Abstract Heinz Werner's (1890–1964) book *Comparative Psychology of Mental Development* is reviewed in the context of the dynamics of values and types of scientific rationality, sciences of complexity, cognitive psychology and cultural studies. The reviewer describes developmental tasks of the orthogenetic law applied to dynamical systems that are far from equilibrium between integration and differentiation, to the role of uncertainty, and to paradoxes of systems thinking, and compares epistemic, social and ethical problems raised by Werner and modern researchers.

Key Words comparative psychology, culture, developmental psychology, differentiation, ethics, holism, integration, orthogenetic law, systems thinking, types of scientific rationality, Werner

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Developmental Comparative Psychology and Development of Comparisons

Werner, Heinz, *Comparative Psychology of Mental Development* (with a new prologue by Margery B. Franklin). Clinton Corners, NY: Percheron Press, 2004. 564 pp. ISBN 0–9719587–1–8 (pbk).

Developmental Comparative Psychology as Thinking and Developing Psychology

Heinz Werner's fundamental work *Comparative Psychology of Mental Development* determined or influenced many approaches in psychology. According to Werner's main conclusions, the most important human mental ability, thinking, is a relating and comparative activity with a central selective, integrating and commanding function (p. 52). From this point of view, it is evident that Werner's main efforts were to make developmental comparative psychology not just comparing psychology but, first of all, 'thinking psychology'; and he has reached this aim. His discussions, sharp polemics and criticisms of authors who

Vol. 12(3): 352–377 [DOI: 10.1177/1354067X06064598]

are already (almost) forgotten still retain much of their challenge today. This is one reason why this book, the first edition of which was published in 1926, has had a series of repeated editions, with this latest one in 2004 containing the previous preface by Gordon W. Allport and a new prologue by Margery B. Franklin.

Many of Werner's statements are actual and relevant not only for comparative psychology in the narrow sense, but also for many other areas of modern psychology, psychogenetics, neurosciences, computer sciences, and so on, which are working with comparisons of developments. In turn, understanding development of these comparisons in different areas and different periods, understanding what, why and how researchers start to compare (and finish doing so), seems a necessary part of developmental, cultural, philosophical studies. It reveals the development of human thought.

From this point of view, it seems important and interesting to conduct developmental comparative studies of Werner's work and works of modern researchers.

First of all, one should note that the meanings and estimates of some terms differ now from those in Werner's time. The most demonstrative example are the oppositions 'primitive man' vs. 'intellectual man' and 'primitive cultures' vs. 'advanced cultures', analyzed by Franklin (in the prologue, pp. xiii–xiv). In particular, she writes that the German word *urtümlich*, translated in the book as *primitive*, actually signifies *original* rather than *simple*, *crude* or *inferior*.

Franklin delineates Werner's main themes, which look more important for modern developmental research.

Werner's central theme is the holistic approach as a powerful scientific paradigm, which 'emphasizes the interdependence and interaction of systems within the organism and the organism with the environment' (p. xv), and the development of holistic (idiographic, qualitative) methodology in its opposition to quantitative methodology. 'If we restrict our efforts to the calculation of average age scores and developmental curves of achievement, the essential goal of genetic psychology, viz. the understanding of the process of growth, can never be achieved' (p. 497).

Werner essentially developed the holistic approach in psychology by enriching previous principles and introducing some new ones. In a consistent way he applied them to the consideration of the development of mind in phylogenesis and ontogenesis, in primitive and advanced cultures, and in normal and pathological cases. His methodology is expressed in many original and very important statements. For example, he emphasized the meaninglessness of the question about the

age at which a definite mental function begins to emerge in children. One may ask only about levels of development of the function, which is in the process of qualitative change and interaction with other functions at different age levels (pp. 17, 216, 234, 474). Concerning psychological experiments and the testing of children's mental abilities, Werner wrote about the necessity of organizing the environment and interactions that are natural for the child, and including tasks within the sphere of her or his interests, otherwise s/he demonstrates not logical abilities themselves, but abilities to reconstruct intellectual models of the other person, that is, in the given case, of the logician (p. 23). This looks to be highly consonant with Donaldson's (1978) and Perret-Clermont's (1986) approaches and their criticisms of Piaget's approach.

Areas of agreement and disagreement between Werner's and Vygotsky's approaches are also of great interest. A special conceptual effort seems necessary now to understand, for example, Werner's statement that 'the idea of "culture" as a maker of mentality is a reversion to an atomistic psychology' (pp. 16–17). This looks opposed to the Vygotskian idea of the interiorization of culture and of cultural mediation as a main determining factor of mental development. Yet one can see that Werner's criticisms concerned authors who used the term 'culture' with a different meaning, and he did not consider Vygotsky's work in this context (perhaps he did not know about it at all). Meanwhile, in one of the previous paragraphs he has written:

> The single man as a member of generic unity possesses characteristics which are his because of his integration within a totality . . . The individual thinks, speaks a certain language, and acts in a characteristic way because of his participation, his integration, in the whole. (p. 9)

This seems rather in agreement with the Vygotskian cultural-historical approach. Moreover, one can find confirmations of fundamental parallels in Werner's and Vygotsky's thought and methodological approaches at many points. One example concerns such an important area of methodology as genetic experiments. Werner studied principles of historical development of musical systems, and their mastery by an individual child. He conducted an excellent genetic experiment in which participants were taught a specially designed musical system of tones and intervals between them. According to Werner, analysis of the process of learning this system provides an opportunity to understand some universal laws of development (pp. 101–103). Vygotsky's thought unfolded in a very similar direction, though in a different domain. He studied stages of the historical

and individual development of thought and the mastery of concepts. To reach that aim, he used, in particular, a set of specially designed objects differing in shape, color, and so on, and in unfamiliar names of groups for the objects (the method of double stimulation). Scientific dialogue between Werner and Vygotsky concerning this issue could be very interesting.

