit-

uational processes. They are subjective units specific to given situations or types of situations. This emphasis on specificity to situations is underplayed by Piaget, who defined schemes by their effects (pole of assimilation) rather than their releasing conditions or situational aspect (pole of accommodation). Vygotsky (1978), however, explicitly emphasized the need to formulate *psychological units* (*mediations*, in the hegelian/marxist sense) that reflect this being-in-situation of the subject – situational units showing how the subject/organism relates to the situation and praxis at hand. He died before having reached a satisfactory formulation of processual mechanisms, with psychological units that are universal (Gonzalez Rey, 1995; Kozulin, 1990; van der Veer & Valsiner, 1991; Wertsch, 1985; Zinchenko, 1985). A great merit of his work is to have insisted that theoretical categories in human development must integrate both the "internal", processual and subjective, aspect with the "external", psychosocial and situational, aspect (Gonzalez Rey, 1995). Piaget neglected the "external" aspect, but the affinities with Vygotsky are clear in the last Piaget (whom I have called Piaget IV, Pascual-Leone 1989, 1991a); in particular in his works on equilibration, dialectics and semantic-pragmatics (Piaget, 1967, 1980, 1985; Piaget & Garcia, 1983, 1987). This convergence becomes obvious when we see how psychological units have evolved within the (liberalized) schools of these two masters.

From a Vygotskian perspective Zinchenko (1985) proposed tool-mediated action as a suitable psychological unit; suitable because mental processes (processual forms) are also regarded as tools. This interpretation suits Piaget's idea that all schemes are schemes of assimilation. The internal structure of this processual unit is clarified by the theory of activity, under a dialectical-constructivist interpretation, and/or by neoPiagetian theory (for lack of space, I give as only example my own formulation). From these perspectives, and adopting an observer's description, any tool-mediated action (mental and/or instrumental mediation of performance) has three components (Cole, 1985; Leontiev, 1981): (1) A functional system outlining the dynamic, semantic-pragmatic activity or "action game" (goal targets, means, prescriptions and interdictions of a general nature, etc.) according to which the scheme in question functions in the multiple types of praxis where it applies; (2) a releasing component that contains conditions, or potential "cues", that activate (and guide the application of) the scheme's effects; (3) an effecting component, with effects (actions, percepts, representations, mental transformations, operations, etc.) that inform (give form to) performance when the scheme applies. Let's take this definition as an observer's analytic formula of dynamic organismic processes that are both subjective (conscious or unconscious) and cortical; and which are not decomposable without losing their relation to performance as a totality. Considered in this manner, this definition of tool-mediated action is identical to the dialectical-constructivist definition of organismic processual schemes, which I have proposed from a neoPiagetian perspective independently from Leontiev (Pascual-Leone, 1987; Pascual-Leone, Goodman, Ammon, & Subelman, 1978; Pascual-Leone & Johnson, 1991). Thus the informational psychological units of liberalized Vygotskians and Piagetians are in fact the same. But in addition to schemes we need other mechanisms that can explain without circularity (and without falling into paradoxes) the dynamic processes of equilibration (Piaget, 1980, 1985), which Vygotsky or Luria would have called dynamic syntheses (Kozulin, 1990; Luria, 1973; van der Veer & Valsiner, 1991). Indeed, as Piaget (1980, p. 217) has said, somewhat cryptically: "la dialectique constitue l'aspect inférentiel de toute équilibration". To which Rolando Garcia, his main collaborator of the later years, added: "L'inférence est ici en jeu, mais ce n'est pas l'inférence propre à un système formel. C'est ainsi que nous comprenons l'affirmation de Piaget selon laquelle la dialectique est l'aspect inférentiel de l'équilibration. Mais le problème de savoir en quoi consiste au juste cette inférence reste ouvert" (Garcia, 1980, p. 239).

The principle of equilibration or dynamic synthesis

Both the later Piaget (Piaget IV, see Pascual-Leone, 1991a) and Vygotsky see that high cogni-

