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How can we better identify the hidden intellectually-creative abilities of the gifted?

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Abstract

This article proposes a new approach to the psychological assessment of potential intellectually-creative abilities of the gifted based on the new cognitive-developmental theory of giftedness developed by the author. The major limitations of conventional intelligence tests are shortly analyzed. The nine methodological and procedural principles, which constitute this approach, are presented along with the examples of new intelligence tests. The principles state that new intelligence tests should first of all examine the psychological mental context generated by gifted individuals themselves. These tests should have an "open character," evaluate the basis of giftedness (not its numerous traits or manifestations), and allow both retrospective and prospective assessment. New tests should not evaluate psychological functions/processes (e.g., attention or memory) and mental speed, and they should not be very long or time-consuming. Cognitive styles, metacognitive and extracognitive abilities should also be assessed. Child's sensitive periods – which form the developmental foundation of giftedness – should be examined as well.

Key words: Cognitive-developmental theory of giftedness, psychological mental context, retrospective and prospective assessment, methodological and procedural principles, assessment of intellectual abilities.

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Introduction

Linda Silverman (2008) convincingly demonstrated that intelligence tests were, are, and will be the major instrument used to assess an individual's intellectual abilities and thus will remain the main tool to identify the gifted. Intelligence tests have been one of psychology's important technological innovations since the last century. Although modern information technology leads to the emergence of new technological innovations in psychology – for example, technologies related to cyberpsychology (Shavinina, 1998, 2000a, 2000b) – intelligence tests continue to be its most traditional and widespread technology. The problem with intelligence testing is that it is not developing very fast (Daniel, 1997; Flanagan & Alfonso, 1995; Esters, Ittenbach, & Han, 1997; Shobris, 1996; Sternberg & Kaufman, 1997; Sternberg, Wagner, Williams, & Horvath, 1995). The reasons for this have been thoroughly identified in the literature (Sternberg & Kaufman, 1997). The lack of satisfactory theories of human intelligence and intellectual giftedness, upon which any development of new assessment methods is based, is also one of the reasons. To understand the nature of human intelligence and intellectual giftedness means to understand what intelligence tests should measure, and how, as well as how to better identify the hidden intellectually-creative abilities of the gifted.

Intelligence testing may advance by being strongly influenced by current scientific data in general and by recent research findings from the psychology of high abilities in particular. This article presents one such attempt. It should be emphasized that this is the attempt to move the field of giftedness forward in the direction of the comprehensive assessment of high abilities, and specifically the measurement of potential gifts and talents of everyone. It is a disturbing reality that we do not have reliable and exact assessment methods, that would allow us to identify (not lose!) the hidden abilities of children and adolescents. Many examples demonstrate that giftedness of many geniuses and other highly accomplished individuals were overlooked in their early years. Albert Einstein is probably the best known of them (Shavinina, 2008a). This is an alarming thought that even today, more than a hundred years after Einstein's childhood, many individual gifts and talents are going to be lost because of a lack of appropriate assessment. If one thinks for a while about the impact of the gifted on society in general (Shavinina, 2008c) and their unique innovative abilities in particular (Shavinina, 2008b), then it is clear that the assessment of high ability is an extremely important scientific topic and the task of developing comprehensive and ideal identification methods is a great job for giftedness researchers of the future.

The purpose of this article is to offer a new perspective on the identification of gifted and talented children that is based on a new cognitive-developmental theory of giftedness (Shavinina, 2007, 2008a). The article consists of three sections. The first section describes theoretical foundations underlying the proposed approach. The second section discusses major limitations of traditional intelligence tests, which inspired my search for an alternative measurement of intellectually-creative abilities of the gifted. Finally, the third section presents a new approach to the assessment of intellectually-creative abilities that is based on nine relatively independent and at the same time interrelated principles. These methodological and procedural principles are considered below along with examples of new intelligence tests or, to be more accurate, sub-tests.