Werner's second main theme analyzed by Franklin in the prologue is a study of 'primitive' mind and society. One should agree with Franklin that Werner did not consider *primitive* to be *inferior*. He wrote that 'the primitive function is a necessary element in the mentality of any well-balanced person of high activity' (p. 282), and described the richness of the primitive mind, including physiognomic perception, imagination, fantasy, and so on. He emphasized that an adult person of advanced culture 'does not always act on the higher levels of behavior' but can 'exhibit in his varying behavior different phases of development' (p. 38). At the same time, Werner emphasized some advantages of primitive mentality. One can see a reflection of these fundamental ideas in, for example, so well-elaborated and famous a psychological theory as Kahneman and Tversky's 'heuristics and biases' approach (Kahneman & Tversky, 1984).

The third theme of Werner's work is the study of different spheres of humans' experience, including scientific, religious experiences, and so on (p. xxxiii).

The pivot of Werner's comparative studies in all the domains was the orthogenetic principle formulated by Goethe and elaborated by Spencer. According to this principle, a main law of development of any wholes (organisms, individuals' mentalities, societies, etc.) is 'a tendency to move from a state of relative globality and undifferentiatedness toward states of increasing differentiation and hierarchic integration' (Werner, cited by Franklin, p. xxv). Respectively, regress is related to a decrease of differentiation and integration, and an increase of diffuseness, non-clarity and discoordination. In this article I will consider some possible directions of development of the orthogenetic law and compare epistemic, social and ethical problems raised by Werner and modern researchers.

Integration and Differentiation: Developmental Tasks of the Orthogenetic Law

If the orthogenetic principle describes most general laws of development in terms of systems increasing in integration and differentiation, one may set a problem of applicability of this principle to itself, and

study how the principle can be differentiated and integrated so as to develop. Let us consider it in more detail.

It looks as if Werner considered differentiation and integration to be linked with one another by relations that provide either simultaneous progressive or simultaneous regressive changes in both differentiation and integration. I could not find Werner's reasoning for analyzing, for example, an *increase* of differentiation accompanied by a simultaneous opposing *decrease* of integration, or vice versa. Yet it seems to me that, according to his main ideas, a link which provides changes of variables of a single type—in the same direction (either both growths or both declines)—is an attribute of poorly differentiated systems of low plasticity.

One can pose the following crucially important questions.

(A) Questions concerning relations of integration and differentiation *within* a system. Do relations between measures of differentiation and integration (both qualitative and quantitative) keep constant throughout an individual's development and at its different stages? Are the relations between differentiation and integration constant for different organisms, individuals' mentalities, societies, and so on? Are they constant in health and illness, and in different illnesses? In general, are different rates and asynchronies of increase (or decrease) of differentiation and integration possible, and are counter-oriented increases and decreases possible?

(B) Questions on interactions *between* systems. What are the laws of the interactions between systems that differ from one another in their internal 'integration/differentiation' relation? Do the interactions of these systems become more integrated and differentiated? How does Ashby's law of requisite variety work in the area of distribution of 'integration/differentiation' relations among systems? In which cases are system interactions synergetic or mutually inhibiting, in which does one system 'win' and the other 'lose', and so on? Concerning human cultures, are their laws of interactions of cultures of different 'integration/differentiation' relations? If yes, what are they?

These are questions for further studies.

Systems Far from Equilibrium between Integration and Differentiation

If one believes that relations between differentiation and integration are constant and unshakable, one should try to figure out the fundamental constant of world development—perhaps in a mathematical way like a physical constant—to reflect these stable relations. Yet I think it is more accurate to say that the relations are dynamically

changing, and that the development of different wholes and their parts is one of different relations between differentiation and integration (Figure 1). The ideal balance, in which any step towards increasing (or decreasing) differentiation is always accompanied by an equivalent simultaneous step towards increasing (decreasing) integration, and vice versa, seems rather an abstraction.

Werner differentiated between two meanings of the term 'development':

- development as specialization;
- development as creation (or creative development).

He emphasized that 'although in actual genesis specialization and creation are interlocked, true development itself rests in creation' (p. 19).

Respectively, one can differentiate between two types of systems that are far from equilibrium between differentiation and integration (A.N. Poddiakov, 2000). Development of systems of the first type is mainly related to formation of new lower and lower specialized levels, which get subordinated to higher, already existing, levels. This provides

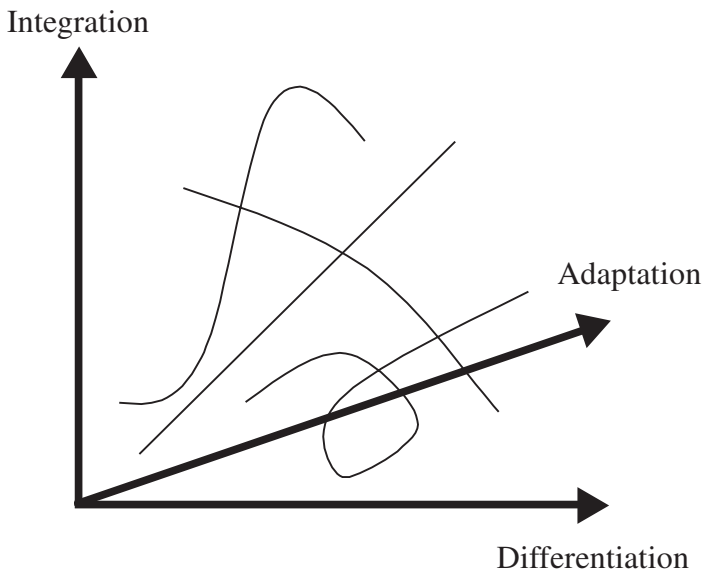

Figure 1. Development of systems: diversity of trajectories in the space of differentiation–integration–adaptation. The straight trajectory at equal angles to all three axes is the simplest, and the remainder demonstrate more complex relations between differentiation, integration and adaptation

structures at the higher levels with an opportunity for more perfect control, and increases their relative importance in a system.

