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Knowledge and Cognitive Development in Adulthood

Abstract: This paper considers the possibilities for and mechanisms of cognitive development in adulthood with the primary objective of providing an impetus for its alternative conceptualisation. The analysis covers the classical (Vygotsky and Piaget) and the post-modern, constructivist developmental and contextualist theories of cognitive development, as well as the relevant available empirical research. Despite the significant inconsistencies in the analysed theories and the empirical evidence, the results of the analysis point to the conclusion that significant positive changes in cognitive development can and do happen during adulthood and that they are founded on systems and structures of knowledge formed during the individual's life. The mechanisms responsible for cognitive development in adulthood are as follows: a progression in the use of systems of meaning and knowledge, the establishment of a unified conceptual framework for the interpretation of reality and the intellectualisation of the cognitive space as a whole and of individual cognitive functions.

Key words: cognitive development, adulthood, formal thought, post-formal thought, knowledge networks, reversed developmental trend.

Initial Misunderstanding and Quiet Compromise

The relationship between development and learning, despite its relatively long and complex history, is still a central theme in theories of development and learning, including those relating to adults. The theoretical understanding which has the longest tradition in attempting to explain this relationship is the one promoting the idea that development is a function of external stimuli, primarily learning. In its embryonic phase this idea was embraced by almost all the Romantics. Its systematic formation and investigation began with Hegel (1964) and his stance on the rootedness of the mind in tradition. From Hegel it made its way in somewhat altered form, via Marx and his influence on Vygotsky, to the field of psychology and cognitive development. In Vygotsky's (1983) understanding of the

roots of intellectual development, one should not so much seek within man as outside him, in his socio-cultural environment and the supports and stimuli this imposes on him and provides him with. Off course, it is reasonable to presume that not all socio-cultural variables have a developmental character or the status of constructor of cognitive abilities and cognitive functioning. A general measure of their individual significance and value is certainly to be found in the basic socio-cultural units. Since the symbol (sign) is the basic socio-cultural element, then what we might call symbolic capacity, that is, the complex of relationships between meaning and significance which a symbol carries and entails, in an ideal sense, is the basic measure of value of each individual socio-cultural variable in cognitive development. The actual measure of that value depends on a range of factors, but primarily on societal intent and opportunity to continually and systematically act on the intellectual development of the individual by way of appropriate organisation of external supports with symbolic content at the focal point. In other words, education and learning. Classic psychological studies (Thorndike, 1928; Jones & Conrad, 1933; Wechsler, 1958; Cattell, 1971; Horn, 1972; АНАНЬЕВ, СТЕПАНОВА, 1972; Schaie & Willis, 1986) already showed that education, as the most significant model for the social organisation of external supports, was closely linked with intellectual development.

A completely different understanding of the relationship between learning and development came from the hereditist tradition, the most significant representative of which, in the area of psychology and cognitive development, was Piaget. Learning, according to Piaget (1970; 1983; 1988), is a function of development, and not an element which determined or explained it. Piaget defined development as a progression through qualitatively differing developmental stages which were associated with differing ways of imparting meaning to, understanding and constructing knowledge of reality. In each stage, appropriate cognitive and logical structures form (mature) spontaneously, allowing the learning or resolution of different developmental tasks, and culminate in formal thought, i.e. adult reason.

Among the multitude of theoretical differences and their practical implications between the Moscow and Geneva psychological schools we can nevertheless relatively easily observe an unwritten but fundamental consensus – that after adolescence there is no development, or at least it should not be discussed. Both for Vygotsky and for Piaget, intellectual development happens in conditions of dynamic change of the organic type, and as such it is definitely complete in early youth. The primary consequence of this stance, formulated practically explicitly by Piaget and only implicitly by Vygotsky, is that the absence of biological growth detracts from developmental possibilities. This unwritten agreement was very

clearly articulated by Flavell (1970) in his opinion that due to the lack of physical maturing there are no further qualitative or universal developmental changes in adulthood. Claiming that development ended with physical maturing, he gave currency to the now-forgotten theory of plasticity and in a sense “reconciled” Vygostky and Piaget since neither one nor the other would have been able to dispute this in view of the overall structure of their basic theoretical assumptions.