Theoretical basis: Cognitive-developmental theory of giftedness

My dissatisfaction with the existing psychological theories of human intelligence and giftedness was the first reason that led me to recognize an increasing need for an innovative approach to intelligence testing (Shavinina, 2001). Nonetheless, this is not the goal of this article to examine the advantages and shortcomings of the existing theories of intelligence and intellectual giftedness. It has already been done elsewhere (Detterman, 1994; Heller, Monks, Sternberg, & Subotnik, 2000; Kholodnaya, 1997; Neisser, Boodoo, Bouchard, Boykin, Brody, Ceci, Halpern, Loehlin, Perloff, Sternberg, & Urbina, 1996; Shavinina & Kholodnaya, 1996; Sternberg, 1985, 1990; Ziegler, 2008). Rather, the objective of the current section is to briefly outline the main facets of a new cognitive-developmental theory of giftedness, which provide the theoretical foundation for a new approach to the psychological assessment of intellectually-creative abilities of the gifted.

The theory of the individual intelligence was introduced by Kholodnaya (1990) and developed by Kholodnaya (1993) and Shavinina & Kholodnaya (1996) into the theory of intellectual giftedness. Shavinina (2007, 2008a) further developed it into the cognitive-developmental theory of giftedness. Kholodnaya (1993) demonstrated that the major difficulty in understanding the nature of intelligence and intellectual giftedness is that various traits, characteristics, properties, and qualities of intelligence and giftedness (i.e., their external *manifestations* in any real activity) have been the subject of psychological research; but the psychological basis (or psychological carrier) of these manifestations has not been studied (Kholodnaya, 1997; Shavinina & Kholodnaya, 1996; Shavinina, 2008a). Attempts to understand the nature of any psychological phenomenon solely on the basis of listening and describing its own characteristics, traits, features, qualities, and properties are unsatisfactory[2]. Vekker (1981) showed that contradictions and crises in psychology testify to this. The external manifestations of any psychological phenomenon can be investigated endlessly; however, the real, deep understanding of the phenomenon will not be attained.

In this light the only promising solution is to consider intellectual giftedness as the sum of its two important parts: the external manifestations of intellectual giftedness (i.e., its features, traits, characteristics, properties, and qualities) and the psychological basis of intellectual giftedness (i.e., the psychological carrier of these manifestations; Kholodnaya, 1993). A need for a new research direction was therefore highlighted. Specifically, it was argued that there is an urgent need to re-examine scholars' approach to the nature of intellectual giftedness as psychological phenomenon. It means that psychologists should not answer the question: "What is intellectual giftedness?" by listing its characteristics and traits (i.e., its external manifestations). Rather, they should answer the following question: "What is the carrier (a basis) of the characteristics and traits associated with intellectual giftedness?" (Kholodnaya, 1990; Shavinina & Kholodnaya, 1996; Shavinina, 2008a).

Kholodnaya (1993) argued that from this radically changed point of view, scientists should study an individual's mental or cognitive experience and, more precisely, the specificity of its structural organization. This experience is the psychological basis of intellectual giftedness. In other words, the individual cognitive experience serves as the psychological

[2] More and more researchers criticize the personality trait approach to the study of the gifted that exists in the field of giftedness (Shavinina, 1995; Ziegler, 2008).

carrier of numerous manifestations (i.e., features, traits, characteristics, properties, and qualities) of giftedness.

Following Kholodnaya (1997), I define human intelligence as a specific form of the organization of the individual mental or cognitive experience that is responsible for the effective perception and understanding of the surrounding reality. In turn, mental or cognitive experience is defined as a system of the available psychological mechanisms, which forms a basis for the human cognitive attitude to the world around and predetermines the specificity of his or her intellectual activity (Shavinina & Kholodnaya, 1996).

According to the cognitive-developmental theory of giftedness, the nature of giftedness is explained by its neuropsychological, developmental and cognitive foundations (Shavinina, 2007, 2008a). The neuropsychological foundation of giftedness is mainly connected with high plasticity of the brain of the gifted (Kalbfleisch, 2008), which is the basis of their unusual sensitivity. The first years of a child's life are characterized by a number of sensitive periods – periods of a child's heightened and very selective responsiveness to everything what is going on around him or her. Sensitive periods – which constitute the developmental foundation of giftedness – accelerate the child's mental development through the actualization of his or her intellectual potential and the growth of the individual's cognitive resources. The advanced intellectual development of the gifted during sensitive periods explains why gifted development is the uneven, asynchronous, or dyssynchronous, and, hence, unusual development. Periods of heightened (cognitive, emotional, and social) sensitivity is a real explanation of this specific development of the gifted (Shavinina, 1997, 1999).