Development of systems of the second type is mainly related to the emergence (creation) of new higher levels, initially imperfect but with more and more perfect and flexible control over re-structuring and coordination of the lower levels. This type, applied to the human mind, is described by Werner: 'It is reasonable, therefore, to identify the development of the human mentality with an increasing centralization by means of superior ordering functions which give form and direction to the lower activities' (pp. 52–53). For example, generalized thinking takes control over correlation and subordination of sensuous impressions at the higher stages of development (p. 52). The same concerns creation of personal voluntary control of physiological functions, complex behavior, and so on. In general, all the higher mental functions developing in children (speech, thinking, memory, voluntary behavior, etc.) acquire 'a higher degree of subordinating power' and become powerful integrators (p. 56b).

To confirm possibilities of asymmetries and imbalances between integration and differentiation, let us consider some examples from different areas.

The Child's Individual Development

In the area of individual development, N.N. Poddiakov links the problem of creative development with the problem of the variety of imbalances between integration and differentiation. He elaborates on an idea that the existence of Werner's creative type of development signifies relative domination of hierarchic integration over progressive differentiation in children's mental development, and distinguishes 'search-and-trial' types of the integration. Several global structures can be synthesizing themselves in different combinations, 'trying' to find optimal variants of functioning and development. The newly emerging 'search-and-trial' global structures can serve as a front for changing so-called 'horizons of development'. These are different from the Vygotskian zone of proximal development and can determine the directions of further differentiation and specialization (N.N. Poddiakov, 1997).

Kadankova (2000) has confirmed N.N. Poddiakov's idea about the relative domination of integration over differentiation at preschool age at a neuropsychological level.

New structures of higher levels interact, in both synergetic and conflictive ways, with already existing lower level structures, and with the newer, just emerging higher level structures. In non-pathological development, these synergetic and conflictive interactions between

structures result in an emerging novel whole with new qualities of integration and differentiation (A.N. Poddiakov, 2000).

Individual Differences

In the area of individual differences, relative dominance of either the left hemisphere of the brain or the right one in different people can serve another example of asymmetry between integration and differentiation. The left hemisphere is mainly responsible for well-differentiated logical, analytical, sequential and conscious processing of information of high certainty. The right hemisphere is mainly responsible for global, synthetic, simultaneous, more intuitive processing of information of high uncertainty. Respectively, a person with relative domination of the left hemisphere is characterized by the relative domination of processes of analysis (differentiation) over synthesis (integration), and, vice versa, a person with relative domination of the right hemisphere is characterized by the relative domination of processes of synthesis (integration) over analysis (differentiation) (Rotenberg, 1993; Springer & Deutsch, 1989). One should note that the dominations are relative, not absolute, and processes of integration and differentiation work together, being interwoven one with another.

Cross-cultural Differences

In the area of cross-cultural differences, Nisbett has studied East Asians' and Westerners' thought styles (Nisbett, 2004; Nisbett, Peng, Choi, & Norenzayan, 2001). He shows that East Asians reason mainly holistically using synthesis and dialectical reasoning. They focus on the objects in their surrounding field and are sensitive to covariations. In contrast, Westerners' reasoning is analytical: 'They focus on the object (whether physical or social) and its attributes, . . . often fail to see covariations in the stimulus field, typically (and often mistakenly) explain objects' behavior with respect to their presumed dispositions' (Nisbett, n.d.).

Interestingly, Werner wrote that advanced thinking tends to group diversity of appearances and reasons 'under one comprehensive idea and invest with one lawfulness' (p. 309). Is it more appropriate to Western or Asian advanced styles of thought, and in what historical period? For example, analyzing the cultural development of European society during past centuries, Ivanchenko (1999) writes about sequential interchanges of stages of relative domination of either analytical or synthetic types in architecture, arts, music and literature approximately every half a century. Is it right for Asian culture in the same measure?

Based on all these studies in different areas, one can conclude that relations between hierarchic integration and progressive differentiation are not constant. Imbalance, asymmetries and asynchronies, interchange of domination of integration and differentiation are the rule rather than the exception in most domains of development. The space 'differentiation–integration–adaptation' is filled with systems' developmental trajectories essentially differing from one another.

Diversity of the trajectories and uncertainty in their prediction can increase because of multiple interactions between the systems (or the wholes, to use Werner's terms).

I doubt that there is a universal constant of world development concerning relations between integration and differentiation. Yet I think that a pattern of (changing) laws describing processes of interactions between integration and differentiation in interacting complex systems is possible, and search for it is a challenge for science. Concepts of integration and differentiation may develop in the natural and social sciences, creating a changing pattern of approaches to general understanding of the processes and their possible operationalizations.

Werner's Approach and Sciences of Complexity

Ideas about the structural similarity of developmental processes in different systems, including dynamics of integration and differentiation, are actively elaborated in modern sciences of complexity (synergetics, non-linear dynamics, etc.) (Haken, 1983; Prigogine & Stengers, 1984). Taking into account Werner's attention to crises of development, one should mention a fact established in this area in recent decades. In many cases, graphical representations of dynamics of unfolding crises looks very similar (Malinetsky, 2005). Dynamics of economic measures before an economic crisis look like dynamics of concentration of chemical essences before an earthquake, of heart rate before heart attack, and so on—and may be described by the same formalisms.

Dynamical visual metaphors of increasing differentiation and integration can serve so called 'cellular automata'[1] (Figure 2). Theory of cellular automata is an important and intensively developing area of theory of complex systems and computer sciences. It is used to design artificial intelligence systems (e.g. based on neurocomputing models), to simulate some psychological and social processes, and so on (Cellular automaton, n.d.; Dooley, 1997; Prigogine & Stengers, 1984).