Hints at Cognitive Developmental Potential in Adulthood

Piaget described as “formal operational” the ability to think outside the immediate, given reality and independently of it. In the formal operational stage, the individual acquires the ability to think abstractly, to think about the possible and the probable, to combine different elements of the subject of thought and to systematically vary them, and to verify the validity of observed and established relationships. According to Piaget (1972), these abilities are acquired between the ages of 11 and 12 and between 15 and 20 at the latest. Cognitive structures, at the centre of which are the processes of imparting meaning to and the construction and transformation of experience, are invariants which function independently of the domain to which they relate and the content of the knowledge which they are processing (Piaget, 1970).

Piaget’s understanding of formal operations is from the gnoseological point of view entirely acceptable, but from the perspective of the psychology of cognition and individual cognitive activity it is not without its difficulties. From a gnoseological perspective, conclusion (cognition) is independent of the content of the premise from which the conclusion is being drawn; from a psychological point of view, it is not. The first serious impetus for the revision of Piaget’s theory came during the 1970s and 1980s from research into the cognitive development of children. Empirical studies showed that possession of relevant knowledge affected the ability of the child to conserve number and volume, to draw a conclusion, to select an appropriate problem-solving strategy and to adopt a non-ego-centric perspective (Price-Williams, Gordon, Ramirez, 1969). In some studies it was established that there was low correlation between developmental tasks of the same type but differing content (Beilin, 1971), and that grouping operations were an automatic consequence of previously acquired knowledge (Lindberg, 1980). It was also shown that small children could successfully solve transitive conclusion problems if they were previously taught the concepts used in the problems set (Bryant & Trobasco, 1971). This was probably the impetus for Piaget himself to somewhat revise his earlier position. In his later work, Piaget stressed that for-

mal operations were not fully developed by late adolescence or early adulthood and that their complete development depended on several factors, primarily the amount and type of environmental stimulation. Entry into the formal operational stage however depended on ability and professional specialisation, and the spheres in which they were applied (Piaget, 1972). Adolescents or adults who were able at the formal level to solve a particular type of task were not able to do so in other areas of knowledge. The fact that some adults were not able to solve a large number of the tests which he and Inhelder had prepared was explained by Piaget as resulting from a lack of interest in and knowledge of mathematics and the natural sciences (Piaget, 1972). This explanation however did not mean that Piaget definitely allowed the possibility of further developmental changes after adolescence and the affirmation of knowledge in thought. This might only mean that development really did end with formal thought, but that not all those above 12 years of age necessarily achieved formal thought. Even after this period, thought for some individuals could remain egocentric in certain areas, unable to accept any other point of view except its own or to consider differing aspects of the same situation or problem. In some areas, thought could be arrested at a specific level, incapable of abstraction, which did not mean it would be so in other areas and content of thought. However, even this is sufficient to at least show that formal operations are not invariant, that is, a monolithic ability independent of the content of knowledge and context. On the contrary, in fact – for higher levels of cognitive functioning, the possession of knowledge of an appropriate level and structure are of primary importance. Thought is never devoid of concrete substantiality, and this means a dynamic system of knowledge and information on the subject of thought (symbolic capacity). Without the category of knowledge it is difficult to explain intellectual growth and differences in cognitive functioning, and success in carrying out operations of the same type but differing content. Mental functioning is primarily determined by its content (Vygotsky, 1982), its progression and its foundation. Any attempt to regard operations as something primal, basic and invariant and to reduce thought to the mechanical functioning of operations so understood is erroneous at its foundation since the actualisation of operations is directly dependent on the actualisation of the knowledge they contain (Rubinštajn, 1981). Popper (Poper, 1991) espoused a similar point of view, differentiating between thoughts in the sense of mental processes (World 2) and thought in the sense of content (World 3). World 3 is by all means a product of World 2, but likewise World 2 is a product of World 3. Recognising the only partial autonomy of and mutual interaction between these worlds is key to the understanding of thought and the potential for its development.

