Piaget and Vygotsky: Many resemblances, and a crucial difference

Orlando Lourenço[*]

Department of Psychology, University of Lisbon, Rua Prof. Joaquim Bastos, 66, 5°B, 4200-604 Porto, Portugal

A B S T R A C T

Piaget and Vygotsky are two influential developmental psychologists. One can even say that their contributions to developmental psychology, albeit different, are similarly remarkable and unique. This article is in four parts. In the first part, I refer briefly to a commonly noticed difference between Vygotsky's and Piaget's theories. In the second part, I show that there are many resemblances between Vygotsky and Piaget. In the third part, I argue that in spite of such resemblances, there exists a crucial, and generally unnoticed, difference between Piaget's and Vygotsky's theories, and that this difference underlies the way each author addresses the following issues: 1) the *origins* of development and the *motor* of development; 2) the relationships among *equal peers vs.* those based on *authorities*, as they are sources of development and learning; 3) the more appropriate *methods* for studying developmental changes; 4) the importance of the distinction between *true vs. necessary* knowledge; and 5) the role of *transformation* and personal reconstruction *vs.* that of *transmission* and social influence in the phenomena of development and learning. Finally, I summarize the main ideas and arguments which I elaborate throughout this article, and mention what can be gained when the generally ignored aforementioned difference is noticed.

© 2012 Elsevier Ltd. All rights reserved.

If it were asked who are the two main geniuses in the field of developmental psychology, many, if not all, developmentalists would certainly point to Jean Piaget (1896–1980) and Lev Vygotsky (1896–1934) in either order. Their impact on psychological development and education, for example, is so deep that one may rightly say that their respective contributions to these two issues are too much present to not be noticed, and much monumental to be grasped (e.g., Daniels, Cole, & Wertsch, 2007; Greenfield, 2001; Gruber & Vonèche, 1995; Kirschner & Martin, 2010; Müller, Carpendale, & Smith, 2009; Smith, Dockrell, & Tomlinson, 1997; Tryphon & Vonèche, 1996, 2001).

After being ignored in the Western society and censured for several years in his own country, Vygotsky's *sociocultural* theory is now an important topic of theoretical analysis and empirical research in developmental psychology, in general, and in educational psychology, in particular (e.g., Daniels et al., 2007; Matusov & Hayes, 2000; Vianna & Stetsenko, 2006; Wertsch, 1985a, 1985b; Wertsch & Tulviste, 1992). Although the idea that Piaget is almost "…a figure of the past…" (Cohen, 1983, p. 152) is, to an extent, embraced by some developmentalists (e.g., Siegal, 1999), his *constructivist approach* to development and knowledge continues to inspire empirical research and theoretical debates (see, for instance, Beilin, 1990, 1992; Chapman, 1988; Kamii, 1981; Müller et al., 2009; Smith, 1993; Smith, Thelen, Titzer, & McLin, 1999).

As could be expected, the comparison of Vygotsky's theory with that of Piaget was inevitable (e.g., Bidell, 1988; Bruner, 1997; DeVries, 2000; Duncan, 1995; Feldman & Fower, 1997; Forman & Kraker, 1985; Glassman, 1994, 1995; Lerman, 1996; Matusov & Hayes, 2000; Shayer, 2003; Tryphon & Vonèche, 1996; Vianna & Stetsenko, 2006). First, Piaget and Vygotsky were the two most

* Tel.: +351 22502 8690.
E-mail addresses: oml2105@fp.ul.pt, orlandol@fpce.ul.pt.

influential figures in the field of child development in the last century. Second, Piaget's (1983) theory is almost always an obligatory reference to any other theory of psychological development (see Müller et al., 2009; Scholnick, Nelson, Gelman, & Miller, 1999). Third, everybody who is familiar with both developmental figures knows of Vygotsky's (1962, 1978) several arguments with diverse of Piaget's ideas, namely with that one which subordinates learning to development (see Piaget, 1972a). Finally, Piaget (1962) judged to be misunderstood in some of his ideas by his developmental colleague, for example, for downplaying the role of the social in the child's development (see, for this respect, Carpendale & Müller, 2004a).

In what follows, I show that the comparison between the two theories has moved along two phases: a first phase in which, among others, it was emphasized a supposedly fundamental difference between Piaget and Vygotsky, and a second phase wherein several authors saw many resemblances between the two influential developmental psychologists. My main purpose in this article is to argue that, although I accept that there are many similarities or resemblances between those two geniuses of developmental psychology, there exists a crucial, and generally unobserved or at least overlooked, difference between Piaget's and Vygotsky's approaches to development, knowledge, and learning. I believe that to point to such crucial difference may be considered as a third phase of the comparison between Vygotsky's and Piaget's theories.

1. Piaget and Vygotsky: a supposedly fundamental difference

As referred to above, in the first phase of comparison of Piaget to Vygotsky it was said that there exists a fundamental distinction between their theories. The main argument was that Piaget developed a theory wherein the individual constructs his or her knowledge *individually* or solitarily (e.g., Bruner, 1997; Forman, 1992; Tappan, 1997), whereas Vygotsky put forward a theory in which one only develops as one participates in various forms of *social interaction*, using then *tools* (e.g., abacus, pencil, hammer) and *signs* (e.g., language, pretend play, mathematical formulae), tools and signs which are also social in their very nature (Vygotsky, 1987; see, for instance, Stetsenko, 2004, for the role of tools and signs in Vygotsky's thinking). In other words, in this first phase of comparison between the two theories, it was mainly said that, instead of a Piagetian individual or *solitary* knower, what appears in Vygotsky's thinking is a collective and *social* subject or knower (e.g., Bruner, 1997).

According to Amin and Valsiner (2004), "[t]he construction of this [individualistic-collectivist] divide is an interesting example of historical myopia in contemporary psychology." (p. 87). This divide is also rejected by other authors and researchers (e.g., Bickhard, 2004; Carpendale & Müller, 2004a; Cole & Wertsch, 1996; Kitchener, 1996, 2004; Müller & Carpendale, 2000, Smith, 1995). The rejection, by several authors, of such a supposedly fundamental difference between Piaget's emphasis on an individualistic perspective and Vygotsky's focus on a collectivistic one is well understandable. In fact, an

emphasis on a *relational* perspective rather than on an individualistic stance is present in both Vygotsky's and Piaget's writings. For instance, Vygotsky's (1978) idea that "[a]ll the higher functions originate as actual relations between human individuals." (p. 57) is also present in many of Piaget's affirmations. On several occasions, Piaget stated that "… by himself, the individual would never achieve complete conservation and reversibility." (Piaget, 1973, p. 271); "[t]he individual would not come to organize his operations in a coherent whole if he did not engage in thought exchanges and cooperation with others…" (Piaget, 1947, p. 174); "…the individual can achieve his inventions and intellectual constructions only to the extent that he is the set of collective interactions…" (Piaget, 1967a, p. 508); and "… there are neither individuals as such nor society as such. There are just inter-individual relations" (Piaget, 1995. p. 210).

The rejection of the above mentioned divide on the basis of the idea that Vygotsky's and Piaget's theories espouse a relational perspective rather than a genetic or developmental individualism, was one of the main reasons why the first phase of comparison between the two authors was followed by a second phase in which their theories are judged to be almost identical or, at least, much more similar than they were previously perceived.

2. Piaget and Vygotsky: their resemblances

In this second phase of comparison between the two geniuses of developmental psychology, the main argument is that there are considerable resemblances between Vygotsky's and Piaget's theories and that their differences can be relatively ignored (e.g., Bidell, 1988; Glassman, 1994). What then are those similarities or resemblances? Besides other similitudes, Piaget and Vygotsky share the following: 1) a *genetic*, i.e., developmental, perspective; 2) a *dialectical* approach; 3) a *non-reductionist* view; 4) a *non-dualistic* thesis; 5) an emphasis on *action*; 6) a primacy of *processes* over external contents or outcomes; and 7) a focus on the *qualitative* changes over the quantitative ones (see also Marti, 1996). In what follows I elaborated on each of these issues.

According to the authors who can be included in this phase of resemblances between Piaget and Vygotsky, these two theorists and researchers consider that a *developmental perspective* is essential for an understanding of psychological phenomena and processes, namely those relatively more elaborated or complex, as is the case of Piaget's mental operations, formal operations, for instance (Inhelder & Piaget, 1958; Piaget, 1947), and of Vygotsky's (1978) symbolic operations, for example, to tie a knot on one's handkerchief for one to remember to do something in a near future (i.e., mediated memory). Vygotsky's (1978) following affirmation documents well his interest in a developmental perspective: "…we are advocating the *developmental approach* as an essential addition to experimental psychology." (p. 61, emphasis added). Piaget's concern with a developmental perspective is so deep, that he even considered that the study of how *new modes of thinking develop* during ontogenesis constitutes the first great mystery of knowledge (see Piaget, 1978, p. 5).

Parenthetically, for Piaget, the second great mystery of knowledge is to explain how these new modes of thinking become psychologically *necessary*. I will return to this issue later when I discuss the role of necessary knowledge in Piaget's and Vygotsky's theories.

For the defenders involved in this phase, both Piaget (1980) and Vygotsky (see Cole & Scribner, 1978, pp. 1–14) share a *dialectical approach*, in that psychological development involves a continuous interaction among distinct, but interdependent, functions or processes, such as assimilation/accommodation in Piaget's (1952, 1980, 1985) theory, and internalization/externalization in Vygotsky's (1962, 1978) thinking. It is because of these successive assimilations/accommodations that the Piagetian subject constructs, for instance, forms of logical reasoning increasingly more complex and advanced (e.g., the passage from *concrete* operations to *formal* operations; see Inhelder & Piaget, 1958, for a distinction between these two forms of operational operations). And it is due to these successive internalizations/externalizations that the Vygotskian individual acquires, for example, forms of action increasingly more advanced and mediated (e.g., the passage from *natural* memory to *mediated* memory; see Vygotsky, 1978, pp. 38–39, for a distinction between natural memory and mediated memory). The Vygotskian idea (see Vygotsky, 1978, p. 73; and also John-Steiner & Souberman, 1978, p. 121) that development is not merely an accumulation of changes, but rather a complex dialectical process, characterized by periodicity, qualitative transformation of one form into another, intertwining of external and internal factors, and adaptive process is also a central thesis in Piaget's approach (e.g., Piaget, 1980, 1985). Actually, Vygotsky's view that development implies a rejection of the frequently held view that cognitive development results from a gradual accumulation of separate changes (see Vygotsky, 1978, p. 73), is even an essential characteristic of Piagetian cognitive stages for, in comparison to its predecessor, each stage represents a higher qualitative, not quantitative, form of knowing or thinking (i.e., to know better rather than to know more of the same; see Piaget, 1960, pp. 12–13).