A whole family of cellular automata and other models and simulations, visualizing complex interactions between systems in physics, chemistry, biology, social life (egoistic and altruistic behavior,

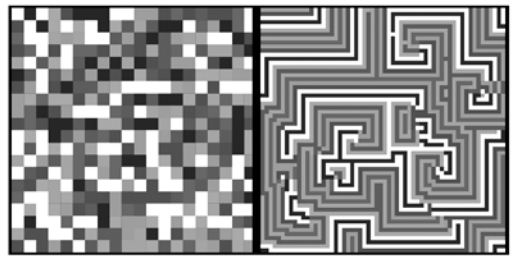

Figure 2. On the left: one of the possible initial random states of the cellular automaton; *on the right*: the state at the fiftieth loop of transformation (A.N. Poddiakov, 2000). Throughout the transformations, one can see effects of 'ordering out of chaos' and emerging, that is, turning non-integrated small wholes into the large whole pattern of well-differentiated and well-ordered structures, containing 'centers of crystallization', thin and long spirals, crosses, fragments of lines, and so on

segregation, etc.), has been designed, for example, in the NetLogo Learning Lab of the Institute for Modeling Complexity (NetLogo Learning Lab, n.d.). Use of these and other models and simulations in sciences of complexity is a creative cultural tool for development of ideas about complex dynamical systems. Such tools are a result of, to use Werner's term, human creative development, though Werner perhaps expected neither the emergence of the tools nor their potential contribution to the elaboration of his ideas.

Dynamics of the Essential, Changeability of Hierarchies, and Uncertainty as a Source of Development

A key concept of Werner's approach is *hierarchical* integration. A main feature of the hierarchical integration of advanced perceptions, images, thoughts, is that they are more organized and ordered than are more primitive ones in terms of distinguishing essential and non-essential moments (see, e.g., p. 159). One should enrich this idea by extension that essential and non-essential moments are not constant, invariant, but dynamically changing. Objects, properties, links, conditions, factors, and so on, which are non-essential in definite patterns of situations, can be turned into the most essential and crucially important in other situations. Zavalishina (1985) calls this a principle of potential essentiality, and opposes it to a principle of constancy (invariantness) of the essential.

The objective dynamics of the essential/non-essential is strengthened by the creative activity of humans in physical and social worlds (A.N. Poddiakov, 2000). A creative person reconsiders the interrelation between the essential and non-essential, and is able to see the essential

in things which seem non-essential to others, and understand the non-essentiality of things which seem essential for them. After that reconsideration and understanding, during the practical realization of a creative project, things and phenomena which were non-existent and non-essential emerge and become more and more essential than many things and phenomena which existed previously, and assume higher and higher positions in hierarchies.

Yet, as Werner emphasizes, a general law is that levels that become lower do not disappear, but keep some specific influences over the higher ones, and from time to time can take control over them even in an advanced whole. He gives examples from mental development, and I can give an example from area of creation and use of tools. At the beginning of repair works following the catastrophe at Chernobyl nuclear power station in 1986, engineers began to use distantly controlled advanced technical equipment (cars, robots and other devices) to work with objects on the territory of the station. Yet the electronic chips of this advanced equipment got destroyed by radiation. So the engineers returned to the use of more primitive and rough distantly controlled devices from the previous generation. These devices did not have some advanced features, but could work in conditions of radiation. So, one can see here competition of tools of different novelty and different levels of organization with a temporary return to domination of the older structures in a definite area.

Each process of creation of novelty is inseparably linked with (based on, accompanied with and results in) changes of hierarchies. Co-existence and interactions between different hierarchies is a law of development of complex dynamical systems (Valsiner, 1996, 1999, 2001).

What happens with differentiation and integration of the whole in the process of changes and breaches of hierarchies? It seems that the whole is transiting via stages of temporary and partial decrease of integration, increasing diffuseness and non-clarity. Werner's estimate of that diffuseness and non-clarity seems ambivalent. On the one hand, he thinks that the general trend of advanced thought is oriented from non-clarity and diffuseness towards increasing clarity and decreasing diffuseness. Moreover, he writes: 'What is true of the individual mental structure constituted of various genetic levels likewise holds true for the structure of the different social organisms. . . . As the society advances the stratifications of mental form stand out with increasing clarity' (p. 271). Non-clarity is an attribute of regress.

On the other hand, he thinks that 'diffuseness has its place in any kind of creative conceptualization' (p. 282), and creative conceptualization is the process which Werner considers most important in human

development. For example, it concerns problem solving. Paradoxically, diffuseness in placement of materials of a construction task can help a child to find the correct solution faster than is the case when the same materials are placed orderly (pp. 116–117). Yet one can see that, in general, Werner has a higher appreciation of clarity and definiteness than non-clarity and indefiniteness.

This scientific position itself looks like a transition in hierarchies of values. In the previous age of the mechanistic paradigm, absolute clarity seemed a main value of knowledge, and non-clarity seemed an evil to be avoided. Recently, in some aspects, the hierarchy of values seems the opposite, 'upside-down'. The increasing definiteness of the situation seems to exclude more and more possibilities and ultimately retains the only possible but perhaps inappropriate variant of behavior and of the development of events (Lotman, 1992). Movement to such clarity and definiteness seems an attribute of regress. For example, in complex problem solving, plans that are too clear and definite hinder success, and dominate in unsuccessful, not successful, problem solvers. Successful problem solvers design plans which are diffuse in some measure (Dörner, 1997). Uncertainty provides new and unknown possibilities for further creative development (Lotman, 1992).

In the area of education, N.N. Poddiakov (1981) writes about the necessity of special didactic work not only on the development of clear knowledge, but also on the development of 'horizons of uncertain knowledge' in children as a part of their 'horizons of development'. 'Coping with the uncertainty of learnt knowledge in some areas of the cognitive sphere should accompany the increase of uncertainty in some other areas. . . . This is a condition of principle of the self-development of thought' (p. 130).

Asmolov emphasizes the necessity of premeditated creation of the so-called 'school of uncertainty'. This school is part of a variable education in a changing world which provides children and adolescents with an opportunity to prepare for life in uncertain situations. The school develops people's ability to search for, create and use uncertain situations as a dynamic reserve of variable developmental paths (Asmolov, 1996). What could Werner's estimate of such a concept—'school of uncertainty'—be? He wrote about the necessity of preparing young generations for new patterns of an ever-changing future, but little appreciated non-clarity.