A half-hearted attempt to relativise the influence of knowledge in the cognitive functioning of adults and justify the conviction that formal operations were the pinnacle and the ultimate stage of development and that after them there could be no further qualitative cognitive change was seen in the *regression hypothesis*. The regression hypothesis expresses the conviction that abilities are formed through early development, reach their peak during young adulthood and then begin to decline during middle and old age, with adults “losing” abilities in reverse order to that in which they acquired them. Since the ability for abstract thought is “lost” first, this means that children and the elderly have a similar level of cognitive functioning (see: Papalia & Bielby, 1974; Whitebourne & Weinstok, 1979). Although the regression hypothesis has been tested in multiple studies (Deney & Lenon, 1972; Tesch; Hornblum & Overton, 1976) it seems that there is no basis for its full acceptance. The aforementioned studies suggest that the level of cognitive functioning of adults is determined by the type of task they are solving and the prior experience that they have of this process, and that nothing suggests the inevitability of regression to lower levels of cognitive functioning with age. As some researchers rightly point out (Hornblum & Overton, 1976), it seems that the regression hypothesis is acceptable only for completely new and unknown areas and situations, where adults temporarily “regress” to lower levels of cognitive functioning in order to familiarise themselves with new material. Once they have done so they are able in future encounters to progress with it to a higher level of cognitive functioning. Although providing no evidence of further developmental changes in adulthood, the aforementioned studies have more affirmed than refuted the significance of knowledge for the cognitive functioning of adults.

The Postmodern Contribution to the Understanding of Cognitive Development

The first significant theoretical impetus for critical reconsideration of Piaget’s theories from the perspective of adulthood was given by Riegel (1975; 1976). In his view, Piaget, with his formal operational stage as a state of final equilibrium or maximum adaptation to the environment, left no possibility for further cognitive change in adulthood. Riegel believed that complete equilibrium was not possible, or rather could only be possible once all personal and historical tasks were complete. However this never happens, since new questions and problems always arise within the individual or in the environment, which ensures the continuity of disbalance and therefore the potential for further development. On the other

hand, formal operations – as a closed system of logic in which all elements are known and can be manipulated – do not adequately describe the mature and creative thought of an adult, which entails contradiction, ambiguity and inconsistency. Formal thought is not sufficient in tackling the relativism and confusing inconsistency of the open systems with which adults are usually faced. Later theoretical and empirical research showed that formal operations were not the final phase of cognitive development and that cognitive development did not end in adolescence or young adulthood. On the contrary, it suggested that adulthood was a period of further cognitive growth, albeit qualitatively different growth to that in childhood (Tennant & Pogson, 1995). Two related postmodern theoretical schools each affirmed the idea that powerful and – depending on the role and function of the adult – relevant cognitive structures developed in adulthood.

According to the contextualist theories of development, cognitive changes happen in adulthood which allows the individual to resolve complex life problems and function in simultaneous, multiple realities and multiple frames of reference in terms of thought and values. According to one group of such theories (Basseches, 1980, 1984a, 1984b; Kramer, 1983, 1990; Labouvie-Vief, 1980, 1984, 1992, 2006; Sinnott, 1981, 1984, 1989; Kitchener & King, 1981), after the formal operational stage, under the influence of the socio-culture context and of experience, a form of (postformal) thought develops which is based on the expansion of knowledge and understanding and the employment of its relativistic and dialectical nature. Labouvie-Vief (2006) suggests that cultural transmission and organised support are the most significant factors in cognitive development in adulthood. Although inspired by Piaget, in recognising that the establishment of mature thought structures is not possible without appropriate social and cultural support, i.e. that the level of complexity of thought is highly correlated with education, she has moved very close to Vygotsky. Postformal thought is not so much founded on the bipolar logic of formal operations (right and wrong) as on the restrictedness, contradictoriness, inconsistency and subjectivity of knowledge and systems of knowledge. The individual is obliged and able to “bridge” differing and contradicting “realities” in order to more flexibly and comprehensively understand the world and to function effectively within it. Summarising the extensive theoretical and empirical material on postformal thought, Kramer (1983, 1989) singles out the following of its basic characteristics: a) understanding the relativistic nature of knowledge; b) accepting contradiction to the extent to which it is part of reality and c) integrating contradiction into an all-encompassing system. This suggests that postformal thought is significantly different in quality to formal thought and that, therefore, development does not end in adolescence or young adulthood. The terms used to describe this type of cognitive develop-