It is still said in this phase of similitudes between Piaget and Vygotsky that they also share a *non-reductionist* view of human intelligence and consciousness. For them, human consciousness and intelligence are forms of organization and adaptation neither reducible, respectively, to a set of reflexes (Vygotsky, 1987), nor to the initial, external manifestations through which such forms often appear (Piaget, 1967b). Vygotsky's (1978, p. 63) thesis that "[i]n reality, psychology teaches us at every step that though two types of activity can have the same external manifestation, whether in origin or essence, their nature may differ most profoundly", reminds us clearly of Piaget's distinction between the external content of a child's answer on an operational task, and its underlying structure or form. Everyone who knows Piaget's theory is well aware that two apparently different answers of a given child on a certain Piagetian task may appeal to the same structure or form, and that a different cognitive structure may underlie two apparently similar answers on the part of the individual (see Piaget, 1947, 1983).

According to the authors belonging to this phase of comparison between Vygotsky and Piaget (e.g., Bidell, 1988; Glassman, 1994), they also espouse a *non-dualist* thesis regarding the individual and his or her physical and social context. For both developmentalists, the individual and her or his physical and social context are not dichotomies or independent and isolated polarities, in that they are rather interdependent and relational realities (e.g., Kitchener, 1996, 2004; Piaget, 1995; Vygotsky, 1978; see also Amin & Valsiner, 2004; Carpendale & Müller, 2004b; Smith, 1996; Stetsenko, 2008). For instance, according to Piaget, the individual would not come to organize her intellectual operations in a coherent whole if she did not engage in thought exchanges and cooperation with others (see Piaget, 1947, p. 174). Similarly, for Vygotsky, all the higher functions originate as actual relations between human individuals (see Vygotsky, 1978, p. 57).

Piaget and Vygotsky both put also a great emphasis on the importance of *action* on the genesis of the diverse forms of intelligence, and on all functions of consciousness. Accordingly, for Piaget (1964, p. 176), "To know an object is to act on it. To know is to modify, to transform the object, and to understand the process of this transformation". In a similar way, for Vygotsky (1962, p. 153, emphasis in original), "In the *beginning* was the deed. The word was not the beginning – action was there first; it is the end of development, crowning the deed."

Both Vygotsky and Piaget stress the primacy of *processes* of development, not its external outcomes or exterior manifestations. Vygotsky's (1978, p. 63) above mentioned view that two types of activity can have the same external manifestation, whether in origin or essence, their nature may differ most profoundly, is a clear indicator that, for him, if one wants to understand the very nature of a subject's certain activity, one has to look at the psychological processes underlying that activity. The idea that two apparently similar answers in terms of content may differ profoundly in terms of structure or underlying psychological processes lies at the heart of Piaget's constant resort to his clinical method (Piaget, 1972d; see below), a method more interested in the (internal) reasoning processes which lead to a subject's certain answer on a Piagetian task than in the (external) answer in itself. The above mentioned primacy was one of the reasons why neither Piaget (1983) nor Vygotsky (1978) favored mental tests, such as the Wechsler's (1939) test. As is well-known, mental tests are more directed to measuring the quantity (Anastasi, 1982) rather than the quality of intelligence (Piaget, 1947; Vygotsky, 1962). In other words, mental tests are limited to assessing how intelligent an individual is (e.g., her IQ is 140), not to understanding, for example, which form of intelligence (e.g., pre-operational, concrete operational, formal operational), or memory (e.g., natural, mediated), lies at the heart of the subject's performance on certain tasks and situations (see Piaget, 1947; Piaget & Inhelder, 1974; Vygotsky, 1962, 1978).

Finally, both the Swiss psychologist Piaget and the Soviet psychologist Vygotsky have put a great emphasis on the qualitative or *transformational changes*, not the quantitative or variational ones (see Overton, 1998, for a distinction between these two forms of change). For

instance, the appearance of mediated memory, after the emergence of natural memory, was a phenomenon to which Vygotsky (1978, pp. 38–51) dedicated particular attention. Needless to say that, for Vygotsky, mediated memory is a better form of memory than natural memory. Being incapable and, after that, being capable, of tying a knot on one's handkerchief as a reminder for one to do something in a relatively proximal future, exemplifies a passage from natural to mediated memory. In the same vein, the emergence of *formal* operations after the appearance of *concrete* operations is a typical qualitative change in Piaget's thinking (Inhelder & Piaget, 1958). To know that, all over the world, there are more flowers than roses because there are flowers which are not roses (concrete operational thinking) and, after that, to know that cats and dogs give rise, in terms of propositional logic, to four classes (i.e., cats and dogs, class 1; cats and not dogs, class 2; dogs and not cats, class 3; neither cats nor dogs, class 4), typifies a passage from concrete operational thinking to formal thought. Because formal operations are operations upon concrete operations, it is crystal clear that the former are a better type of knowing than the latter (see Inhelder & Piaget, 1958; Piaget & Szeminska, 1948).

To summarize, contrary to the initial phase of comparison between Piaget and Vygotsky, a phase in which it was argued that the Piagetian solitary or individual knower had nothing to do with the Vygotskian social and collective subject, in the second phase of such comparison, Piaget's and Vygotsky's theories are seen as sharing several issues. In other words, those theories were judged, for instance, to share a developmental perspective, a dialectical approach, a non-reductionist thesis, a non-dualistic view, a stress on action, a focus on the primacy of inner processes over external contents, and an emphasis on the qualitative changes over the quantitative ones.

3. Piaget and Vygotsky: a crucial, and generally unnoticed, difference

Although I accept that, as seen before, there are many resemblances between Piaget's and Vygotsky's theories, my main goal in this article is to argue that there exists a crucial, and generally unnoticed or at least overlooked, difference between them. To put it simply, Piaget's approach is fundamentally oriented to an *autonomous* subject when she confronts the physical (e.g., Piaget & Inhelder, 1974), and the social world (Piaget, 1995) (see also, Piaget, 1970a, 1972a). In Piaget's words, "…the development of operational behavior is an *autonomous process* rather than a secondary consequence… When we speak of the autonomy of this development we wish to understand in the very precise sense that the development can be explained without necessary reference to various factors which undoubtedly do play a part in its concrete realization, e.g., maturation, learning and social education, including language. For the key to its explanation lies in the concept of equilibration in that it is a wider notion than any of these and comprehends them all." (Inhelder & Piaget, 1969, p. 292, emphasis added).

In contradistinction, even though there exists in Vygotsky's (e.g., 1962, 1978, 1994) theory a certain tension between an orientation to autonomy and an orientation to heteronomy (see below), in the end, he appeals almost always to a *heteronomous* individual for his or her development depends heavily on the existing diverse social structures with which he or she is confronted. In Vygotsky's (1978) view, "[f]rom the very first days of the child's development his activities acquire a meaning of their own in a system of *social behavior* and, being directed towards a definite purpose, are refracted through the prism of the child's environment." (p. 30, emphasis added). In other words, the Piagetian subject is, ultimately, the main constructor of, or responsible for, all his or her actions, operations, and social interactions (see Piaget, 1970a, p. 15). Contrary to this, the Vygotskian subject's activity is always referred to an action or operation which initially represents an external, not internal, activity or operation (see Vygotsky, 1978, p. 56).

I believe that Piaget's psychological persistent orientation to an autonomous individual has much to do with his religious orientation to *immanence*, i.e., to a form of divinity or God who is wholly internal to the believer and the universe and, thus, with Piaget's rejection of an orientation to *transcendence*, i.e., to think of God or divinity in the form of a person who is totally external to the believer and above the universe (see, for instance, Piaget, 1928a; and also Chapman, 1988, pp. 69–73; Vidal, 1998). In this vein, one may say that, psychologically, transcendence, for example, is to unilateral respect just as immanence is to mutual respect as defined in Piaget's (1965) seminal book, *The moral judgment of the child* (see below). Similarly, one may claim that, psychologically, transcendence corresponds to heteronomy and authority-based relationships, and immanence to autonomy and social relationships between two equal peers. As I will show later, contrary to Vygotsky's (1978) thinking, Piaget (1965) valued mutual respect, autonomy, and social relationships among equal peers more than unilateral respect, heteronomy, and authority-based relationships. Mainly because of the different value that Piaget and Vygotsky attributed to those types of respect (unilateral *vs.* mutual) and social relationships (between two equal peers *vs.* those appealing to authority figures), I think that, even psychologically, Piaget is, so to speak, oriented to *immanence* and autonomy, i.e., to what is intrinsic to the individual and comes primarily from the subject's own actions and coordination of actions. On the contrary, Vygotsky is, as it were, psychologically oriented to *transcendence* and heteronomy, i.e., to what is extrinsic to the individual and comes primarily from without, that is, from what transcends or is above that individual, namely, from the subject's interaction with adults and more, not equally, competent peers (see Vygotsky, 1978, pp. 56–57).

In the same vein, Piaget's (1964, 1967b, 1972b) permanent refusal of one's obedience to dogmas, established truths and external authorities, and his persistent appeal to an autonomous subject in the construction of her development and knowledge, speaks in favor of his psychological fundamental orientation to immanence and autonomy, for such construction does not depend on something that, so to speak, is exterior and above that subject or individual. On the contrary, Vygotsky's (1929, 1962, 1978, 1981, 1987) constant subordination of the individual to what comes

from the exterior and transcends, as it were, that individual, testifies to his psychological dominant orientation to transcendence and heteronomy, for such subordination means that the Vygotskian subject's knowledge and development depends, in the last analysis, on the existing diverse social structures or what, so to say, is exterior and comes from without.

I think that pointing to that central difference between Piaget and Vygotsky leads us to a better understanding of many issues both authors addressed and, hence, that there is much to be gained when such difference is stressed (see Final Words section). It should be noted that this crucial difference remains, despite the modifications both authors introduced into their respective theories throughout their writings. Concerning these modifications, it suffices to say that Piaget (1972c) came to recognize that formal thought was more dependent upon context than he had initially admitted (Inhelder & Piaget, 1958); and that Vygotsky was increasingly distancing from an orthodoxy Marxism, an ideology which almost makes the idea of an individual consciousness disappear, because of its subordination to the collective and social consciousness (see Davydov & Radzikhovskii, 1985; see also Wertsch, 1985a, 1985b).