The accelerated intellectual development of the gifted leads to the appearance of their unique cognitive experience. This experience – which consists of conceptual structures, knowledge base, and subjective mental space – is a cognitive basis of giftedness (Kholodnaya, 1993; Shavinina & Kholodnaya, 1996). The uniqueness of the cognitive experience of the gifted consists in its more complex, rich, integrated, differentiated and unfolded structural organization in comparison with the cognitive experience of those who were not identified as gifted (Shavinina & Kholodnaya, 1996). The cognitive experience manifests itself in a specific type of mental representations (i.e., how an individual sees, understands, and interprets everything what is going on in the surrounding reality; Kholodnaya, 1993). It means that gifted individuals have a unique intellectual picture of the world (Shavinina & Kholodnaya, 1996), which is responsible for their exceptional performance and/or achievements. In other words, the gifted see, understand, and interpret everything differently. The unique type of representations of the gifted or their unique point of view or their unique vision is the essence of giftedness (Shavinina, 2007, 2008). This is true for all categories of the gifted, including child prodigies, talented scientists of Nobel calibre, and great entrepreneurs (Shavinina, 2003, 2004, 2006).

The cognitive experience serves as a psychological basis for the three main levels of the manifestations of giftedness (i.e., its various characteristics, traits, properties, and qualities): intellectually-creative, metacognitive, and extracognitive abilities, respectively (Kholodnaya, 1993; Shavinina, 1994; Shavinina & Ferrari, 2004). That is, the gifted individuals' highly developed intellectually-creative, metacognitive and extracognitive[3] abilities are the manifes-

[3] The word *extracognitive* is probably not the best one, but it seems appropriate for the description of a wide range of phenomena at the current stage of research when scientific studies are not numerous and psychologists only relatively recently began to study extracognitive abilities.

tations of their unique cognitive experience (Shavinina & Kholodnaya, 1996; Shavinina & Sheeratan, 2004). Well developed extracognitive abilities testify to the highest level of the development of giftedness (Shavinina, 1995, 2004).

Therefore, according to the cognitive-developmental theory of giftedness, giftedness is a result of the protracted inner process of the construction and growth of the individual's cognitive resources leading to a unique cognitive experience beyond which there are periods of heightened cognitive sensitivity. The unique cognitive experience manifests itself in the gifted's unique intellectual picture of the world. The essence of giftedness is all about a unique point of view, a unique vision of gifted individuals. One of the most important aspects of this uniqueness is their ability to see everything in a highly objective manner, that is, the objectivization of cognition. In the context of this article, it is important to consider the fundamental issue of objective mental representations of reality in detail.

Mental representations as proto-phenomena of cognitive experience or why they are important for the identification of the gifted

Kholodnaya's (1990) investigations of the nature of human intelligence have shown that one of the basic phenomenons (i.e., proto-phenomenon) of an individual's intellectual life and his or her experience as a whole is one's representations. Kholodnaya (1990) found that the main function of intelligence consists in the construction of the adequate representations of reality. Indeed, many scientists have considered representations to be important in understanding the nature of human intelligence. Thus, Oatley (1978) argued that an individual's representations are, probably, the closest to the scientific understanding of intelligence. Klix (1988) pointed out that adequate representations are the foundation of all transformations, combinations, and reductions of information. Piaget (1969) asserted that logical reasoning is dependent on the structure of a child's representation of reality.

Krutetskii's (1968) studies of mathematically able children have shown that their problem representations extend beyond the given information and existing facts and they more readily determine the nature of missing and irrelevant data. Bamberger (1986) found that musically gifted children have an unusual capacity for representing musical relations to themselves in multiple ways and these multiple representations are conceived not as distinct but rather as intertwined and intersecting.