ment include: *problem-finding* (Arlin, 1975, 1984), *relativistic thinking* (Sinnott, 1984a), *dialectical thinking* (Basseches, 1980, 1984), *relativistic / dialectical thinking* (Kramer, 1990), *metasystemic thinking* (Commons, et al., 1989), *intrasystemic and autonomous thought structures* (Labouvie-Vief, 1980, 1982), *expertise* (Tenant & Pogson, 1995) *wisdom* (Sternberg, 1990; Merriam & Caffarella, 1999; Kitchener, King & DeLuca, 2006), *integrative thinking* (Kallio, 2011).

Constructivist theories of development (Perry, 1999; Belenky et al., 1986; Baxter-Magolda, 2004; Kegan, 1982, 1994) also affirm the idea of continued cognitive development in adulthood, introducing the variable of the construction and transformation of knowledge and experience to the cognitive developmental model for adults. In describing the changes which occur after formal logical thought, the following terms are most commonly used: *epistemological convictions*, *epistemological reflection*, *epistemological theories*, *epistemological forms*, *epistemological assumptions*, *epistemological attitude*, *epistemic cognition*, *epistemological understanding*, *epistemic reasoning*, *epistemological perspective*, *personal epistemology*, *epistemological orientation*, *epistemic elaboration*, *epistemic validation*, *implicit epistemology*, *folk epistemology* etc. (see: Hofer, 2001; Briel et al., 2011).

Perry (1999) conceptualised intellectual development as lifelong change in the frame of reference for the interpretation of reality. This frame changes in accordance with changes to the epistemic form. Over time, epistemic forms (belief about knowledge) become more complex, with greater capacity for the explanation, reorganisation and transformation of experience. Perry's empirical studies showed that students during four-year courses of study significantly transformed their epistemic forms and that their intellectual progression passed through nine stages of development – from dualistic (regarding the world through the right-wrong dichotomy), to relativistic thinking which culminated in commitments to an affirmation of their own roles and values in different domains of decision-making, which comprises the basic structure for dealing with the uncertainties and ambiguities inherent in relativism. According to Perry the final level is reached at the time of graduation. However, although they all start out as dualists, the majority do not achieve full and final epistemic development.

For Kegan (1982, 1994), too, development is a lifelong process which undergoes transformations through five “orders of mind”, ending in the final stage of dialectical or trans-systemic thought. This level of thought arises from the need to respond to the demands of life in a postmodern society, the basic characteristic of which is cognitive complexity. The complexity of life roles requires both the expansion of the store of knowledge and skills (informative learning) and a change in the way in which we acquire knowledge and learn (transformative learning). Although greatly inspired by Piaget, to whose genius he devotes

an entire chapter in his most significant work, Kegan (1994) in his basic position on the significance of culture to the development of thought, and on the social origins of the higher cognitive functions, is very close to the tradition to which Vygotsky also belongs.

The Interdependence of Knowledge, Age and Development in Adulthood

Although they emphasise the development of new forms of ability in adulthood, the theories of postformal cognitive development do not underestimate the significance of formal thought. On the contrary, integral to them is the strongly-formulated idea that a minimum of formal thought is the basis for full development in adulthood (Kramer, 1989; Labouvie-Vief, 2006). The concept of formal thought has primarily been criticised for its neglect of the thinker him-/herself, who in thinking is imputed with complete “objectivity”, neutrality and a lack of knowledge, experience and identity. The theories and studies of postformal thought have drawn attention to the fact that cognitive development in adulthood is founded on social experience, life expectations and tasks and individual worldview, but also on prior educational and developmental achievements.

New and more complex forms and stages of thought are not universal, neither do all necessarily achieve them. They are rather an opportunity which may arise under certain conditions, primarily those of high levels of social support (see: Labouvie-Vief, 2006). The hypothesis of the connection between the level of education and more complex forms of thought has received significant empirical support (Kitchener & King, 1989; King & Kitchener, 1994; Erwin, 1983; Pirttilä-Backman & Kajanne, 2001; Hood & Deopere, 2002). In some studies a positive connection has been identified not just between the level of education (lower vocational, higher vocational, university) but also the area of study (technical, medical and social sciences) and reflective judgement (Pirttilä-Backman, 1993; De Corte, Op't Eynde & Verschaffel, 2002).