In what follows, I argue that Piaget's constant psychological orientation to autonomy, and Vygotsky's dominant orientation to heteronomy lie at the heart of essential features of their respective theories, namely, the way they consider:

- The *origins* of knowledge and the *motor* of development;
- the relations among equal *peers vs.* those based on *authorities* such as parents and teachers, as they are sources of development and learning;
- the more appropriate *method* for studying developmental changes;
- the importance of the distinction between *true vs. necessary* knowledge; and
- the role of *transformation* and personal reconstruction *vs.* that of *transmission* and social influence in the development and learning phenomena.

4. Piaget and Vygotsky on the origins of knowledge and motor of development

Accepting the influence of what he called the three traditional factors of development (i.e., maturation, physical experience, and social experience), Piaget (1983, 1985; Piaget & Inhelder, 1969) always considered the subject's actions and coordination of actions the ultimate factor responsible for the individual's own development, knowledge, and learning.

Contrary claims notwithstanding (e.g., Fischer & Granott, 1995), Piaget always sustained that instruction coming from the external environment can accelerate the child's development. However, as far as *operational* competences or qualitatively distinct forms of reasoning are concerned, for Piaget, such an external influence on the individual's development is not as relevant as it seems at the first glance. According to Piaget, instruction may even lead to memorization or rote learning of data and facts without involving the construction of operational

instruments or forms of thinking which may relate these data and facts to logical networks governed, for instance, by the idea of logical necessity (see Smith, 1993, 2009). The irrefutable fact of a child to be able to count due to direct teaching and, even so, not yet to be capable of an operational understanding of the number concept, speaks in favor of the paramount importance Piaget attributed to the child's coordination of actions for such type of understanding. For instance, when a child counts from left to right and, after that, from right to left, and then concludes that a given number of roses in a certain set of this type of flowers is the same numerical quantity, regardless of the direction of such counting, she coordinates two actions upon objects and reaches a true (and necessary) knowledge. Therefore, for Piaget, it is the subject's actions upon objects and the coordination of those actions that are the ultimate origin of an operational understanding of the number concept, and other similar ones. Piaget's following affirmation substantiates this point fairly well: "No doubt..., the verbal counting can accelerate the process of evolution [i.e., an operational understanding of the number concept]. But, by itself, the verbalizing of the name of numbers [i.e., verbal counting] does not lead to such understanding" (Piaget & Szeminska, 1948, p. 85). In other words, for Piaget, a key-concept for such understanding is *psychogenesis* (see Bennour & Vonèche, 2009), which constitutes an indicator of his belief that development is something relatively natural and spontaneous (see Piaget, 1969, p. 59), or, so to speak, coming from within, not an indicator of the idea that development is something social or cultural or, as it were, coming from without.

Instead of Piaget's key-concept of psychogenesis, in Vygotsky's (1978) theory, a key-concept for the understanding of higher mental processes, such as voluntary attention or logical memory, is *sociogenesis*. With respect to the role of sociogenesis in Vygotsky's theory, consider, for instance, his following thesis: "Every function in the child's cultural development appears twice: first, on the social level, and later, on the individual; first, *between* people (*interpsychological*), and then *inside* the child (*intrapsychological*). This applies equally to voluntary attention, logical memory, and to the formation of concepts. All the higher functions originate as actual relations between human individuals." (Vygotsky, 1978, p. 57; emphasis in original). This thesis, which is central in Vygotsky's theory, shows clearly how much his thinking is, ultimately, oriented to the subordination of the individual to others, to collective consciousness, and what comes from without. It should be noted that the subordination of the individual consciousness to the collective consciousness in Vygotsky's theory is consonant with a Marxist position which underlies his theory (see Cole & Scribner, 1978, pp. 1–10).

Regarding the origins of knowledge and the motor of development, there are still other indicators of a dominant orientation to heteronomy in Vygotsky's thinking, and of a persistent orientation to autonomy in Piaget's work. For example, according to Piaget, scientific concepts, such as number, classification, and transitivity (Inhelder & Piaget, 1969; Piaget, 1942), emerge in child's thought in the sequence of a relatively natural process, that is, without the direct intervention of formal teaching, such as that which

occurs at schools. Stated differently, these changes emerge from a process in which pre-operational concepts, pre-concepts, or perceptual and figurative notions are then transformed into operational (and scientific) concepts by the child's actions and coordination of actions. A perceptual or figurative notion of number, for instance, is contained in the young child's idea that the numerical quantity of a given set of elements depends upon the spatial configuration that these elements form in the respective set. An operational and scientific understanding of the number concept is exhibited, for example, in older children's idea that that numerical quantity is totally independent of the spatial arrangement of its respective elements in the set at hand.

The relatively autonomous and natural origin of scientific concepts, which was so emphasized by Piaget (Inhelder & Piaget, 1969), is not visible in Vygotsky's theory. In fact, in his theory, whereas the origin of the child's pre-concepts, pseudo-concepts, or "*thinking in complexes*" (Vygotsky, 1962, p. 61, emphasis in original) is "rooted in his practical experience" (p. 63), the origin of scientific concepts should be mainly found in the formal definitions given to children by their teachers or adults. In other words, according to Vygotsky (1962), "[v]erbal intercourse with adults thus becomes a powerful factor in the development of the child's [scientific] concepts. The transition from thinking in complexes to thinking in concepts passes unnoticed by the child because his pseudo-concepts coincide in content with the adult's concepts." (p. 69). This being so, there is no surprise in Vygotsky's (1962, p. 59) affirmation that "[t]he investigator must…view concept formation as a function of the adolescent's total social and cultural growth, which affects not only the contents but also the method of his thinking." In short, according to Vygotsky, one should view concept formation as a function of the individual's social and cultural development (see also Howe, 1996). As mentioned before, in Piaget's theory, concept formation results from a relatively natural and spontaneous process (see Inhelder & Piaget, 1969, p. 292; Piaget, 1969, p. 59). This Piaget's view of concept formation makes us think of his persistent orientation to an autonomous subject, just as Vygotsky's thesis of concept formation reminds us of his dominant orientation to a heteronomous individual.

It should be noted, however, that there are also in Vygotsky's theory some indicators of a certain tension between his dominant orientation to heteronomy and his occasional orientation to autonomy, and that these indicators attenuate, so to speak, Vygotsky's dominant orientation to heteronomy or subordination of the individual to the collective and the social. I limit myself to mentioning only three of those indicators: "(a) *An operation that initially represents an external activity* [e.g., egocentric speech] *is reconstructed and begins to occur internally* [e.g., private and internal speech]…"; "(b) *An interpersonal process* [e.g., social language] *is transformed into an intrapersonal one* [i.e., internal language or speech]…."; "(c) *The transformation of an interpersonal process into an intrapersonal one is the result of a long series of developmental events*…". (Vygotsky, 1978, pp. 56–57, emphasis in original). In fact, each one of these three Vygotskian statements shows that the passage from the interpersonal or external to the intrapersonal or internal is not due to a simple and external cause, but that it also requires reconstruction and transformation on the part of the individual.

As I see it, the dominant orientation of Vygotsky's thinking to heteronomy rather than to autonomy is one of the reasons why Vygotsky (1962, pp. 9–24, 1978, pp. 79–91) always distanced from Piaget's thinking, a thinking wherein Vygotsky saw a clear inclination to individualism. Needless to say that Piaget's orientation to the individual subject was, for Vygotsky, incompatible with a Marxist framework which pervades all his work. In Cole and Scribner's (1978, p. 6) words, "…Vygotsky clearly viewed Marxist thought as a valuable scientific resource from very early in his career. 'A psychologically relevant application of dialectical and historical materialism' would be one accurate summary of Vygotsky's sociocultural theory of higher mental processes." (see also Davydov & Radzikhovskii, 1985). It is also feasible that the prohibition for several years of Vygotsky's work in his own country has to do with some of his concessions to the individual's autonomy in relation to external and social contexts. In this vein, we might even think that, because of his frequent orientation to a heteronomous individual and to Marxist ideology, Vygotsky was not comfortable with the idea of an autonomous individual and Piaget's theory, and that because of some of his concessions to the idea of autonomy (see above) Vygotsky had some problems with Marxist ideology (e.g., to have his work censured for several years in his own country).

In summary, as far as the origins of knowledge and motor of development is concerned, Piaget appealed to a relatively natural and spontaneous process, and Vygotsky appealed to a relatively cultural and social one. The former fits well with Piaget's fundamental orientation to an autonomous individual, whereas the latter goes well with Vygotsky's dominant orientation to a heteronomous subject.

5. Vygotsky and Piaget on social relationships

One's social relationship with another person may be a social relationship between two *equal peers*, or a relationship based on the *authority* of one of the two persons involved in the respective relationship (Piaget, 1965). It is easy to see that whereas the former agrees well with the idea of autonomy, the latter is more compatible with the idea of heteronomy.

In addition to having conceptualized these two types of social relationship, Piaget (1965) always argued that it is the first, the one appealing to the idea of equality, cooperation, and mutual respect, i.e., *autonomous morality*, not the second, the one appealing to obedience, constraint and unilateral respect, i.e., *heteronomous morality*, which promotes the development of intellectual reversibility (Piaget, 1928b) and moral reciprocity (Piaget, 1965). By being asymmetric, a relationship between a child and an adult wanting to be obeyed may easily lead to the child's conformity, obedience, and passivity (i.e., an orientation to heteronomy), not to the child's initiative, questioning, and activity (i.e., an orientation to autonomy). By valuing the

relationships among equal peers to the detriment of those based on authority, and arguing that a morality appealing to *mutual respect* is more advanced than one dependent on *unilateral respect*, Piaget (1965, 1995) introduced into his theory other indicator of his fundamental orientation to autonomy.

This indicator, however, does not have any correspondence in Vygotsky's (1978) theory, in that for Vygotsky what promotes learning (and development) is not a relationship between two equal peers, but a relationship between a child and an adult, or another more capable, not equal, peer than the child (see Vygotsky, 1978, p. 86).

I have referred earlier to the important role Vygotsky conceded to adults, namely teachers, in the child's formation of scientific concepts. Contrary to Piaget's (1983) constructivist views, according to which knowledge and development are, in the last analysis, an individual construction, Vygotsky (1962) sustained that it should not be required of children that they come to understand scientific concepts by reconstructing or reinventing them, but rather that children acquire such concepts on the basis of precise and formal definitions provided by adults, teachers in particular. This Vygotskian thesis does imply an emphasis on an asymmetric (and vertical) type of relationships among people and, hence, it signals, once again, an orientation to a heteronomous subject while s/he learns scientific concepts.