tive functions cannot be described or explained just in terms of logical structures. Their difference is one of emphasis. Piaget's emphasis is placed on the constructivist description of the different levels of psycho-logical processing structures that develop in the individual: and also on equilibration and reflective abstraction processes that mediate transition from one level to the next (Piaget, 1980, 1985; Piaget & Garcia, 1983, 1987). These levels constitute, like the layers of an onion, different developmental stages – each stage incorporating within an organic system the level of processing which it inaugurates, plus all the preceding ones. The transitions from one such stage to the next are caused, according to Piaget, by equilibration processes (dynamic syntheses) that progressively optimize performance: and the equilibration processes are in turn to be explained by a change in biological "regulations" of the subject – a construct that has remained unexplicated (Maurice & Montangero, 1992; Piaget, 1967, 1985). Vygotsky, like other dialectical developmental psychologists (e.g., Wallon, 1945; Zazzo, 1975), would rather explain development in terms of more conventional, multiple, organismic processes (e.g., memory, attention, affective/motivation, cognitive processes, etc.) promoted by, and developed from, the experience and interpersonal relations that a historico-cultural context generates. What remains unexplicated in this approach is how experiences, ideas, tools, etc., which are culturally truly-novel, can be *created* by individuals within the Culture: how these truly-novel processes are *objectified* by them into products – cultural objects or concepts: and how these processes or products (and their uses) are *internalized* by other members of the culture (Moll, 1994; Pascual-Leone, 1987). Perhaps we can clarify what Piaget, Vygotsky and their schools left unexplicated (e.g., "regulations", "creation", "objectification", "internalization"), and avoid paradoxes, by investigating more deeply the kinds of substantive ("ontological") processes involved.

Consider an issue on which both Vygotsky (Kozulin, 1990; van der Veer & Valsiner, 1991) and Piaget (Maurice & Montangero, 1992; Piaget, 1985) agreed. There are three complementary sorts of dialectics, which together promote development: (1) A *natural external dialectics* between the individual and his/her life context: (2) an *external intersubjective dialectics*, from each person to other persons: and (3) an *internal dialectics* interrelating psychological processing components (schemes and resource capacities) within the individual. These three sorts of dialectics together constitute situations as subjectively/objectively experienced. In this respect I mention the distinction between *facilitating situations* and *misleading situations* (Pascual-Leone, 1985, 1987): this is a fundamental distinction not found in Piaget or Vygotsky. A situation is *facilitating* when all the schemes it activates are compatible with the task at hand. A situation is *misleading* when it elicits schemes that interfere with the task at hand. For instance, in Piaget's Conservation tasks the situation elicits perceptual-global schemes of quantity that make the "sausage" appear to have more substance than the "ball" of clay: this is a misleading Gestaltist (S-R Compatibility) "field effect" that supermarkets use very effectively in their packaging. Facilitating situations, because the schemes they elicit contribute to (or do not interfere with) the subject's task, are optimal to examine learning abilities: and have been traditionally so used by learning theoreticians, from Behaviorist to Vygotskian. When development is studied using facilitating situations (as learning theoreticians and perceptionists often do) it appears as continuous, a linear growth function being its characteristic curve. Misleading situations, in contrast, are characteristic of problem-solving paradigms and were unwittingly used by Piaget and others to investigate cognitive development. In these situations development appears as discontinuous, in the sense of exhibiting a non-linearly growing, at times stepwise, characteristic growth curve as a function of chronological age. This is found predominantly in cross-sectional studies, where there is no contamination with learning by virtue of repeated testing. The stages of development described by Piaget and neoPiagetians are found reliably only in misleading situations. And in these misleading paradigms subjects' performance often conforms to what non-linear system theories like catastrophe theory (Molenaar & van der Maas, 1994; van der Maas, 1993) would predict: which has led to claims that development is explained by non-linear system theories (Thelen & Smith, 1994).

From the perspective of the three sorts of dialectics mentioned above, misleading situations (but not facilitating situations) are a source of internal conflicts – dialectical contradictions – between or among alternative processing strategies elicited by the task which draw on different processing resources (schemes or capacities) of the organism. Stages of development appear in misleading situations because learned habits (or innate automatisms) become obstacles for good performances. This is why in misleading situations subjects use problem-solving – non-automatized methods (invention, creatively-synthesized truly-novel performances) – to cope with task demands, and do so by way of *dynamic syntheses*. Dynamic syntheses are brought about by the tendency (this is Piaget's "assimilation") of dominant compatible schemes to apply together, and *overdetermine* (Freud – Pascual-Leone & Johnson, 1991; Pascual-Leone & Morra, 1991; Rappaport, 1960) mentations or performance of subjects. Influenced by (although critical of) Gestalt psychology, Piaget (1969, 1971) and Vygotsky (1978, van der Veer & Valsiner, 1991) saw equilibrations/dynamic syntheses as the main organismic cause of "creative" problem-solving coping with situations. In these syntheses, task-relevant schemes not activated by the situation are internally activated by the subject's *mental attention* (Houde, 1992, 1994; Luria, 1973; Pascual-Leone, 1969, 1970, 1980, 1987; Pascual-Leone & Baillargeon, 1994; Pascual- Leone & Smith, 1969). Although Piaget may not have favoured this interpretation, attention, as an organismic causal factor, is implicit in his theory, as a quotation from Garcia shows. This quotation refers to Piaget's view of natural numbers as derived from dialectical syntheses of numerical relations of cardinality (inclusion of classes) and ordinality (serial order). Garcia's quotation follows: "...Mais il faut néanmoins admettre que classifier signifie centrer l'attention sur les similitudes, tandis que la mise en ordre signifie centrer l'attention sur des différences. Dans ce sens précis, le nombre apparaît comme une synthèse d'opérations contraires (classification et ordre), même s'il n'y a pas de contradiction formelle entre elles" (Garcia, 1980, p. 234).