However, education and acquired knowledge and experience are not the only determinants of cognitive development. Since it occurs over time, cognitive development is also simultaneously the effect of achieved developmental level and of age and maturity. Studies of the Piagetian type from the 1970s were already suggesting that intellectual functioning was dependent on age. Learners were successful in completing different tasks requiring the same logical structure at different ages. Conservation of number was mastered at 5-6, conservation of liquid volume at 7-8, and conservation of weight at 9-10 (Flavell, 1963;

Brainerd, 1970). As regards adults, Perry's (1999) research suggested changes in thought processes occurring during the years spent at university. In the initial years of their studies students think in absolute categories, adopting the relativistic attitude later on, i.e. the conviction that knowledge is subjective. Kramer and Woodruff (1986) also established that the peak of relativistic thought was reached during the individual's forties, followed by more significant use of dialectical patterns of thinking. Other studies have also shown that the ability for post-formal thought increases with age (Basseches, 1984a; Labouvie-Vief, DeVoe, & Bulka, 1989; Sinnott, 1984b), and that older students in higher education have a different organisation of cognitive patterns to younger students (Blanchard-Fields, 1989).

Since in most of these studies the subjects had completed higher education or were students, it is possible that age itself is not a significant factor in cognitive functioning, only that it is reflected in the influence of education or intelligence level. However some research has shown that the influence of age on relativistic thought remains stable even when the level of education and intelligence is controlled (Hood & Deopere, 2002).

But the relationship between age and cognitive ability is not absolutely clear and is certainly "contaminated" by acquired knowledge and experience. Studies show that age has a negative impact on the cognitive functioning of adults (vocabulary, memory and spatial reasoning) in the period between 20 and 50 years of age and not just from 50 to 80 as is usually assumed; however the negative affect of age on cognitive ability is small when the available sum of knowledge is great, and vice-versa – the negative effects of age are greater if there is a significant deficit in knowledge (Schroeder & Salthouse, 2003; Salthouse, 2002). This model is not, however, final, since there are greatly differing combinations of the relationship between age and knowledge depending on the stability or decline of cognitive abilities in adulthood (Salthouse, 2002).

The Mechanisms of Cognitive Development in Adulthood

The tendency for favouritism is the primary cause behind misunderstandings in the traditional understanding of the relationship between maturing and learning in development. At the core of the basic dilemma – is development a function of learning or is learning a function of development? – in the newer theories and empirical studies of cognitive development, a general opinion has arisen regarding the need for and possibility of a relative balance between the basic developmental influences, especially where the more complex forms of adult cognition

are concerned. However, it remains somewhat unclear which mechanisms lie behind this relationship.

Based on the previous review, and the empirical studies which have pointed to the role of knowledge in cognitive development, we believe that three primary mechanisms explain cognitive development in adulthood:

- progression in the use of complex systems of meaning and knowledge,
- the establishment of a unified conceptual framework or system of meaning and knowledge and
- the intellectualisation of the cognitive system and cognitive functions.

Complex Systems of Meaning and Knowledge in the Cognitive Development of Adults

Although doubtless of importance, learning itself does not fully determine developmental potential. Other factors come into play too, primarily those coming from the area of development itself, the level of development achieved and the opportunities and abilities to use increasingly complex systems of meaning and knowledge in thought.

There is a mutual interdependence between development and learning on the one hand, and the system of external supports and stimuli on the other – a definite and firm two-way connection. Just as external supports and stimuli enable development, so development itself, that is the the achieved level of development, allows and requires a quite specific type and structure of external stimuli. It is clear enough that there is no point in offering steak to a hungry newborn baby. But it seems that this simple rule – that a stimulus, in order to be effective, must be acceptable to its intended recipient – is rather difficult to apply to the understanding of the relationship between development and learning. However it is of key importance for any effort aimed at systematically impacting cognitive development. For if the understanding of the impact of external supports on cognitive development is important in attempting to shape it, then understanding of the action of the achieved level of development on external supports is significant for the way in which this intention is to be achieved.