In general, zones of uncertainty and ambiguity in some areas can be very important for development. For example, non-desire to define exactly some loose scientific concepts may be a tool to stimulate

creative ideas in interdisciplinary areas (Löwy, 1992); a refusal to define exactly rules of economical games may be a tool to stimulate innovative decisions, and so on. So, now uncertainty is considered a source of innovative development. Creative search for novelty breaks hierarchies, but, paradoxically, such breaches become more and more necessary in development of systems of increasing hierarchical integration and progressive differentiation (Valsiner, 1996, 1999, 2001).

Reductionism, Holism, 'Holismionism' and 'Reductholism': Paradoxes of Systems Thought

> *Crab*: HOLISM is the most natural thing in the world to grasp. It's simply the belief that 'the whole is greater than the sums of its parts'. No one in his right mind could reject holism.
>
> *Anteater*: REDUCTIONISM is the most natural thing in the world to grasp. It's simply the belief that 'a whole can be understood completely if you understand its parts, and the nature of their "sum"'. No one in his right mind could reject reductionism.
>
> (Hofstadter, 1979, p. 312)

The general problem of understanding relations between integration and differentiation, synthesis and analysis, holism and reductionism is that there is *no absolute objective criterion by which to distinguish wholes, their parts, subparts,* and so on. Ashby has designed a system of formalisms and proved that, in any given whole with arbitrary behavior, one can find a number of arbitrary parts. Thus, it has been mathematically proved that distinguishing of parts and links between them depends on an observer and, therefore, is not only objective, but also subjective (Ashby, 1962; Heylighen, 1999). One should note that diversity of variants of the distinguishing cannot be completely voluntary. It is necessary that one distinguished part is combined with another one in such a way that both parts are in relations of homomorphism with the given whole. Yet, even in spite of this limitation, many variants of such homomorphism are possible.

So, distinguishing of either a greater number of smaller parts (tendency to differentiation and analysis) or a lesser number of larger parts (tendency to synthesis and integration) depends on a researcher's point of view, attitudes, aims, and so on.

> Depending on which distinctions the observer makes, he or she may see their variety and dependency (and thus the complexity of the model) to be larger or smaller, and this will also determine whether the complexity is seen to increase or decrease. (Heylighen, 1999, p. 5)

Concerning a close problem, Werner expresses a resonating idea: discerning either gradualness or saltatory changes in observable development depends on researchers' 'general methodological approaches that direct the formulation of the experimental problems and procedures' (p. 472).

To return to the opposition 'holism–reductionism', the same type of reasoning that Ashby elaborated is supported in an amusing and non-formalized way in Hofstadter's book (1979). He gives excellent visual metaphors—for example, a picture of small letters as elements of a larger complex pattern in which one can read either the word 'holism' or 'reductionism' or puns 'holismionism' and 'reductholism' (Hofstadter, 1979, pp. 310, 335).

Sadovsky (1972) has formulated a system of paradoxes of systems thought. In particular, based on the works of Friedrich Shelling (1775–1854), he describes the so-called 'paradox of wholeness': one can describe and understand the given system as a whole only if one has studied its parts and links between them; but one can describe and understand the parts of the system and the links between them only if one has studied the system as a whole. This logical circle is endless, and the only practical way to cope with the problem is step by step, by search-and-trial approximating work, throughout which some preliminary incomplete and imperfect hypotheses of both approaches become more and more appropriate to the essence of the system. In other words, *the holistic approach is possible only under condition of realization of the reductionistic approach, and, vice versa, the reductionistic approach is possible only under condition of realization of the holistic approach*.

Ashby's, Hofstadter's and Sadovsky's statements are formulated for structures of systems and their functioning. Yet these statements can be applied to development of the systems as well. In non-absolute but considerable measure, it depends on a researcher what type of processes will be seen as leading and dominating in a developing system: either increasing integration or differentiation. Meanwhile, the opposing approach will be always presented in the study of the system—at least, in an implicit and unconscious way.

Ambivalence of Analysis of Correlations' Structures

To show dependence of interpretations on a researcher's point of view, her or his previous knowledge, and so on, let us consider the following example. Let us imagine that decreasing coefficients of correlations between different mental functions throughout some observable time have been found in an experiential study. What does it signify: (a) an increase of differentiation and specialization of the functions; or (b) a

decrease of their hierarchic integration and coordination; or (c) both types of the changes? Werner's reasoning is that the decrease of the correlations confirms increase of differentiation and specialization of functions in the context of an increase of their hierarchic integration (pp. 56–56b). Yet approaches different from Werner's one are possible.

Heylighen (1999) considers integration to be the process of increase in the number or strength of connections. If so, decrease of significant correlations (connections) seems related to decrease, not increase, of integratedness—in contrast with Werner's approach.

In an explicit way, Pyankova (2005, p. 323) considers an increase (decrease) of cognitive integratedness as simultaneously a decrease (increase) of differentiatedness, and vice versa, 'like in communicating vessels'. This looks the opposite to Werner's approach, in which integration and differentiation seem to be in a synergetic relation rather than in the reciprocal relation of communicating vessels, in which increase of a liquid in one vessel is accompanied by a simultaneous decrease in the other one, and the total amount of the liquid remains constant. Yet Pyankova's research deals with the psychogenetic study of coefficients of correlations in twins' development. It is a special domain of modern comparative developmental psychology. In psychogenetic math models, the increase of coefficients of environmental influence on a person is linked (in a direct way via exact formalisms) with a decrease of coefficients of influence of heredity, and vice versa. Pyankova's interpretation of relations between integration and differentiation as reciprocal ones confirms the wholeness of the paradigm used. It is the integral part of this approach.

The methodological and perhaps even philosophical problem of interpretations of dynamics of correlations gets harder to solve if one takes into account the opportunity of pathology, and constructs a way of understanding what normal and pathological development are. For example, if a researcher thinks that s/he is dealing with a developing mental disease, s/he may conclude that decrease of correlations between mental functions signifies a decrease of their coordination and integration (until complete destruction of relations between them, when correlations get closer and closer to zero).