Mental attention mechanisms and the problems of Plato

Piaget's "regulations" as the cause of equilibration remain unexplicated (Garcia, 1980; Pascual-Leone, 1969, 1970, 1987, 1988). "Regulations" is a name for processes that overcome the limits of simple associative learning; for in misleading situations transfer of this learning can hinder task solution. Associative learning is a basic, "low-road" way of thinking and knowing (Pascual-Leone & Irwin, 1994) which is very powerful – as research on connectionist/neural networks has shown (Pascual-Leone, 1994). But this "bottom up" learning has its own severe limitations: Whenever the paradigm is a problem-solving one (i.e., truly novel, misleading situation with only one or few exposures to the task) the powerful cue-driven bottom-up process of associative learning (whether in humans or in computers!) may become a hindrance. Indeed, by virtue of associative learning, highly activated schemes, even if they are misleading, tend to dominate in this case and determine performance. This is why purely associative organisms or machines are so limited in truly novel, creative problem solving. Associative learning models, not having "top-down" processing mechanisms, fall under the learning paradox and cannot solve Plato's problems (Pascual-Leone, 1991a). To achieve these aims we need theories which have *more than one* learning mechanisms *and* can generate dynamic syntheses (Pascual-Leone, 1987, 1991a, 1995; Pascual-Leone & Goodman, 1979). One of these mechanisms must deal with content/ associative learning, and I call it Content or *C* learning. With repetition and automatization *C* learning produces "effortless" but slow structural learning, which I call *LC* learning (these are the learning options that behaviorists, perceptionists, Gibsonians, connectionist simulators, etc., have emphasized). *LC* learning is a very efficient learning in facilitating situations, because it is then driven by salient "cues". What Vygotsky (1986; Kozulin, 1990) called "complexes" and "everyday" concepts (as distinct from proper or "scientific" concepts) are most likely products of *LC* learning in facilitating situations created via human mediation – external intersubjective dialectics. In misleading situations, however, *LC* learning cannot

be applied effectively by itself, because in that case salient "cues" can lead to error.

Another learning mechanism, which is driven by executive processes in mental attention and leads to rapid Logical-structural learning, I call *LM* learning. ("Logical" is used here in the sense of Piaget – functional structures – and does not refer to formal logic.) *LM* learning takes place with the help of endogenous *mental attention*, a content-free (non-informational, non-schematic) organismic resource or capacity which, monitored by executive (planning) schemes, can be used to hyperactivate with mental "energy" task-relevant schemes: in particular schemes that are not highly activated by the situation. This mental "energy" or *M*-capacity is a brain utility, controlled "top-down" by the prefrontal lobe. *Mental attention* can also be used to centrally inhibit or "mentally interrupt" schemes that are task-irrelevant (this is the I – Interruption – capacity, also controlled "top-down" by the prefrontal lobe). Schemes that are co-functional (i.e., compatible in their function) and often *co-activated* (i.e., activated simultaneously or in immediate serial order) tend to become structured together - Piaget would say "coordinated" – into a common superordinate logical structure; and the speed of this structural learning process is proportional to the activation level of the schemes involved. From these learning assumptions three important consequences follow: (*LM*1) In *LM* learning, since *M*-capacity is hyperactivating task-relevant schemes while I-capacity is inhibiting task-irrelevant schemes, only schemes which are tagged as relevant by the dominant executive schemes will become part of the *LM* structure in question; thus ordinary contextual schemes will be excluded and, so purified, the resulting *LM* scheme can function as a concept, a central conceptual structure (Case, Okamoto, Henderson & Mckeough, 1993) or a Piagetian operational structure. (*LM*2) Since the growth of *M* is constrained by a maturational process which runs from the second month of life till adolescence (Johnson, Fabian, & Pascual-Leone, 1989; Pascual-Leone, 1970, 1987; Pascual-Leone & Johnson, 1991), the level of complexity that the subject can generate in *LM* schemes will be, *within misleading situations*, bound by his or her (hidden) *M* capacity growth, a growth whose spurts (levels) accompany Piagetian and neoPiagetian stages. It follows that in misleading situations the processual complexity level, or *M* demand, of a given conceptual structure (*LM* scheme) cannot be greater than the subject's own *M*-capacity, if it is learned by a subject without the help of an external human mediator (who, by creating a facilitating situation, may lower the *M* demand). This is the reason why stages of development may only become manifest in misleading situations. (*LM*3) High cognitive functions, as well as Vygotsky's proper or "scientific" concepts (Kozulin, 1990; Vygotsky, 1986) emerge, from experience and historico-cultural interactions, by means of *LM* learning and often in misleading situations.