External supports (learning) presume the receptiveness, opportunity and need of the individual to use them and respond to them. Development is a life-long process only in potential. In reality it is limited by a range of factors of differing origin, primarily that of success in establishing a correspondence between the type of external support and the opportunities for its use (the principle of

availability). Significant cognitive declines come about only when the individual is unable to find and make use of adequate external supports and stimuli – in other words learning – or when those offered to him or her – in other words education – do not resonate with his or her current needs and experience and cannot be integrated in the individual or significantly transform them. Keeping in mind symbolic capacity as the basic unit of measurement and the explicit carrier of a formative and transformative charge, we believe that the line along which potential external supports may be used during life begins with and develops from the simple, emotional and perceptive in childhood and extends to complex and abstract systems of meaning and knowledge in adulthood. We might say that the individual, in the use of external supports, owing to continued learning and the continued integration and transformation of experience, progresses from the mother's smile and a rattle to hypothesis and theory. From this potential, broad range of options, and based on prior learning and achievement, a choice is made from what is possible and essential for further intellectual progression. Accordingly, and more simply put, the ambition of lifelong development cannot be founded on nor can it end with the symbolism of "doggy and kitty", just as the earlier stages of intellectual development cannot be founded on complex and abstract systems of meaning and knowledge. Neither case permits what we call development, or surpassing one's own susceptibility and one's own initial and prior potential, at the centre of which lies the mechanism for the integration and transformation of knowledge and experience. This surpassing, which is not spontaneous, at least not in adulthood, can be achieved only, as Cattell (1971) would put it, through prior investment. This means that the current level and the opportunities to use external supports are a function and results of the previous level and prior opportunities. Since the basis of investment is time, then an arithmetic progression in the use of external supports of differing symbolic capacity is expected. For this reason it is very probable that cognitive development, and intellectual development as a whole, during the individual's life, comes about through the use of increasingly complex systems of meaning and knowledge, and explicit intellectual progress in adulthood, especially where the higher cognitive functions and levels are concerned, can only happen under their influence. This is what facilitates relativistic and dialectical thought, that is, intrasystemic and metasystemic thought or epistemological reflection, reasoning and perspective. Complex forms of thought can only be born from complex knowledge. In adulthood they develop on a foundation of the internalisation of more or less structured, organised and interconnected concepts, ideas, theories, attitudes and facts, and not so much on the basis of the internalisation of universal procedures, techniques, processes and ways of cognising and thinking.

Unified Conceptual Framework – Knowledge Networks

As has already been said, thought is not only expressed through mental processes, operations and forms but also through the content which is processed within them. Knowledge and the psychological processes and operations of thought are connected and interdependent qualities, the unity of which indeed comprises the phenomenon of thought in its full sense. The measure of development of one is determined by the measure of development of the other. With maturity and age, however, knowledge becomes the increasingly dominant thought structure and the external expression of mental development. One might even say that thought becomes less and less an operational quality and more and more a conceptual one with development and age. For this reason we must first and foremost talk about the development of thought in adulthood as the development of knowledge – the construction and structuring of conceptual systems. Cognitive development proceeds primarily as a process and as an attempt to internalise reality in a rationally acceptable way and to form a unified concept or model of it which acts as a filter – a deciphering and encoding system through which all information and content that the individual encounters is passed through and made accessible. This is a general framework for the reception and utilisation of information, each separate segment and element of which carries and entails a rich potential of information about reality and about the assumptions on which it is founded. The development of thought in adults, in terms of its ultimate scope and form, is manifested as a generalisation of knowledge, as a qualitative change in the structure of knowledge and as the creation of a general and relative unified knowledge network, a relatively coherent system of relations which can be applied to different content and information, to make sense of it and give it meaning. Knowledge networks are not, of course, saturated only with what might be called knowledge in the classical sense, although scientific and theoretical knowledge is their key constitutive element. Since adults are under consideration here, who as a rule have and acquire rich life experience in a variety of domains, they also comprise implicit, everyday knowledge and experience which entails all that which is found between direct empirical knowledge and experience and unwritten but accepted metaphysical assumptions. Although comprised of diverse and heterogeneous content, knowledge networks function as somewhat integrated systems and structures. Regardless of how complex and “rich” they are, they have limited scope if the horizontal, vertical and diagonal connections between them are not of such character and strength that they can be used as a whole. For this reason, over time and during maturing and aging, these networks are constantly modified or rebuilt through the process of learning and the acquisition of experience, and