Let us consider Chuprikiva's (1997, p. 87) reasoning from this point of view. Following Werner, she considers: (a) an increase of coefficients of correlations from infancy to childhood; and (b) a sequential decrease from childhood to adolescence, which have been found in Asch's work (p. 56a). She interprets this ∩-shaped dynamics as a transition from infants' unstable and syncretic structures and processes to children's ones, which get more integrated, and then to adolescents' specialized

ones. Yet she deals with normal development. Otherwise, one could interpret the same ∩-shaped dynamics of the coefficients of correlations as attributes of regress and destruction of the whole. One can see here that the same experiential data may lead to ambivalent and contradictory conclusions.

As for me, the similar ambivalence of interpretations can be found in some other of Werner's statements, such as 'there is a series of facts which apparently indicate a much closer functional relation between percept and pure image even in the contemporary primitive mentality than in the mentality of the man of advanced culture' (pp. 145–146). The ambivalence is a result of the absence of explicit operationalizations of the concept 'close functional relation'. If one understands the close functional relation as a straight link (almost) without mediations, Werner's statement seems essentially correct. Yet, in contrast, one may understand the close functional relations as those that are being supported by multiple diverse mediations of higher density and feedback. Then one may consider that a person at the next stages of cultural development could not have lesser close functional relations between percepts and images, visions and affects, and so on, though qualities of that closeness can differ from closeness in a person of the previous stages. Vygotsky has shown that mastery of interiorized mediators (special cultural tools) provides a person with an opportunity to master the higher behaviors, which are inaccessible without these mediators. In other words, the person *creates* closer functional relations, and that higher closeness was impossible at the previous stages.[2]

The Objective World and Subjectivity

Werner's main idea related to the orthogenetic law concerns the developmental increase of distance (polarization) between a subject and the objective world. At primitive levels, the subject and objects are not separated, and their interactions are immediate. The younger the subject is, the 'nearer' s/he is to the world, and 'the distance separating subject and object increases with age' (p. 383). The same concerns primitive cultures. In contrast, at advanced levels, 'an ego that measures its ends and its powers ultimately stands opposed to an objectivity which enforces an adequately organized activity, that is, an activity fitted to cope with objective properties and potentialities' (p. 211).

Are different approaches possible? In a demonstratively paradoxical way, Lem (1990, pp. 140–141) writes that the younger civilization did not closely adjoin to (border upon) nature. Not only stars and other

planets, but even the bottom of the sea and the bowels of the earth were not reachable for its people, and its magic rituals aimed to cause rain, its ways of communicating with sun, and so on, could not have real feedback. In this sense, people's beliefs about most of the world could be arbitrary. Yet as the civilization grew older, its areas of close contact with nature expanded. Both atoms and cosmic objects, including meteors striking the Earth, and so on, became objects of real interaction in humans' practice, and their knowledge about nature grew closer to the real world.

So, on the one hand, one can agree with Werner that the distance separating a subject and some objects increases with the age of child (or a civilization). On the other hand, paradoxically, because of this distancing, some other objects are brought closer to the subject. Use of devices of *mediation* creates opportunities for *immediate* contacts with such objects and at such levels as are inaccessible without mediators. This is one of the main senses of creation via mediation devices. It concerns both the use of a wooden stick by an ape to bring food closer to her or him and the use of rockets and other space equipment which provides people of the 20th and 21st century with opportunities to touch rocks from the Moon with their hands, as well as the use of numerous other tools in many domains.

Meanwhile, the discussion about the increase/decrease of the distance between a subject and the objective world seems endless, because new realities, transforming the interactions between the subject and the world, are created by people in the course of their development, and new dimensions contributing to the distance should be taken into account. Let us consider the following example.

'At Worst I'll Just Reboot': Advanced Polarization or Primitivation?

In modern information societies based on computer technologies, two statements by Werner have received new confirmations from an unexpected perspective. These are the statements that the development of instruments of mediation contributes to the polarization between a subject and the objective world (p. 191) and that an adult person of an advanced culture 'does not always act on the higher levels of behavior' and can 'exhibit in his varying behavior different phases of development' (p. 38), including regressive development. Consider a common objective of designers of advanced computer software and hardware, which is to create such a simulation in virtual reality that it cannot be distinguished from 'real reality' even by an expert. This seems an ideal aim, and an important condition for the successful solution of some practical problems: for example, effective training for real activities by

computer simulators, and so on. Yet it leads to the rebirth of the age-old problem of relations between a sign (or symbol) and the object it designates. The realities presented by computer virtual worlds can lead not only to positive effects on real activity after training, but also to negative effects which include confusion and non-differentiation of real and virtual worlds in the consciousness of the individual, which of course is very dangerous. A professional programmer gave me an example of this. One evening after working hard on a new program he was walking home from his office. It was dark out and he crossed the street, although he clearly remembers seeing a red light signal and the lights of oncoming cars. It was only when he heard the screeching brakes of a car which almost hit him and the shouting of the driver that he realized how dangerous the situation was. He was afraid not so much of what actually happened as much as of his thoughts before crossing the street: 'It doesn't matter,' he said to himself. 'At worst I'll just reboot.'

I do not have data, whether, for example, professional drivers, pilots, and so on, reason in the same way ('At worst I'll just reboot') in extreme situations (caused by tiredness, stress of information overload, etc.) in real driving and flights after simulator-based trainings, but it seems possible if one does not take special preventive measures.

So, do distances separating subjects and objects increase or decrease with the age and/or experience (of a child, a professional, a society, a civilization)? Do 'distances' separating mental functions in subjects increase or decrease? The answers depend on one's understanding of qualities of wholeness (of the mentality, of the world, etc.) and one's understanding of relations within the wholeness and its relations with external objects and subjects. Closeness, remoteness, clomoteness and remoseness—to continue Hofstadter's way of reasoning.