Such orientation is also present in other features of Vygotsky's theory, particularly in these two: 1) his opposition (see Vygotsky, 1978, pp. 80–81) to the idea that subordinates learning to development, as his the case of Piaget (1964, p. 45, 1972a, p. 24, 1998); and 2) the way Vygotsky (1978, pp. 84–91) conceived of his key-idea of zone of proximal development.

As is well-known, the individual's level of development is seen by Piaget (see above) as a previous condition for all she learns, never the other way around. According to Piaget, what we do learn, be it facts, concepts, norms, and values, greatly depends on our level of operational development and understanding. Though necessary, social factors do not determine the child's development (see Chapman, 1988; Piaget & Inhelder, 1969; Smith, 2009). In Piaget's thinking, what, above all, influences the child's development are factors of internal type, such as the subject's actions and coordination of actions on objects. *Equilibration* or self-regulation (Piaget, 1985), i.e., a continuous balance between assimilation and accommodation, which leads to an ever increasing form of equilibrium or level of development, is the key-concept here. Moreover, one might even say that, in Piaget's theory, rationality and operational understanding are, to some extent, constructed, regardless of others' presence, influence, or teaching, this being other indicator of the autonomy of the Piagetian individual.

In contrast to this Piagetian view, in Vygotsky's theory, it is thanks to others that one becomes conscious and intelligent, this being another indicator of Vygotsky's orientation to heteronomy and subordination of the individual to what comes from without and the exterior. Kaye (1982) synthesizes this difference between Piaget and Vygotsky by pointing to the diverse direction development follows in

the two theories. Whereas in Piaget's theory cognitive processes are first constructed internally and it is only after this that such internal construction has external repercussions in the child's relationship with objects and other people, in Vygotsky's theory the child first establishes relationships with others, and once interiorized, they form the starting point to the child's cognitive developmental processes. Because of this difference between the two approaches, Piaget's theory is sometimes described as an "*inside-out*" theory, whereas Vygotsky's theory is sometimes considered an "*outside-in*" theory (see Marti, 1996, p. 58). In other words, according to Vygotsky (1978, p. 60), "...the developmental process lags behind the learning process". Thus, for Vygotsky, in the tradition of Marx and Engels, the process of individual developmental change is rooted in society and culture (see Cole & Scribner, 1978, p. 7). For Piaget (1964, 1970a, p. 24), the process of development commands the process of learning in that for one to learn certain scientific concepts (e.g., proportionality) one has to be capable of formal thinking (Inhelder & Piaget, 1958).

However, Vygotsky's (1978, pp. 84–91) well-known idea of *zone of proximal development* (зона ближайшего развития), often abbreviated ZPD, is the one that documents fairly well the superiority that Vygotsky attributed to vertical, asymmetrical, or authority-based relationships, when compared with horizontal, symmetrical, or among equal peers relationships. One thing, stressed Vygotsky (1978), is what the child is capable of doing by himself, level of real or *actual development*; other, and different, thing, is what the child is able to do because of others' guidance, level of potential or *proximal development*. But who are these "others" to whom Vygotsky alludes? Equal others to the child or superior others to herself or himself? The answer is: those who are more competent than the child. Vygotsky's (1978) definition of the notion of zone of proximal development, leaves no doubt in this respect: "... what we call *the zone of proximal development...is the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers.*" (p. 86, emphasis in original; see also Vianna & Stetsenko, 2006).

To sum up, vertical or authority-based relationships are, for Vygotsky, more valuable than peers-based ones. It is telling that even when Vygotsky speaks of relationships among peers, these peers are not equal to the child, but more capable peers. These two of Vygotsky's ideas are consistent with his emphasis on the dependency of the individual upon superior others (i.e., orientation to heteronomy), and thus not consistent with the idea of an autonomous subject.

6. Vygotsky and Piaget on the method

As mentioned earlier, Piaget and Vygotsky share a stress on a developmental approach to the understanding of psychological processes and phenomena. However, the fundamental orientation to a relatively autonomous subject in Piaget's theory, and the dominant orientation to

a relatively heteronomous individual in Vygotsky's thinking are also visible in the method each author chose to investigate, respectively, the emergence and genesis of intellectual operations, and higher mental functions. Whereas Piaget (1972d, pp. 6–30) resorted to the *clinical* or *critical method*, a method designed for capturing the emergence and genesis of the individual's structural, and relatively spontaneous, competences, Vygotsky (1978, pp. 58–75) attributed a great value to what he called "… *experimental-developmental* [method], in the sense that it *artificially* provokes or creates a process of psychological development." (p. 61, emphasis added). This experimental-developmental method has a strong microgenetic component in that it analyzes how much determined intellectual competences or certain problem-solving strategies change, when the child benefits from others' instruction, namely from adults or more capable peers.

In a clinical or critical experiment, children are asked to justify their answers when confronted with questions and counter-suggestions provided by the experimenter on certain of Piaget's tasks (e.g., Piaget & Inhelder, 1974; see, for a detailed description of such method, Bond & Tryphon, 2009). More concretely, in a typical Piagetian interview, the investigator first confronts the child with a Piagetian task, for instance, a number conservation one (Piaget & Szeminska, 1948), and then asks the child to respond to questions concerning the task at hand, to justify her answers, and react to presented counter-suggestions, that is, responses from a putative child whose answers are not equal to those provided by the child in question. What is intended is to get children's relatively natural, spontaneous or autonomous beliefs and ideas, that is, their *croyances déclanchées* (i.e., liberated beliefs; see Salzstein, Dias, & Millery, 2004), as Piaget (1972d, p. 15) used to say, not to obtain children's *croyances suggérées* (i.e., suggested beliefs; see Piaget, 1972d, p. 16). The ultimate goal in a Piagetian clinical interview is, thus, to capture children's own way of thinking due to their constructions, reconstructions, and coordination of actions, not to get what they learned from others in a more or less direct manner (see also Bond & Tryphon, 2009).

In contradistinction, in a typical microgenetic experiment (e.g., Siegler & Crowley, 1991), children are subject to various sessions for a short period of time executing then multiple attempts in order to solve a problem, generally under adult guidance or orientation. As Vygotsky (1978) said: "Any psychological process, whether the development of thought or voluntary behavior, is a process undergoing changes right before one's eyes. The development in question can be limited to only *a few seconds*, or even *fractions of seconds* (as is the case in normal perception). It can also (as in the case of complex mental processes) last hours or even weeks." (p. 61, emphasis added). In other words, "[i]n a prototypic microgenetic study, children receive multiple trials of a problem, or several versions of a type or problem, over several testing sessions." (Miller & Coyle, 1999, p. 210). The idea is to get "… moment-by-moment change during a short time, usually changes throughout an experimental session for a number of versions over weeks or months [or days, hours, or even smaller units; see above]." (p. 209). Microgenetic

studies are not so much interested in getting children's relatively spontaneous and natural changes, as they are interested in capturing children's changes and strategies suggested by the experimenter, i.e., changes and strategies which, compared to children's spontaneous and autonomous changes, are more easily subject to training and acceleration. Whereas children's relatively spontaneous and autonomous changes make us think of an autonomous individual somehow independent of context, changes and strategies suggested by the experimenter lead us to think of a heteronomous individual relatively dependent on specific situations and external guidance.

As noticed earlier, both Piaget and Vygotsky have stressed the role of action in development. However, Vygotsky, not Piaget, refers always to a mediated action (see Wertsch, 2007). Because of this, the concept of *scaffolding*, a term coined by Wood, Bruner, and Ross (1976) to describe a tutorial interaction between an adult and a child, fits well with Vygotsky's theory, not with Piaget's thinking (see Bruner, 1997; Van de Pol, Volman, & Beishuizen, 2010). Instead of scaffolding, which appeals to something that is exterior or external to the individual, in Piaget's (1985) theory, we have *equilibration*, self-regulation and *équilibration majorante* (i.e., optimizing equilibration), which resorts to something that is interior to the individual. In short, scaffolding appeals mainly to a heteronomous subject, whereas equilibration or self-regulation points above all to an autonomous individual. Chapman's (1992) following words document fairly well Piaget's emphasis on the subject's autonomy as she deals with the environment: "…a central aspect of cognitive development for Piaget was the increasing capacity for [the individual] anticipating events and acting on them in advance." (48).

It is true that sometimes Piaget also resorted to the microgenetic method, for example, in his multiple observations of his own three children regarding the origins of intelligence (Piaget, 1952), construction of reality (Piaget, 1954), and play, dreams and imitation (Piaget, 1976). And it is also true that sometimes Vygotsky (1978, pp. 52–81) employed something similar to the Piagetian clinical method in some of his experiments on the child's strategies and competences for using signs (e.g., cards whereon was written the name of a certain color) to solve memory and voluntary attention problems (e.g., not to have the possibility of using, during a kind of clinical interview, the name of certain color or colors whose use had been forbidden by the experimenter at the beginning of the interview). Vygotsky (1978, pp. 42–43) observed, for instance, that "…the less effective but the earliest method used [by experimental subjects]", after the experimenter's suggestion to the child that he might "…use the cards to carry out his task ('take the cards, they will help you to win')", is the following: "…the child may put forbidden colors out of sight, display the remainder, and, as he answers the questions, place the colors already mentioned to one side."

However, despite Piaget's occasional use of the microgenetic method, and Vygotsky's occasional resort to a kind of clinical method, it is the former that lies at the heart of Piaget's theory, and it is the latter that underlies several of Vygotsky's experiments. It worth mentioning that Vygotsky's notion of zone of proximal development would lose

much of its meaning without its microgenetic component, i.e., the idea that when a child aims at solving a problem she does it better under an adult's guidance than autonomously. In the same vein, Piaget's theory would lose much of its uniqueness if it were deprived of its clinical methodology, i.e., the idea that a child, who performs well on an operational task, does it autonomously, not because of the experimenter's guidance or suggestions. According to Piaget, to provide children with suggestions is even a typical danger when one resorts to his cherished methodology. When this is the case, one runs the risk of capturing, not what the child thinks by himself, but what he thinks due to the experimenter's hints and suggestions (see also Salzstein et al., 2004).

In short, Piaget's clinical method reflects his fundamental orientation to autonomy just as Vygotsky's microgenetic experiments point to his dominant orientation to heteronomy. Whereas Piaget aimed primarily at getting the child's spontaneous, natural, and autonomous capacity for solving the problems which she is confronted with, Vygotsky was mainly interested in getting the child's ability to solve the problems she is presented along with adult's hints, suggestions, and guidance.