guided by integration as the primary developmental principle of adulthood they gradually become generalised, condense their meaning and take on the form of what Allport (1969) calls a unifying philosophy of life – a clear perception of life's goal in the form of an understandable theory or overriding personal principle of behaviour and thought and accordingly of further growth and development.

The Developmental Shift in Adulthood

The above-discussed understanding of the relationship between development and the system of external support is however not without its difficulties in terms of its consistency and coherence. Firstly, one might ask whether cognitive development is always purely progressive, and practically delimited only by one's life expectancy, considering the arithmetic progression in the use of external supports and the effects of prior investment. There are other questions: how are changes that are organic in nature involved in cognitive development, and what are their consequences and their evolutionary course in childhood and adolescence and their involutorial course in adulthood? How can we explain the qualitative cognitive difference between the same age categories but differing "investment" categories, and vice versa? Huberman's (1974) conclusion, based on an analysis of different studies – that intelligence tests reveal a greater correlation between people of the same level of education than between those of the same chronological age – in a way upsets the notion of age as a source of variation in the use of external supports. But is the fact that the nature of development in children and adults is completely different not of significance for the learning process and the use of external supports and further cognitive development? Should the fact that the use of external supports in childhood happens in conditions of organic evolution and that it happens in conditions of organic involution in adulthood be completely ignored? What happens when, over time, the unity of organic and socio-cultural development which Vygotsky (1972) talks about begins to break down – when socio-cultural development loses its biological support and when involutorial processes begin to oppose socio-cultural efforts towards further progress, or at least towards the maintenance of established cognitive structures?

Age is not in itself a motivating force for development, and the function of external supports in development does not significantly change with the entry into adulthood. However, as soon as socio-cultural development begins to lose its biological support, the entire course of cognitive development and the developmental model change, and thus so do the character and direction of action of the socio-cultural stimuli which permit further development. The presence

of biological support causes development in childhood to progress according to the model of frontal growth and the gradual differentiation and specialisation of functions, while the lack of biological support in adulthood gives rise to the integration of the cognitive functions and abilities. The need for the establishment of structure, therefore, determines differentiation and specialisation, while the need for the maintenance and functionalisation of already-established structures determines the integration of cognitive abilities. In order for existing structures to be maintained and regression avoided, strong connections need to be established between their separate elements and functions. Cognition must function as a compact whole in order to compensate for the action of general involutorial processes. However, if differentiation and specialisation on the one hand and the integration of cognitive functions on the other are biologically inspired that does not mean this is how they are facilitated. Everything which happens within this general model is a consequence of socio-cultural influences, but their action greatly differs with regard to the variable of age, which can best be observed at the level of microgenesis.

Microgenesis, that is, the development of each individual function, requires and selects for a quite specific kind of social stimulus, with selection becoming increasingly rigorous or specific with age. This relates to the simple fact that stimuli to the development of attention are not identical to those demanded by the development of thought, or are less and less so. Due to the modest initial potential in the case of thought, for example, owing to the modest symbolic capacity which may be "absorbed" in the initial stages of development, the external supports which may be employed are simple structures displaying almost no differentiated or specific effects. In the initial developmental stage, the relationship between external supports and development is governed by the rule, "everything acts on everything". Every stimulus, due to general sensitivity and instability, has a quite general and non-specific action. With age and with further organic changes, the action of external supports becomes increasingly specific, which ultimately allows for differentiation of functions and for microgenesis. However, due to the interdependence of functions, the principle of the undifferentiated action of external stimuli is maintained throughout life, although with age and with organic change of the involutorial type it becomes more significant and acts in reverse. One aspect of Guilford's (1967) understanding of the intellect is inspirational for a fuller explanation of this process. Certain intellectual functions, according to Guilford, (1967) exist in a hierarchically and cumulatively interdependent relationship, which means that where there is no cognition there is no memory either, and without memory there is no convergent and therefore no divergent production, and without these there is no evaluation as the highest intellectual