Social Interactions and Intercultural Comparisons

Social relations are one of the main areas of Werner's interest, and he considered them, as well as other problems, in the context of the universal orthogenetic law. 'In a higher form of society the relation of the individual to a superior social organism is that of pronounced contradistinctive polarity', which on a primitive level 'is hardly formulated at all' (p. 436). In primitive societies, 'the primary form of social organization is as *personalized* as the individual member of the group is *socialized*' (p. 439).

Besides general statements about integration and differentiation in the development of a society, Werner's book contains consideration of

many very interesting examples of social interactions: between children and adults in different cultures and situations, between peers, and so on; examples of manipulative behavior and counteraction to manipulation (e.g. children's unwillingness to be conditioned in psychological experiments, in which the speed of conditioning in children is the object of study [p. 56c]), and so on. No less interesting examples concern situations in which joint activity and interactions are absent: for example, situations in which interactions between adults and children are absent. It may result in polarization of subjective mental maps in both children and adults. Their subjective maps of the same space look like a positive and negative slides (pp. 385–389)!

I will consider in more detail here two areas of Werner's comparative studies of social interactions. The studies are related to intercultural interactions and comparisons.

Intercultural Interactions and Dynamics of Development

Comparing teaching/learning and development of young generations in different cultures, Werner emphasized the greater plasticity in the development of a Western child. This plasticity is related to higher intense interactions between the older and the younger generations. Adolescence in the advanced culture means 'preparation for new patterns of life, for an ever-changing future, and for a projection of youthful ideals into an aging world' (p. 27). The system of social interactions in traditional societies is more rigid. In particular, it results in the fact that children from traditional societies who enter a Western system of education outstrip their Western peers in some ways during an initial period, but may 'exhibit a retrogression' and 'fall behind' in latter ones (p. 28).

Now we have more interpretations related not only to the features of the cultures themselves, but also to possible different orientations of Western education to its own young members and to young members from 'primitive' cultures at the beginning of the 20th century (and perhaps even into the 21st). It is possible to counteract the successful learning of members of other cultures in a premeditated or unpremeditated way. Hedegaard (2005) writes about racist attitude to students from national minorities as a reason for their strategies of 'pattern breaking', and Díaz and Hernandez (1998) introduce a special concept of the zone of negative development to analyze the teaching of students from national minorities. Barton and Fairhall (1995) have characterized the application of European system of mathematics education for teaching Maori in New Zealand as an unpremeditated educational Trojan horse, destroying their cultural specificity and

previous cultural achievements, including language and mathematics. Premeditated 'Trojan horse' teaching is also possible in some situations (A.N. Poddiakov, 2004). I do not know if Werner was aware of these issues of the possible premeditated and unpremeditated inhibiting influence on learning in the context of the other culture, and could discuss them in his publications. Yet he appears to be a thinker who has considered the problem of the different dynamics of different children's development within a socio-cultural and interactive context.

Interaction of Good and Evil: The Comparative Analysis That Has Been Stopped

Based on Ruth Benedict's (1934) study, Werner compares patterns of culture in two human societies opposed in their relations to ethics. Interestingly, before that comparative analysis, he notes that comparison of the specific cultural patterns 'is only indirectly related to developmental psychology' (p. 411), but in spite of this note he thinks it necessary to compare these patterns.

In one cultural pattern, of the Pueblos of New Mexico, people have obligations to tend to 'peaceful and non-militant measures', 'not to feel anger', and so on (pp. 411–412). As in Apollonian culture, they conceive 'life as a well-ordered cosmos', which contrasts with 'the Dionysian man, whose main purpose in life is heroic opposal of restrictive forces. Excess and conflict are, for the latter, the essence of nature and human existence' (p. 411). People of the other tribe conceive 'all existence . . . as a cut-throat struggle in which deadly antagonists are pitted against one another in a contest for the goods of life' (Benedict, cited by Werner, p. 414). Cheating, stealing, hostility, murders and suicides are not unusual.

Comparative analysis of cultural patterns of good and evil seems of crucial importance. Notions of good and evil are an integral and alienable part of the human self; 'the psychological and the moral are inextricable' (Benson, 2001, p. 61). Psychology is not a neutral observer of the development of society and a finder of universal laws underlying human essence, but rather 'a contributing player' that co-constructs spaces of this development (Benson, 2001). A researcher (a philosopher, a psychologist, etc.) who studies humans' existence cannot ignore mass homicide and exclude it from consideration of this existence, otherwise s/he rejects his or her mission (Lem, 2003, p. 448).

Now, from the point of view of these statements, it seems more and more natural that Werner considers the opposition of patterns of main moral values in different cultures—in spite of his preliminary comment mentioned above that comparison of specific cultural patterns is not

directly related to developmental psychology (p. 411). Reformulating the statement by Lem, one can say that a researcher who studies development of different wholes of increasing progressive differentiation and hierarchic integration, including human beings, cannot ignore termination of the wholes by one another, ignore the premeditated turning of others' well-differentiated and integrated structures into nothing. In different parts of Werner's book, one can find many examples of such activities (hunting by insects; extirpation of parts of live apes' brains by researchers-humans; murders in human societies), though he does not systematize them, and takes only the primitive cultural patterns for comparative analysis.

As for me, there is an existential, scientific and biographical question concerning perception of the Second World War and use of its materials for psychological researches and practice. Why does Werner, raising the issue of the opposition between 'peaceful and non-militant measures' and 'cut-throat struggle' *before* the Second World War (in spite of the seeming absence of its direct relation to comparative developmental psychology), add nothing concerning this matter to his revised and expanded book of 1948 (the last references in the Addenda are from 1947) or to the next editions *after* the war?