Contemporary cognitive psychology in the expert-novice paradigm also gives evidence of the importance of the phenomenon of representations in the understanding of the nature of giftedness (Chi & Ceci, 1987; Chi et al., 1981; Ericsson et al., 2008; Kanevsky, 1990; Schneider, 1993; Shore & Kanevsky, 1993; Sternberg & Powell, 1983). For example, Chi et al. (1981) demonstrated the main differences in problem representations between physics experts and novices. They found, for instance, that experts classified problems according to underlying principles and rules, whereas novices tended to use superficial meanings of words and diagrams for the aim of classification. Kanevsky's (1990) data also support the general notion in the expert-novice paradigm that experts represent problems differently from novices. "The high ability children more often commented on the commonalities in the rules, apparatus, and strategy. It was suggested that this was due to differences in their understanding or internal representation of the problem that made these commonalities more apparent to them" (Shore & Kanevsky, 1993, p.138).

Therefore, cognitive experience manifests itself in the specific types of representations. This means that intelligent persons in general – and particularly the gifted – see, understand, and interpret everything differently from other people. Specifically, they construct an individual intellectual picture of the world (of event, action, idea, problem, and any aspect of the surrounding reality) in a very objective manner, that is, exactly as the situation requires (Kholodnaya, 1993, 1997; Shavinina, 1996). Objectivization of cognition is thus a critical element of mental representations of the gifted. This is why their individual intellectual picture of the world or their point of view is a unique one.

To sum-up, a new approach to the psychological assessment of intellectually-creative abilities, which will be presented below, is based on the cognitive-developmental theory of giftedness briefly considered above. This theory brings a new perspective on the psychological understanding of the nature of giftedness and, therefore, calls for new methods for the adequate measurement of an individual's intellectual potential. This is not surprising at all: leading theorists in the field of psychological assessment (Hambleton & Slater, 1997; Hambleton & Wedman, 1997) emphasized that "emerging psychological theories such as those concerning intelligence, aptitudes... require the assessment of new or modified constructs" (Hambleton & Wedman, 1997, p.1). Consequently, it is reasonable to assert that one of the promising directions in the development of intelligence testing is to base the development of new tests on the cognitive-developmental theory of giftedness.

Limitations of traditional intelligence tests

My dissatisfaction with the conventional intelligence tests was the second reason leading to the development of a new approach to the psychological assessment of intellectually-creative abilities of the gifted. The aim of this section is to discuss some of the limitations of the traditional intelligence tests.

In general, within the conventional psychometric approach human intelligence has been regarded synonymous with high IQ. As it is well known, conventional intelligence tests focus mainly on IQ scores, which show how the intelligence of one individual is different from the intelligence of others. Nonetheless, IQ scores are not criteria for the real essence of an individual's intelligence (Feldman, 1982; Kholodnaya, 1997; Olson, 1986; Shavinina & Kholodnaya, 1996; Sternberg, 1985; Sternberg, Wagner, Williams, & Horvath, 1995; Wallach, 1992). A great body of literature has shown that, from the middle to the upper end of their range, scores on conventional tests of intellectual ability do not accurately reflect the nature of intelligence (Wallach, 1992). There are many reasons for this, which are certainly caused by the shortcomings of IQ tests. Consider two of them.

First, for the most part, psychometric intelligence tests measure factual or declarative knowledge, but not intelligence. The "Information" and "Vocabulary" subtests of the Wechsler intelligence scales are examples of such subtests. Since the main goal of traditional education consists in knowledge transfer from one generation to another, then it is not surprising that IQ tests focus on those manifestations of intellectual activity that are very close to academic success. The ability to solve various tasks and/or problems is a good example. Nevertheless, giftedness is not equal to problem solving. The cognitive developmental theory of giftedness considered above excludes the understanding of giftedness as the ability to solve problems.

Moreover, in spite of the importance of various kinds of knowledge in the contemporary understanding of human intelligence and giftedness (Chi & Ceci, 1987; Kholodnaya, 1997; Schneider, 1993; Shavinina & Kholodnaya, 1996; Sternberg, 1985), neither intelligence nor giftedness can be reduced to pure knowledge. From this point of view it is not surprising that a lot of tests, which were initially named as "intelligence tests" in the beginning of the 20th century, have later been re-named as "achievement tests" or "learning ability tests." However, as Sternberg (1988) convincingly underlined, although traditional intelligence tests tell us something about an individual's learning, they fail to measure his or her *ability* to learn. The concept of learning is not equal to the concept of the ability to learn.