ability. The microgenesis of the higher functions is founded on the microgenesis of the preceding functions, where the non-specific effect of external stimuli progresses from the lower to the higher intellectual functions. This means that the non-specific effects of stimuli on the development of cognition is somewhat relevant to the development of memory and other higher functions. As development progresses and the functions change qualitatively, demanding increasingly more specific and direct stimuli for their development, the influence of non-specific action is increasingly lost. With age and the onset of involitional processes which inspire the integration of the intellect, non-specific action becomes evident again, however now it proceeds from the higher to the lower intellectual functions. This means that what is not relevant for the development of cognition is not relevant, or is increasingly less relevant for the development of thought; however, what is relevant for the development of thought becomes relevant to the development of cognition to a significant extent. The hierarchical, cumulative, dependent nature of the intellectual functions permits and facilitates the multidirectional effects of individual socio-cultural stimuli in the opposite direction, but only under the influence of a kind of implosion of their internal structure and organisation. This shift in the use of external supports with age becomes increasingly apparent and is particularly strongly expressed in the period of integration, which it directly facilitates. Microgenesis in its classical form, i.e. autonomous development, and therefore the autonomy of individual functions, become less and less possible, and the measure of the development of the lower intellectual functions is determined by the degree of development of the higher intellectual functions. For this reason the significance of the development of thought for the development of all the other intellectual functions grows with age. The essence of the developmental shift, which begins with the entry into adulthood, can be seen in the fact that thought begins to intellectualise all the other cognitive functions, which means that in establishing and devising connections between them it facilitates their individual development and the creation of a unified structure of the intellect.

Conclusion

Although an unwritten agreement has been established between the classical developmental theories (Vygotsky and Piaget) that there is no cognitive development in adulthood, these theories have been inspirational to empirical research and the formation of new theories which have indicated the need to revise this initial and fundamental conviction. It has been shown that different forms and levels of postformal thought are possible in the post-adolescent period and that

there are significant limitations for any attempt to favour organic or socio-cultural influences on cognitive development. Both the organic and the socio-cultural in human development are found in the complex relationship between figure and ground and each cannot be isolated and considered without the other. What connects organic and socio-cultural influences is the system and structure of meaning and knowledge, which suggests that knowledge cannot be eliminated from the attempt to cognise and to acquire the ability to cognise. This connection happens on a foundation of progression in the use of complex systems of meaning and knowledge, which results in the establishment of a unified conceptual framework for the interpretation of reality and the intellectualisation of the cognitive system and individual cognitive functions.

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Znanje i kognitivni razvoj u odraslom dobu

Apstrakt: U radu se razmatraju mogućnosti i mehanizmi kognitivnog razvoja u odraslom dobu sa osnovnim ciljem da se podstakne traganje za njegovom drugačijom konceptualizacijom. Analiza obuhvata klasične (Vigotski i Pijaže) i postmoderne, konstruktivističko razvojne i kontekstualističke teorije kognitivnog razvoja, kao i relevantna dostupna empirijska istraživanja. Bez obzira na značajnu inkonzistentnost analiziranih teorija i empirijske evidencije, rezultati analize upućuju na zaključak da su moguće i da se dešavaju značajne pozitivne promene u kognitivnom razvoju tokom odraslog doba u čijoj osnovi se nalaze sistemi i strukture znanja koji se oblikuju tokom života. Mehanizmi odgovorni za kognitivni razvoj u odraslom dobu su progresija u korišćenju kompleksnih sistema značenja i znanja, uspostavljanju jedinstvenog konceptualnog okvira za tumačenje i interpretaciju realnosti i intelektualizacija celokupnog kognitivnog prostora i pojedinačnih kognitivnih funkcija.

Ključne reči: kognitivni razvoj, odraslo doba, formalno mišljenje, post-formalno mišljenje, mreže znanja, obrnuti razvojni trend.