7. Piaget and Vygotsky on necessary knowledge

There is a time in the child's development, in which, for instance, on a given Piagetian task, he gives an answer that it is case, *true knowledge,* but also that it has to be the case and could not be otherwise, *necessary knowledge*. Consider, for instance, a number conservation task (Piaget & Szeminska, 1948). For a child to be credited with an operational competence, he has to give not only a correct or true answer, to say that the number of elements in a given set remains the "same thing" (i.e., number), independently of its spatial configuration, but also an answer dominated by a sense of logical necessity, to say that the number of elements in such set has to remain necessarily the same, however different its spatial arrangement may be. For Piaget (1967c), the emergence of necessary knowledge constitutes even "… the *central problem* of the psychogenesis of operational structures" (p. 391; emphasis added). This central problem pervades all his thinking indeed (e.g., Piaget, 1918, 1986, 1987, 2006; see also, Smith, 1993, 2009). Because of this central problem, Piaget could be rightly considered as the psychologist of the necessary. Logical necessity, necessary knowledge and the like are, in the psychological field, concerns unique to Piaget (1987).

I consider Piaget's continuous interest in logical necessity and necessary knowledge a major indicator of his orientation to an autonomous individual. In fact, given that necessary knowledge is: a) *universal,* in that, in principle, it can be acquired by anyone, and hence it does not represent a personal and idiosyncratic possession or acquisition; b) *self-identical*, i.e., it is the same knowledge that is acquired by all of those who do acquire and possess it; and 3) *non-contingent*, i.e., it expresses a necessary truth, which, by definition, is true in all known worlds (see Smith, 1993, pp. 50–51, emphasis in original), its origins cannot be based on empirical generalizations, social regularities, or definitions provided to the child by an adult or a more competent peer.

According to Piaget (1987), the origin of necessary knowledge is not to be found in the subject's actions upon objects, *empirical abstraction* or *physical experience*, which lies at the basis of physical (and contingent) knowledge, but in the subject's coordination of actions upon objects, *reflecting abstraction* or *logicomathematical experience* (Piaget, 2001), which is the basis of logical, mathematical and necessary knowledge (see Piaget, 1969, pp. 61–62; see also Boom, 2009; Campbell, 2009; Smith, 1993). In other words, the subject's autonomy is already present in his knowledge of physical and social regularities, in that such type of knowledge requires previous conceptual schemes constructed by the individual. This subject's autonomy is still greater in the case of logical, mathematical and necessary knowledge, for this type of knowledge implies, in my understanding, a subject's double autonomy. It implies an early, more elementary, autonomy having to do with the individual's actions on objects, and a later, more advanced one, having to do with the subject's coordination of actions on those objects. To say of a given rose that it is red exemplifies a case of physical (and contingent) knowledge, because, for instance, it could be yellow. To understand that a certain number of roses in a given set has to remain the same quantity of roses if no rose is added to, or subtracted from, the respective set, typifies an example of logical, mathematical and necessary knowledge, in that things could not be otherwise.

In my opinion, Piaget's permanent concern with necessary knowledge has no room in Vygotsky's theory. Although in his book, *Thought and Language* (1962, pp. 52–81), Vygotsky analyzes, in a detailed way, the concept formation problem, the analysis revolves around false or pseudo-concepts, and scientific or true concepts, not around concepts (e.g., necessity, logical necessity) having to do with necessary knowledge. Moreover, given the social, historical, cultural, and mediated features of all human actions in Vygotsky's theory (see Wertsch, 1985a, 1985b), it is understandable that a type of knowledge which, by definition, is true in all known worlds (i.e., necessary knowledge) does not make much sense in his thinking. Vygotsky's lack of concern with necessary knowledge favors my thesis of his main orientation to heteronomy, i.e., to that which comes from outside and that, so to speak, transcends the individual.

Even though Vygotsky (1962) recognizes that "concept formation is the result of a complex activity in which all the basic intellectual functions take part" (p. 58), he also states that "[t]he investigator must aim to…view concept formation as a function of the adolescent's total social and cultural growth, which affects not only the contents but also the method of his thinking." (p. 59). For Piaget (1987), appealing to physical generalizations and social regularities for explaining the construction of necessary knowledge would be, as it were, an epistemologically lost battle (see Lourenço & Machado, 1996, p. 150). Social norms and physical knowledge are contingent in their very nature for they change with the passage of time. By definition, necessary knowledge is true in all possible worlds (see Leibniz, 1973). Moreover, for Piaget (1976, p. 10), "…the social factor is … a factor to be explained, and not a fact to be invoked only as an explanatory factor."

In sharp contrast to Vygotsky's lack of concern with *necessary* knowledge, in Piaget's books (e.g., Piaget & Szeminska, 1948), there are several tasks in which the individual does not limit to giving only the correct answer (i.e., true knowledge), but she also recognizes that her (correct) answer has to be necessarily the case and could not be otherwise (i.e., necessary knowledge). For instance, in a set of roses, eight being yellow, and two being white, then the child's correct (and necessary) answer to the experimenter's question, "In this set of roses, are there more roses or more yellow roses?", has to be necessarily the following one: "there are more roses than yellow roses, because the class of roses includes both the subclass of yellow roses and the subclass of white roses." In Vygotsky's (1962, pp. 52–85) experiments on concept formation, there are some experiments wherein children are presented with questions or problems appealing to "…a concept [which] groups objects according to one attribute" (p. 62), for instance, "wooden blocks varying in color, shape, height, and size" (p. 64). On the underside of each block, which is not seen by the child, is written a nonsense word, *bik* or *mur*, for instance. This nonsense word was always associated with a determined dimension or attribute. At the beginning of the experiment, all block are well mixed as to color, shape, size, and height, for instance, and scattered on a table in front of the child. After turning up one of the blocks, "[t]he examiner… shows and reads its name to the child, and asks him to pick out the blocks which he thinks might belong to the same kind." (Vygotsky, 1962, p. 57). Questions of this type, however, do not really appeal to class-inclusion problems. In other words, these experiments and questions remind us more of a *membership* relationship, as that which, for instance, exists in the following example, "this wooden block is large", and less of a *class-inclusion* relationship, as that which is present in the following child's answer to the critical question on Piagetian class-inclusion tasks, "in this set of flowers, 8 being roses, and 2 being daffodils, there are (necessarily) more flowers than roses, because the class of flowers also includes the sub-class of daffodils." (see Inhelder & Piaget, 1969):

As is easy to notice, a membership relationship (e.g., this wooden block is white) represents a true, not necessary, affirmation or proposition, because that wooden block does not have to be white, for it could be black, for instance. Necessity is only involved in the above mentioned class-inclusion relationship, because if the respective set of flowers contains 8 roses and 2 daffodils, then there are necessarily 10 flowers, and 10 (flowers) is necessarily greater than 8 (roses). Smith (1996, p. 500) cogently distinguishes between a *class membership* and a *class-inclusion* relationship. In his words, "[c]lass membership is a relation between a class and its instances, for example the class *flower* and the class *daisy* both apply to the same instance, such as an actual daisy growing in the garden. Class inclusion is a relation between one class and another class, for instance between *daisy* and *flower*." (Emphasis in original). In terms of necessity, if there is an actual daisy in the garden, things could have been otherwise, for instance, it could have been a rose. On the contrary, if the actual object in the garden is a daisy, then it must necessarily be a flower.

To summarize, Piaget's persistent interest in necessary knowledge is an overwhelming indicator of his orientation to autonomy for, as mentioned above, this type of knowledge involves a subject's double autonomy. Contrary to this, Vygotsky's interest in the child's scientific concepts formation, not in necessary knowledge, reveals his main orientation to heteronomy in that we must view scientific concepts formation as a function of the individual's social and cultural growth.

8. Vygotsky and Piaget on transformation and transmission

Piaget (1969, 1972a, 1998) has argued for a constructivist perspective for education, which derives from his epistemological assumptions. On many occasions, Piaget (1970a, 1970b, 1970c, 1983) stated that to know an object is to act upon it, and construct the transformation systems acting on the object or participating in it. Accordingly, in terms of education at any school level, "… to understand, is to invent, or to reconstruct through reinvention." (Piaget, 1972a, p. 24, emphasis in original).

As far as educational methods are concerned, Piaget (1972a, 1973, 1998) was highly critical of a system of education markedly oriented to verbalism, a type of education wherein construction gives way to instruction, activity is more valued than passivity, transformation is subordinated to transmission, and cooperation is less stressed than obedience. In consonance with his epistemological assumptions, Piaget (1970a, 1970b, 1970c, 1972a; see also DeVries, 2000; Kamii, 1981; Schwebel & Raph, 1973) always maintained that for a given learning to be significant, it has to greatly involve the subject's own activity, this being other indicator his of persistent orientation to autonomy. According to Piaget, a truth that is learned without being understood, reconstructed, and reinvented by the respective learner is no significant truth at all. As he emphasized for several times, his stress on the subject's active participation in her own development and learning lies at the heart of the main goals he required from education: "…the goal of intellectual education is to develop intelligence rather than to promote memory [and rote learning], and to give rise to researchers not only to erudite people…". (Piaget, 1969, p. 79). In other words, for Piaget, education should aim at forming creative and critical individuals, not individuals who are only or mainly oriented to an uncritical acceptance of dogmas, established truths or truths imposed from outside or the exterior.

The orientation to autonomy in Piagetian work is still present in the little value Piaget (1970b, p. 715, 1970c, p. 30) conceded to the many attempts to promote operational competences, such as the acquisition of transitivity, conservation, class inclusion, and so on, through a more or less direct and specific training (e.g., Brainerd, 1973, 1974). It is true that, to some extent, Piaget (1970c) accepted that such competences can be accelerated through specific training. However, as far as this specific training is concerned, Piaget raised an astute question: Is it good to accelerate the learning of these concepts and

competences? This acceleration is certainly possible, but we should first ponder or question whether such acceleration is beneficial or rather detrimental to the child's development (see Piaget, 1970c, p. 31). For him (Piaget, 1970b, p. 715; see also Vonèche & Bovet, 1982), whenever one prematurely teaches a given child something that he could have discovered by himself, that child remains deprived of inventing it and, hence, of understating it completely.

When confronted with experiments concerning the learning of some operational competences and knowledge structures, Piaget had the following to say: No doubt, it can be said that some researchers were able to teach such competences. However, in order to be convinced I have always three questions whose answers I would like to know in advance: 1) For how long will such learning endure? 2) Is it possible to apply such a learning to other, not trained, competences? And 3) at what operational level was the individual before being subject to those experiments, and what more complex structures did such a learning produce? (see Piaget, 1964, pp. 17–18)

Concerning the role of experience (and training) in both learning and development there are two issues that should be clarified: First, Piaget never denied the role of experience and, thus, of training, in the individual's learning and even development. What he did deny was an empiricist conceptualization of such a role. Said differently, he never conceived of experience, teaching, and training as a mere transmission of knowledge or simple exposure to others. Whatever may be the case, assimilation and activity on the part of the individual always are critical. Second, it was because of what was said about the first issue that Piaget gave a great importance to what some of his collaborators called *operational learning* (e.g. Inhelder, Sinclair, & Bovet, 1974).