To continue the line of comparative analysis, one may compare the biographies of two great psychologists—Heinz Werner and Viktor Frankl (Viktor Frankl, n.d.). Both men were born in Vienna (Werner in 1890, and Frankl in 1905) and received their university education there. In 1933 Werner emigrated from Germany (to the Netherlands and then to the USA) because of the start of the Nazi repressions, the closure of the Psychological Institute and the termination of his appointment to Hamburg University (Franklin's prologue to Werner). Frankl received a USA visa twice, but declined the opportunity to emigrate so that he could stay with his family. He became a prisoner of a Nazi concentration camp. All the members of his family—parents, brothers, sisters and bride—perished; he was the only who survived. In the camp he started a book, finished by him after the war and becoming one of the greatest books on psychology in the 20th century—*Man's Search for Meaning: An Introduction to Logotherapy* (1984) (to which Gordon W. Allport, who, as noted above, wrote the foreword to Werner's book, contributed the preface).

In contrast, Werner did not enrich his earlier ideas about the opposing cultural patterns in his main book on developmental comparative psychology after the war. Did he become increasingly sure in the 1940s than he was before that this issue was not one of developmental psychology, and that was unworthy of special

consideration without direct links to traditional developmental comparative psychology? Did he think that the description of the tribes mentioned above contains a general solution of the problem 'peace vs war', that parallelisms are evident, and that there is nothing to add? It seems that answers to these existential questions would help us better understand Werner's scientific heritage.

Conclusion: Development of Types of Scientific Rationality

It seems important to consider Werner's main statements in the context of changes of types of scientific rationality analyzed by Stepin (2005). He distinguishes three stages (and respectively three types) of rationality based on a system of relations 'subject–means–object' and explication of their understanding by researchers.

(1) Classical scientific rationality is centered on the object explored, and tries to eliminate everything concerning the subject and the means used by the researcher. This seems an ideal of objectivity in cognition, according to which knowledge about the object should be 'pure' and free from the tracks left by researchers, their exploratory tools, epistemic strategies, values and emotions.

(2) Non-classical scientific rationality takes into account relations between knowledge about the object and features of means and operations of activity used by researchers. Explication of these relations seems a necessary condition of objective knowledge. Yet relations between knowledge about the object and the researchers' values are not recognized in an explicit way here.

(3) Post-non-classical scientific rationality explicitly postulates interactions between: (a) knowledge about the object; (b) epistemic means and tools; and (c) a general system of values and objectives of subjects, including not only internal scientific values and objectives, but also external social ones.

The last type of rationality does not destroy the two previous types, but turns their dominating positions into subordinating ones. Explication of values, including researchers' values, should become dominant in studies of complex developing systems in which humans are involved (Stepin, 2005).

In which measure does Werner's approach belong to any of these types of scientific rationality? Does it belong to any of them in a pure or confused way? In spite of his explicit declaration of principle concerning the progressive differentiation and polarization between subjectivity and objectivity, answers to these questions are not evident.

I think different researchers would include Werner's approach in different types of rationality. Reformulating Franklin's (prologue, p. xxii) statement, one can say that Werner's book is a part of intellectual history, and it includes a history of intellectual breaches from one type of rationality to another.

Consideration of development of researchers' values side by side with development of their strategies and tools of investigations, interpretations of results, and so on, throughout decades provides an opportunity to compare psychological studies at different stages of humankind's development and to test the universality of Werner's general principles of thought development.

The final solution concerning this universality seems impossible, and concrete solutions will depend on researchers' developing paradigms, values, attitudes, research experience. We cannot predict novel dimensions of development of comparisons which will be created by psychologists and researchers in other domains in the future (otherwise these dimensions would not really be novel). Perhaps the only thing about which we may be sure is the following. If researchers in the future reread Werner's works, they will find there the raising and consideration of many crucially important scientific problems that they encounter in their own work. And Werner's way of thought will influence their solutions, stimulating them to think and compare.

Notes

The writing of this article was made possible by a grant from the Russian Humanities Foundation (No. 04-06-00274a) and a grant from Open Russia Regional NGO (2004) that supported the author's visit to Clark University in the fall of 2004. I owe special thanks to Professor Nicholas Thompson and student Emily Abbey from Clark University for sharing information about the NetLogo Learning Lab. I am most grateful to Doctor Rainer Diriwächter, Professor Roger Bibace and Professor Jaan Valsiner for very fruitful joint discussions of the issues presented in the article.

1. A cellular automaton is a mathematical model of a space consisting of a lot of 'cells'. Each of the cells can be in one of a given state and transit into other states under the influence of neighbor cells accordingly to given rules of transitions. (For example, any red cell gets colored white if it touches any white cell on any side or any corner.) In spite of such simple rules of interactions between cells, cellular automata show unexpected phenomena of 'self-organization' of their initial elements, emergence of complex structures out of chaos, their ordering, destruction and 'death'.
2. My subjective opinion is that some inconsistency and ambivalence of interpretations can be found in other conclusions by Werner, and this is a result of his belief in the universality of some principles of development, according to which empirical data should be interpreted. He gives an

example of a drawing of a cube made by a Solomon Islander. A drawing is just a picture of a square (Fig. 31, p. 137). Werner interprets it in the following way: 'Whereas the intellectualized man would draw geometric figures built up of several articulated surfaces, the primitive man may content himself with uniform common qualities of a non-articulated, diffuse nature' (p. 138). Yet the next drawing of the cube made by another Solomon Islander is a picture of five squares of the same size (i.e. the participant has drawn five surfaces of the cube, without the sixth one—the bottom—which is invisible) (Fig. 32, p. 138). Here it seems as if Werner has forgotten about the general non-articulated and ill-differentiated nature of primitive thought: he interprets the second picture in terms of the 'chain type' organization of primitive drawings. Yet I think that one may interpret the second picture as a well-articulated representation of different projections of the cube (like a geometrical development of projections). The picture does not look very different from European technical drawings in engineering.

It does not signify that Werner did not see some advantages of primitive mentality. He mentions the fact that an Eskimo's map of a huge territory of sea and coast drawn from memory was comparable with an Admiralty chart of 1870 in accuracy, and a white man could not do it (p. 147). He also gives other similar examples. Yet in some cases his belief in the orthogenetic law seems to lead to conclusions which should be rethought.

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Biography

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