Because the processual complexity of the *LM* schemes available to a subject is a function of his/her mental effort (i.e., *M*- and *I*- capacities), which increases with age and maturation, this model of *LM/LC* learning offers an explanation of one of Plato's problems – the one concerning distinctiveness and common origin of two modes of processing: properly "conceptual" (analytical) versus experiential (automatized or global everyday notions).

LM learning as processual mechanism corresponds to what cognitive science calls "effortful" or "controlled" processes, *LC* learning to what it calls "automatic" processes. I also distinguish other kinds of learning such as "effortless" learning driven by affective schemes (*LA* learning – Pascual-Leone, 1991b).

Explanation of the "continuous representation" problem, and resolution of the learning and other paradoxes, necessitates, in addition to multiple types of learning, the acceptance of two other mechanisms (compatible with the theories of Piaget and Vygotsky) which neuroscience and connectionist/neuronal modelling investigated under other names. I refer to the principle of overdetermination of performance and the Gestaltist internal "field" factor (S-R compatibility, Minimum Principle).

The Principle of *Schemes' Overdetermination of Performance* (SOP principle) is an organismic generalization of Piaget's principle of Assimilation. Since all activated schemes tend simultaneously to apply to *inform* (in the etymological sense of "injecting" form into) the synthesized performance, the performance, at any time, is synthesized by the dominant (most acti-

vated) *cluster of compatible schemes available* in the brain at the time of responding. The probability of this performance is proportional to the relative dominance of the cluster of schemes generating it (Pascual-Leone, 1989, 1995; Pascual-Leone & Baillargeon, 1994; Pascual-Leone & Goodman, 1979; Pascual-Leone & Johnson, 1991; Pascual-Leone & Morra, 1991). This principle is analogous in connectionist models to the "relaxation" or update algorithms which in every trial of a computer-learning experiment, generate the current step of the simulation (Shultz et al., in press; Smolensky, 1988).

The "field" factor, which I prefer to call *F* operator, is an internal-field and performance closure mechanism akin to the neo-Gestaltist principles of "Minimum" and "S-R compatibility" (Pascual-Leone & Morra, 1991). This F operator is a sort of minimax function generated in the brain by neuronal "lateral inhibition" mechanisms in conjunction with the SOP principle. In process analytical terms this minimax function can be formulated as follows: The performance produced will tend to be such that it minimizes the number of schemes that directly apply to inform the performance (including perception or representation); and it does so while maximizing the set of distict, salient features of experience (activated low-level schemes) that, directly or indirectly, inform this experience (Pascual-Leone, 1987, 1995; Pascual-Leone & Johnson, 1991). For example, errors in the Wechsler picture completion subtest, such as failing to see the missing doorknob in the picture of a door, are caused by this F minimax mechanism, which prevents the application of low-level (local-perceptual) schemes, like the simple doorknob scheme, because automatized higher-order schemes, like the superscheme of a standard door with its own doorknob, can also be applied and incorporate the lower scheme's representation.

As a result of non-linear dynamic interaction among all these mechanisms, a heuristic implicit "choice" and synthesis of performance (whether in action, perception, representation or mentation) takes place, which is brought about by the *F* and *SOP* mechanisms. It is within such a nonlinear dynamics for constructing actual performance that the significance of mental attention, as major developmental mechanism, becomes fully clear. From this perspective endogenous attention appears (Pascual-Leone, 1987; Pascual-Leone & Baillargeon, 1994) as the organismic functional system (or modular "function" <...>) constituted by three resource capacities and a special subrepertoire of schemes – the attentional executive schemes – in their interaction as attentional operators: <*E, M, I, F*>. The attention component *E* is the set of currently dominant attentional executives, usually called by the collective name "the executive"; the component *M* is mental "energy" or capacity; the component *I* is "top-down" (central) inhibition; the component *F* is the neoGestaltist "field factor" just mentioned. By boosting (with $\dot{M}$ operator) the activation of, and/or deactivating (*I* operator), schemes in the field of activation, mental attention (monitored by affects via the *E* operator) can effectively change the "choice" of performance that *F* and *SOP* will together synthesize in a given situation. These are the effortful top-down mental equilibration processes that generate Piagetian operations – whether these operations are described with Piagetian models or otherwise. Although there is no space for further illustrations, I will assert that language and conceptual thinking emerge in the organism in this manner: via both an external intersubjective dialectics and an internal dialectics, which in their interactions, serve to internalize historico-cultural processes used by and created within society. This chain of transitions is illuminated by Vygotsky's "one sentence" formula: "*if at the beginning* of development there stands the act, independent of the word, then at the end of it there stands the word which becomes the act, the word that makes man's action free" (Vygotsky & Luria, 1994, p. 170).

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