Operational learning is a form of learning in which a given individual has to cope with another one who contradicts the answers of that individual on a certain Piagetian task, giving rise then to what is known as *cognitive,* and *sociocognitive conflict* (e.g., Doise & Mugny, 1984; Roy & Howe, 1990). This conflict, by provoking disequilibrium on the individual's level of operational understanding, gives rise to re-equilibration and, hence, to a more advanced level of such understanding. Needless to say that if it is true that equilibration or self-regulation involves an active and autonomous individual, then, by definition, re-equilibration still involves more autonomy, activity and coordination of actions on the part of that individual. In short, more than subordinating learning to development, Piaget (1969, 1970b, 1970c, 1972a), in accordance with his epistemological assumptions, has defended a constructivist approach to learning, that is, an approach in which the focus falls on the individual's actions and transformations, not on verbal transmissions from others or from outside. However brilliant it may be, teaching has only positive effects on those who understand it, by reinvention or reconstruction (see above).

As was already discussed, there are several aspects in Vygotsky's theory which make us think of transformation and, thus, of a certain subject's autonomy in relation to what come from without or is taught to him or her (see also, Daniels, 2001). Indeed, a certain emphasis on

transformation generated from within the subject and, therefore, on something that points more to the natural than the cultural, is visible in each one of three ideas lying at the heart of Vygotsky's sociocultural approach: *internalization*, *mediation*, and *zone of proximal development*.

Although any mental function is initially social, its internalization or interiorization does not occur passively, but it rather involves a "…*reconstruction* of an external operation" (Vygotsky, 1978, p. 56, emphasis added). It is true that for Vygotsky, psychological development goes from a *cultural* to a *natural* line, such that, even initially, all psychological activity is socially mediated, with language playing an overwhelming role in such move or process. However, this does not mean that the individual's psychological activity can be entirely reduced to cultural relations and social transmissions. Actually, cultural development does not generate in the child's behavior anything else that does not exist potentially in natural development (see Vygotsky, 1929, p. 418).

As mentioned earlier, Vygotsky's (1978, p. 86) zone of proximal development points to the idea that a child who solves a given problem under adult guidance or in collaboration with more capable peers does it better than alone (see also Hogan & Tudge, 1999). For Vygotsky, however, the influence of such adult guidance or collaboration with more competent peers on the child's ability to solve the problem at hand depends on the child's level of actual development. This dependence attenuates, so to speak, Vygotsky' s idea that development lags behind learning and shows, therefore, that his zone of potential development involves more than simple adult guidance or collaboration with more capable peers, because the child's potential or proximal development has something to do with her actual development. As he used to say, any new form of cultural experience does not simply come from the exterior, i.e., from something that is totally independent of the organism's state at a given point of development (see Vygotsky, 1981, p. 168).

Finally, the zone of proximal development, or the distance between the subject's potential development and her actual development, also implies that development due to learning and to what comes from outside (e.g., adult guidance) gives rise to processes of actual development, once the subject intentionally incorporates such learning and another's guidance or cooperation.

Be that as it may, a careful analysis of Vygotsky's work leads us to conclude that, in terms of teaching conceptions, the idea of transmission coming from outside triumphs over the idea of transformation coming from inside. Because of the triumph of transmission over transformation in Vygotsky's thinking (e.g., development or transformation lags behind learning or transmission), one may say once again that his theory is more oriented to heteronomy and what comes from outside than to autonomy and what comes from inside. This being so, it is understandable that several authors (e.g., Karpov & Haywood, 1998) argue that teaching conceptions solely based on Vygotsky's theorizing run the risk of falling prey to the danger of verbalism as a detriment to action, of transmission at the cost of transformation, of passive acceptance at the expense of construction and reinvention.

It should be noticed, however, that even though Vygotsky's key-concepts of internalization, mediation, and zone of potential development make us think, to some extent, of his occasional orientation to autonomy, each of these concepts also contains something that leads us to remind of Vygotsky's dominant orientation to a heteronomous subject. First, however much the internalization process leads to an internal reconstruction of an external operation, Vygotsky's central assumption that psychological functions initially have a social origin keeps being maintained. Second, although for Vygotsky the line of cultural development cannot generate anything else that is not within the line of natural development, this claim does not change his idea that, in Bruner's (1966, p. 10) words, culture is not discovered or invented, but transmitted or ignored. Finally, even though Vygotsky's thesis that the child's potential development depends on her actual development, this thesis does not modify Vygotsky's main idea that scientific concepts, for instance, are not reinvented in the process of development, but they are rather taught to children by adults in a relatively precise form or manner.

In short, by reminding us, to some extent, of a certain idea of autonomy, Vygotsky's key-concepts of internalization, mediation, and zone of proximal development attenuate Vygotsky's dominant orientation to heteronomy. This means that Vygotsky's orientation to heteronomy is not as evident as is Piaget's orientation to autonomy. Vygotsky's global orientation to heteronomy and the existing diverse social structures ends up by being a tribute to a Marxist perspective and dialectical materialism he wanted to bring to psychology (see Cole & Scribner, 1978), just as Piaget's fundamental orientation to autonomy is consonant with a social democratic ideology in which the individual subject is above or outweighs the collective and the social.

To summarize, as far as issues of education are concerned, the key-concepts in Piaget's (1969, 1998) theory are transformation, construction, reconstruction, invention, reinvention, or the like. Piaget's emphasis on these concepts is ultimately due to his position that subordinates learning to development. Contrary to this position, the key-concepts in Vygotsky's (1962, 1978, 1987) educational thinking are transmission, guidance, instruction, and the like. In the long run, Vygotsky's focus on such concepts has to do with his view that subordinates development to learning. As is now easily understood, whereas the former (i.e., concepts of transformation, construction, and reinvention) point more to an autonomous than a heteronomous subject, the latter (i.e., concepts of transmission, guidance, and instruction) make us think more of a heteronomous than an autonomous individual.

9. Final words

In this article, I have argued that, independently of the existing similarities or resemblances between Piaget's and Vygotsky's theories, there exists a crucial, and generally ignored, difference between them, a difference that should be emphasized for a better understanding of both Piaget's and Vygotsky's remarkable contributions to developmental psychology. In short, whereas Piaget's theory continuously revolves around the subject's autonomy when she

confronts her physical and social environment, Vygotsky's thinking turns around the subject's heteronomy as she is confronted with the existing diverse social structures.

By arguing for such difference, I distance myself from a current, present-day interpretation, which, in sharp contrast with a previous one wherein both authors were considered radically different (see, for example, Bruner, 1997), tends now to see their approaches as overlapping or as if the two theories were similar in most, if not all, aspects of their main theses (e.g., Bidell, 1988; Glassman, 1994). I am, therefore, more in accordance with Duncan's (1995) idea that the differences between Piaget and Vygotsky should not be minimized or simplified (see also Vianna & Stetsenko, 2006). Accordingly, some fundamental differences between the two theories are related to their respective underlying philosophy, social influences on development, nature of the process of development, and the universality of cognitive structures (see Duncan, 1995, p. 458).

Throughout this article, I have argued and tried to show that Piaget's pervasive orientation to autonomy and, thus, to what comes from inside and is intrinsic to the individual, and that Vygotsky's dominant orientation to heteronomy and, hence, to what comes from outside and is extrinsic to the subject, underlies the way each author conceives of: 1) the origins of knowledge and the motor of development; 2) the influence of the relationships between two equal peers *vs.* those based on authority on the subject's cognitive (and moral, in the case of Piaget's theory) development; 3) the more suitable method for studying developmental changes; 4) the distinction between true knowledge and necessary knowledge; and 5) the role of transformation and transmission in the fields of development and learning.

I wonder whether those reading this paper are not going to raise, among others, the two following questions: First, is it useful for psychologists, namely for a better understanding of Piaget's and Vygotsky's theories, to resort to concepts, such as immanence and transcendence, whose original meaning is religious, not psychological? Although I have no definite conceptual (and empirical) answer to offer to this more than reasonable question, I believe that the use of these concepts in a psychological, not religious, sense may lead us to better understand Piaget's pervasive orientation to a relatively autonomous development and individual, and Vygotsky's dominant orientation to the idea that everything that occurs internally or at an intrapersonal level, it occurs firstly at an interpersonal level or externally. In the past, the transfer of concepts from a non-psychological domain to the psychological field has proved to be heuristic and useful, in both theoretical and empirical investigations. For example, the concept of reversibility, which is originally a concept from chemistry (e.g., think of reversible reactions), allowed Piaget to explain the very nature of concrete operational and formal operational thought (e.g., Inhelder & Piaget, 1958). Moreover, according to Piaget, reversibility or the possibility of nullifying a certain modification introduced into a given system (e.g., to elongate the space initially occupied by a given raw of bottles, a *direct operation* in Piagetian terms) by performing, externally or mentally, the respective *negative* or *inverse operation* (e.g., to give to the raw of bottles the spatial configuration it had before being elongated), is the main characteristic of logical thought (see Piaget & Inhelder, 1969).

Second question: Will it be that one of the two theories (i.e., Piaget's theory and Vygotsky's approach) and orientations (i.e., orientation to autonomy and orientation to heteronomy) is preferable to the other one? The response to this question belongs necessarily to the reader. And the response will be fundamentally dependent upon the reader's conception about certain points mentioned below. I believe that those who are unsympathetic with Piaget's approach will have difficulty being genuine developmentalists. Is it the same for those who are not keen on Vygotsky's approach?

In 1992, Michael Chapman cogently "… argue[d] that aspects of [Piaget's] work are still insufficiently assimilated or accommodated to in developmental psychology." (p. 39). I think that Chapman's argument regarding Piaget's theory could be also applied to some aspects of Vygotsky's theory. I also think that it is because of this insufficient assimilation/accommodation of Vygotsky's work and Piaget's theory to developmental psychology, that the crucial difference I have elaborated on throughout this article has generally been overlooked and even unnoted by many developmentalists.

What is to be gained when one notices that crucial difference? Among other things, we would come to see that: 1) in spite of the points of similarity between Piaget and Vygotsky, there is something distinctive and *unique* to each theorist and researcher; 2) despite the modifications each author was introducing into his thinking throughout his career, their respective writings present a considerable internal *continuity*; 3) the option for one of the two psychologists is not a mere question of liking or disliking, but it rather implies a *commitment* to a certain conception of development, learning, schools, and even society; 4) any attempt to integrate them in most aspects of their respective works should be cautious and seen in a *critical* way; and 5) each was able to attribute much meaning to the *dimension* his colleague did not choose to study or explore.

Acknowledgments

References

Amin, T., & Valsiner, J. (2004). Coordinating operative and figurative knowledge: Piaget, Vygotsky, and beyond. In J. Carpendale, & U. Müller (Eds.), *Social interaction and the development of knowledge* (pp. 87–109). Mahwah, NJ: Erlbaum.

Anastasi, A. (1982). *Psychological testing* (5th ed.). New York: Macmillan.

Beilin, H. (1990). Piaget's theory: alive and more vigorous than ever. *Human Development, 33*, 362–365.

Beilin, H. (1992). Piaget's enduring contribution to developmental psychology. *Developmental Psychology, 28*, 191–204.

Bennour, M., & Vonèche, J. (2009). The historical context of Piaget's ideas. In U. Müller, J. Carpendale, & L. Smith (Eds.), *The British companion to Piaget* (pp. 45–63). Cambridge: Cambridge University Press.

Bickhard, M. (2004). The social ontology of persons. In J. Carpendale, & U. Müller (Eds.), *Social interaction and the development of knowledge* (pp. 111–132). Mahwah, NJ: Erlbaum.

Bidell, T. (1988). Vygotsky, Piaget and the dialectical of development. *Human Development, 31*, 329–348.

Bond, T., & Tryphon, A. (2009). Piaget and method. In U. Müller, J. Carpendale, & L. Smith (Eds.), *The British companion to Piaget* (pp. 171–199). Cambridge: Cambridge University Press.

Boom, J. (2009). Piaget on equilibration. In U. Müller, J. Carpendale, & L. Smith (Eds.), *The Cambridge companion to Piaget* (pp. 132–149). Cambridge: Cambridge University Press.

Brainerd, C. (1973). Order of acquisition of transitivity, conservation, and class-inclusion of length and weight. *Developmental Psychology, 8*, 105–116.

Brainerd, C. (1974). Training and transfer of transitivity, conservation, and class-inclusion of length. *Child Development, 45*, 324–334.

Bruner, J. (1966). Some elements of discovery. In L. Shulman, & E. Keisler (Eds.), *Learning by discovery: A critical appraisal* (pp. 101–113). Chicago: Rand McNally.

Bruner, J. (1997). Celebrating divergence: Piaget and Vygotsky. *Human Development, 40*, 63–73.

Campbell, R. (2009). Constructive processes: abstraction, generalization, and dialectics. In U. Müller, J. Carpendale, & L. Smith (Eds.), *The British companion to Piaget* (pp. 150–170). Cambridge: Cambridge University Press.

Carpendale., & Müller, U. (Eds.). (2004a). *Social interaction and the development of knowledge* (pp. 1–18). Mahwah, NJ: Erlbaum.

Carpendale, J., & Müller, U. (2004b). Social interaction and the development of rationality and morality: an introduction. In J. Carpendale, & U. Müller (Eds.), *Social interaction and the development of knowledge* (pp. 1–18). Mahwah, NJ: Erlbaum.

Chapman, M. (1988). *Constructive evolution: Origins and development of Piaget's thought.* Cambridge: Cambridge University Press.

Chapman, M. (1992). Equilibration and the dialectics of organization. In H. Beilin, & P. Pufall (Eds.), *Piaget's theory: Prospects and possibilities* (pp. 38–59). Hillsdale, NJ: Erlbaum.

Cohen, D. (1983). *Piaget: Critique and assessment.* London & Canberra: Croom Helm.

Cole, M., & Scribner, S. (1978). Introduction. In L. S. Vygotsky (Ed.), *Mind in society: The development of higher psychological processes* (pp. 1–14). Cambridge, MA: Harvard University Press.

Cole, M., & Wertsch, J. (1996). Beyond the individual-social antinomy in discussions of Piaget and Vygotsky. *Human Development, 39*, 250–256.

Daniels, H. (2001). *Vygotsky and pedagogy.* NY: Routledge/Falmer.

Daniels, H., Cole, M., & Wertsch, J. (Eds.). (2007). *The British companion to Vygotsky.* Cambridge: Cambridge University Press.

Davydov, V., & Radzikhovskii, L. (1985). Vygotsky's theory and the activity-oriented approach in psychology. In J. Wertsch (Ed.), *Culture, communication, and cognition: Vygotskian perspectives* (pp. 35–65). New York: Cambridge University Press.

DeVries, R. (2000). Vygotsky, Piaget, and education: a reciprocal assimilation of theories and educational practices. *New Ideas in Psychology, 18*, 187–213.

Doise, W., & Mugny, G. (1984). *The social development of the intellect.* Oxford: Pergamon Press.

Duncan, R. (1995). Piaget and Vygotsky revisited: dialogue or assimilation. *Developmental Review, 15*, 458–472.

Feldman, D., & Fowler, D. (1997). The nature(s) of developmental change. Piaget, Vygotsky, and the transition process. *New Ideas in Psychology, 15*, 195–210.

Fischer, K., & Granott, N. (1995). Beyond one dimensional change: parallel, concurrent, socially distributed processes in learning and development. *Human Development, 38*, 302–314.

Forman, E. (1992). Discourse, intersubjectivity, and the development of peer collaboration: a Vygotskian approach. In L. Winegar, & J. Valsiner (Eds.), *Children's development within social context, Vol. 1* (pp. 143–159). Hillsdale, NJ: Erlbaum.

Forman, E., & Kraker, M. (1985). The social origins of logic: the contributions of Piaget and Vygotsky. *New Directions for Child and Adolescent Development, 29*, 23–39.

Glassman, M. (1994). All things being equal: the two roads of Piaget and Vygotsky. *Developmental Review, 14*, 186–214.

Glassman, M. (1995). The difference between Piaget and Vygotsky: a response to Duncan. *Developmental Review, 15*, 473–482.

Greenfield, P. (2001). Culture and universals: a tribute to Bärbel Inhelder. In A. Tryphon, & J. Vonèche (Eds.), *Working with Piaget: Essays in honour of Bärbel Inhelder* (pp. 149–178). Hove: Psychology Press.

Gruber, H., & Vonèche, J. (1995). *The essential Piaget (100th anniversary edition).* Northvale: Jason Aronson Inc.

Hogan, D., & Tudge, J. (1999). Implications of Vygotsky's theory for peer learning. In A.O'Donnell., & A. King (Eds.), *Cognitive perspectives on peer learning general psychology* (pp. 39–95). New York: Plenum.

Howe, A. (1996). Development of science concepts within a Vygotskian framework. *Science Education, 80*, 35–51.

Inhelder, B., & Piaget, J. (1958). *The growth of logical thinking from childhood to adolescence.* New York: Basic Books. (Original work published 1955).

Inhelder, B., & Piaget, J. (1969). *The early growth of logic in the child: Classification and seriation*. New York: Norton. (Original work published 1959).

Inhelder, B., Sinclair, H., & Bovet, M. (1974). *Apprentissage et structures de la connaissance*. [*Learning and knowledge structures*]. Paris: Presses Universitaires de France.

John-Steiner, V., & Souberman, E. (1978). Afterword. In L. S. Vygotsky (Ed.), *Mind in society: The development of higher psychological press* (pp. 121–133). Cambridge, MA: Harvard University Press.

Kamii, C. (1981). Application of Piaget's theory to education: the pre-operational level. In I. Sigel, D. Brodzinsky, & R. Galinkoff (Eds.), *New directions in Piagetian theory and practice* (pp. 230–265). Hillsdale, NJ: Erlbaum.

Karpov, Y., & Haywood, H. (1998). Two ways to elaborate Vygotsky's concept of mediation: implications for instruction. *American Psychologist, 53*, 27–36.

Kaye, K. (1982). *The mental and social life of babies*. Chicago: University of Chicago Press.

Kirschner, S., & Martin, J. (Eds.). (2010). *The sociocultural turn in psychology: The contextual emergence of mind and self*. New York: Columbia University Press.

Kitchener, R. (1996). The nature of the social for Piaget and Vygotsky. *Human Development, 39*, 243–249.

Kitchener, R. (2004). Piaget's social epistemology. In J. Carpendale, & U. Müller (Eds.), *Social interaction and the development of knowledge* (pp. 45–66). Mahwah, NJ: Erlbaum.

Leibniz, G. (1973). *New essays on human understanding*. Cambridge: Cambridge University Press. (Original work published 1686).

Lerman, S. (1996). Intersubjectivity in mathematics learning: a challenge to the radical constructivist paradigm? *Journal for Research in Mathematics Education, 27*, 133–150.

Lourenço, O., & Machado, A. (1996). In defense of Piaget's theory: a reply to 10 common criticisms. *Psychological Review, 103*, 143–164.

Marti, E. (1996). Mechanisms of internalization and externalization of knowledge in Piaget's and Vygotsky's theories. In A. Tryphon, & J. Vonèche (Eds.), *Piaget–Vygotsky: The social genesis of thought* (pp. 57–83). Hove: Psychology Press.

Matusov, E., & Hayes, R. (2000). Sociocultural critique of Piaget and Vygotsky. *New Ideas in Psychology, 18*, 215–239.

Miller, P., & Coyle, T. (1999). Developmental changes: lessons from microgenesis. In E. Scholnick, K. Nelson, S. Gelman, & P. Miller (Eds.), *Conceptual development: Piaget's legacy* (pp. 209–239). Mahwah, NJ: Erlbaum.

Müller, U., & Carpendale, J. (2000). The role of social interaction in Piaget's theory: language for social cooperation and social cooperation for language. *New Ideas in Psychology, 18*, 139–156.

Müller, U., Carpendale, J., & Smith, L. (Eds.). (2009). *The British companion to Piaget*. Cambridge: Cambridge University Press.

Overton, W. (1998). Developmental psychology: Philosophy, concepts, and methodology. In W. Damon (Ed.), *Theoretical models of human development. Handbook of child psychology, Vol. 1* (pp. 107–188). New York: Wiley.

Piaget, J. (1918). *Recherche*. [*Search*]. Lausanne: La Concorde.

Piaget, J. (1928a). Immanence et transcendence. [Immanence and transcendence]. In J. Piaget, & J. de La Harpe (Eds.), *Deux types dáttitudes religieuses: Immanence et transcendence [Two types of religious attitudes: Immanence and transcendence]* (pp. 7–40). Geneva: Editions de l'Association Chrétienne d' Etudiants de Suisse Romande.

Piaget, J. (1928b). *Judgment and reasoning in the child*. London: Routledge and Kegan Paul. (Original work published 1924).

Piaget, J. (1942). *Classes, relations et nombres*. [*Classes, relations and numbers*]. Paris: J. Vrin.

Piaget, J. (1947). *La psychologie de l'intelligence*. [*The psychology of intelligence*]. Paris: Armand Colin.

Piaget, J. (1952). *The origins of intelligence in children*. New York: International Universities Press. (Original work published 1936).

Piaget, J. (1954). *The construction of reality in the child*. New York: Basic Books. (Original work published 1937).

Piaget, J. (1960). The general problem of the psychobiological development of the child. In J. Tanner, & B. Inhelder (Eds.), *Discussions on child development, Vol. 4* (pp. 3–27). London: Tavistock.

Piaget, J. (1962). *Comments on Vygotsky's critical remarks*. Cambridge: The M.I.T. Press.

Piaget, J. (1964). Development and learning. In R. Ripple, & U. Rockcastle (Eds.), *Piaget rediscovered*. Ithaca, NY: Cornell University Press.

Piaget, J. (1965). *The moral judgment of the child*. New York: Free Press. (Original work published 1932).

Piaget, J. (1967a). *Biologie et connaissance*. [*Biology and knowledge*]. Saint Amand, France: Gallimard.

Piaget, J. (1967b). *Six psychological studies*. New York: Vintage. (Original work published 1964).

Piaget, J. (Ed.). (1967c). *Logique et connaissance scientifique [Logic and scientific knowledge]*. Paris: Gallimard.

Piaget, J. (1969). *Psychologie and Pédagogie*. [*Psychology and pedagogy*]. Paris: Denoël/Gonthier.

Piaget, J. (1970a). *Genetic epistemology*. New York: Norton.

Piaget, J. (1970b). Piaget's theory. In P. Mussen (Ed.), *Carmichael's manual of child psychology, Vol. 1* (pp. 703–832). New York: Wiley.

Piaget, J. (1970c). A conversation with Piaget. *Psychology Today, 3*, 25–32.

Piaget, J. (1972a). *Où va l'éducation*. [*The future of education*]. Paris: Gonthier.

Piaget, J. (1972b). *Psychology and epistemology*. London: Penguin. (Original work published 1970).

Piaget, J. (1972c). Intellectual evolution from adolescence to adulthood. *Human Development, 15*, 1–12.

Piaget, J. (1972d). *La représentation du monde chez l'enfant*. [*The child's conception of world*]. Paris: Presses Universitaires de France. (Original work published 1926).

Piaget, J. (1973). *Introduction à l'épistémologie génétique: La pensée biologique, la pensée pschologique, et la pénsée sociologique*. [*Introduction to genetic epistemology: Biological thinking, psychological thinking, and sociologic thinking*]. Paris: Presses Universitaires de France. (Original work published 1950).

Piaget, J. (1976). *La formation du symbole chez l'enfant*. [*Play, dreams, and imitation in childhood*]. Neuchâtel: Delachaux et Niestlé. (Original work published 1946).

Piaget, J. (1978). *Recherches sur la généralization*. [*Experiments in generalization*]. Paris: Presses Universitaires de France.

Piaget, J. (1980). *Les forms élémentaires de la dialectique*. [*The elementary forms of dialectics*]. Saint Armand, France: Gallimard.

Piaget, J. (1983). Piaget's theory. In P. Mussen (Ed.), *Handbook of child psychology, Vol. 1* (pp. 103–128). New York: Wiley.

Piaget, J. (1985). *The equilibration of cognitive structures: The central problem of intellectual development*. Chicago: University of Chicago Press. (Original work published 1975).

Piaget, J. (1986). Essay on necessity. *Human Development, 29*, 301–314.

Piaget, J. (1987). *The role of necessity in cognitive development*In *Possibility and necessity, Vol. 2*. Minneapolis: University of Minnesota Press, (Original work published 1981).

Piaget, J. (1995). *Sociological studies*. New York/London: Routledge. (Original work published 1965).

Piaget, J. (1998). *De la Pédagogie*. [*Piaget on pedagogy*]. Paris: Editions Odile Jacob.

Piaget, J. (2001). *Studies in reflecting abstraction*. Hove: Psychology Press. (Original published in 1977).

Piaget, J. (2006). Reason. *New Ideas in Psychology, 24*, 1–29, (Original work published in 2004).

Piaget, J., & Inhelder, B. (1969). *The psychology of the child*. New York: Basic Books. (Original work published 1966).

Piaget, J., & Inhelder, B. (1974). *The child's construction of quantities*. London: Routledge & Paul Kegan. (Original work published 1941).

Piaget, J., & Szeminska, A. (1948). *La genèse du nombre chez l'enfant*. [*The child's conception of number*]. Neuchâtel: Delachaux et Niestlé. (Original work published 1941).

Roy, A., & Howe, C. (1990). Effects of cognitive conflict, socio-cognitive conflict, and imitation on children's social-legal thinking. *European Journal of Social Psychology, 20*, 241–252.

Salzstein, H., Dias, M., & Millery, M. (2004). Moral suggestibility: the complex interaction of development, cultural and contextual factors. *Applied Cognitive Psychology, 18*, 1079–1096.

Scholnick, E., Nelson, C., Gelman, S., & Miller, P. (Eds.). (1999). *Conceptual development: Piaget's legacy*. Mahwah, NJ: Erlbaum.

Schwebel, M., & Raph, J. (1973). *Piaget in the classroom*. USA: Basic Books, Inc.

Shayer, M. (2003). Not just Piaget; not just Vygotsky, and certainly not Vygotsky as *alternative* to Piaget. *Learning and Instruction*, 465–485.

Siegal, M. (1999). Language and thought: the fundamental significance of conversational awareness for cognitive development. *Developmental Science, 2*, 1–34.

Siegler, R., & Crowley, K. (1991). The microgenetic method: a direct means for studying cognitive development. *American Psychologist, 46*, 606–620.

Smith, L. (1993). *Necessary knowledge: Piagetian perspectives on constructivism*. Hove/Hillsdale: Erlbaum.

Smith, L. (1995). Introduction to Piaget's sociological studies. In J. Piaget (Ed.), *Sociological studies* (pp. 1–22). New York/London: Routledge.

Smith, L. (1996). Conclusion: Piaget's epistemology: psychological and educational assessment. In L. Smith (Ed.), *Critical readings on Piaget* (pp. 478–521). London/New York: Routledge.

Smith, L. (2009). Piaget's developmental epistemology. In U. Müller, J. Carpendale, & L. Smith (Eds.), *The British companion to Piaget* (pp. 64–93). Cambridge: Cambridge University Press.

Smith, L., Dockrell, J., & Tomlinson, P. (Eds.). (1997). *Piaget, Vygotsky and beyond: Future issues for development*. London: Routledge.

Smith, L. B., Thelen, E., Titzer, R., & McLin, D. (1999). Knowing in the context of acting: the task dynamics of the A-not-B error. *Psychological Review, 106*, 235–260.

Stetsenko, A. (2004). Introduction to 'tool and sign' by Lev Vygotsky. In R. Rieber, & D. Robinson (Eds.), *The essential Vygotsky* (pp. 499–510). New York: Kluwer Academic/Plenum.

Stetsenko, A. (2008). From relational ontology to transformative activist stance on development and learning: expanding Vygotsky's (CHAT) project. *Cultural Studies of Science Education, 3*, 471–491.

Tappan, M. (1997). Language, culture, and moral development: a Vygotskian perspective. *Developmental Review, 17*, 78–100.

Tryphon, A., & Vonèche, J. (Eds.). (1996). *Piaget–Vygotsky: The social genesis of thought*. Hove: Psychology Press.

Tryphon, A., & Vonèche, J. (Eds.). (2001). *Working with Piaget: Essays in honour of Bärbel Inhelder*. Hove: Psychology Press.

Van de Pol, J., Volman, M., & Beishuizen, J. (2010). Scaffolding in teacher–student interaction: a decade of research. *Educational Psychological Review, 3*, 271–296.

Vianna, E., & Stetsenko, A. (2006). Embracing history trough transforming it: contrasting Piagetian versus Vygotskian (activity), theories of learning and development to expand, constructivism within a dialectical view of his history. *Theory and Psychology, 16*, 81–108.

Vidal, F. (1998). Immanence, affectivité et démocracie dans *Le jugement moral chezlénfant. Bulletin de Psychologie, 51*, 585–597.

Vonèche, & Bovet, M. (1982). Training research and cognitive development: what Piagetians want to accomplish. In S. Modgil, & C.Mogdil.

(Eds.), *Jean Piaget: Consensus and controversy* (pp. 83–94). London: Holt, Rinehart and Winston.

Vygotsky, L. (1929). The problem of the cultural development of the child. *Journal of Genetic Psychology, 6*, 415–434.

Vygotsky, L. (1962). *Thought and language*. Cambridge: The M.I.T Press. (Original work published 1934).

Vygotsky, L. (1978). *Mind in society: The development of higher psychological processes*. Cambridge, MA: Harvard University Press.

Vygotsky, L. (1981). The genesis of higher mental functions. In J. Wertsch (Ed.), *The concept of activity in Soviet psychology* (pp. 144–188). Armonk, NY: Sharpe.

Vygotsky, L. (1987). *Problems of general psychology*In *The collected works of L.S. Vygotsky, Vol. 1*. New York: Plenum.

Vygotsky, L. (1994). Academic concepts in school aged children. In R. van der Veer, & J. Valsiner (Eds.), *The Vygotsky reader* (pp. 111–126). Oxford: Blackwell, (Original work published 1934).

Wechsler, D. (1939). *The measuring of adult intelligence*. Baltimore, MD: Williams and Wilkins.

Wertsch, J. (1985a). *Mind as action*. New York/Oxford: Oxford University Press.

Wertsch, J. (Ed.). (1985b). *Culture, communication, and cognition: Vygotskian perspectives*. New York: Cambridge University Press.

Wertsch, J. (2007). Mediation. In H. Daniels, M. Cole, & J. Wertsch (Eds.), *The British companion to Vygotsky* (pp. 178–192). Cambridge: Cambridge University Press.

Wertsch, J., & Tulviste, P. (1992). L.S. Vygotsky and contemporary developmental psychology. *Developmental Psychology, 28*, 548–557.

Wood, J., Bruner, J., & Ross, G. (1976). The role of tutoring in problem solving. *Journal of Child Psychiatry and Psychology, 17*, 89–100.