Furthermore, along with the academic type of giftedness, which is usually assessed by conventional intelligence tests, there are also creative, practical, emotional, and social types of giftedness (Bar-On et al., 2008; Heng et al., 2008; Kaufman et al., 2008). IQ tests do not measure these types of giftedness, as well as a great variety of domain-specific types of giftedness (Persson, 2008; van Rossum, 2008).

Second, IQ tests reveal not so much the real intellectual abilities of an individual but rather the level of his or her socialization (Kholodnaya, 1997; Shavinina & Kholodnaya, 1996). It is quite clear that, for example, children from the middle and upper social classes have better access to the traditional and non-traditional institutions of elementary, secondary, and higher education. As a result of this, as well as because of the higher educational level of parents, families' educational traditions, and other forms of parental investment in their children's education (e.g., hiring private tutors for teaching special courses, and so on), kids from such families generally acquire a deeper knowledge. As conventional intelligence tests measure an individual's factual or declarative knowledge and simple skills, these children's IQ scores are usually higher than that of their peers from less privileged social classes. For instance, one seven-year-old boy, working on the "Vocabulary" subtest of the Wechsler Intelligence Scale for Children, third edition (WISC-III), told me: "Certainly, I know the complete definition of this word. It is exactly what my dad explained to me yesterday. He is a researcher in the University and currently works in this area." Definitely, the boy's high scores on this subtest were determined to some degree by his father's educational level and professional experience.

Other limitations of IQ tests are also well-known such as, the extreme emphasis on the mental speed and/or speed responses or the assessment of the level of the development of concrete psychological functions (e.g., attention, memory, and so on; Shavinina & Kholodnaya, 1996). Silverman (2008) very well described how to overcome some of these shortcomings in order to fully assess the intellectual potential of the gifted.

It should be acknowledged that these shortcomings of standardized intelligence tests, as well as the shortcomings described below, have generated appeals to the alternative assessment methods (Neisser et al., 1996; Sternberg, 1985, 1988, 1990) and have led some psychologists to real contributions to the field that can be called 'new intelligence testing.' The most known work in this area is that of Sternberg and his colleagues on the measurement of practical intelligence or common sense (Sternberg et al., 1995).

It is quite evident that traditional psychometric testing (i.e., the assessment of intellectual abilities via IQ scores) does not allow one to examine intellectual abilities in accordance with the cognitive developmental theory of giftedness (Shavinina, 2007, 2008a), and especially the cognitive basis of giftedness (i.e., an individual's cognitive experience). Taken together, these main reasons – both dissatisfaction with existing theories of intelligence and

the available assessment methods – have led me to the development of a new approach to the psychological testing of intellectual abilities that is presented below.

Psychological assessment of intellectually-creative abilities of the gifted: A new perspective

From my point of view the development of new tests for the psychological assessment of intellectually-creative abilities of everyone – and especially of hidden or potential abilities of the gifted – should be based on the following principles.

1. Intelligence tests should examine the *psychological mental context* generated by an individual.
2. Intelligence tests should have an *"open character."*
3. Intelligence tests should test the *basis of giftedness (i.e., the psychological carrier of the numerous manifestations of giftedness).*
4. Intelligence tests should not evaluate *psychological functions* (for example, short- and long-term memory, attention span, and so on); instead, they should measure intellectual abilities. Any psychological function, or even their combination, is not intellectual giftedness.
5. Intelligence tests should *avoid the emphasis on speed or speed responses.*
6. Intelligence tests should also measure *intellectual potential or hidden abilities,* not only *actual intellectual abilities.* In other words, intelligence testing should not be exclusively *retrospective* in its measurement of an individual's intellectual resources; it should be *prospective*, too.
7. Intelligence tests should analyze personal *cognitive styles.*
8. Intelligence tests should estimate an individual's *metacognitive and extracognitive abilities.*
9. Intelligence tests (or their subtests) should not be very long, and, as a consequence, time consuming.

These principles concern various facets of intellectual giftedness, both methodological and procedural ones (i.e., *what* should be included in new testing and *how* it should be measured). Very roughly, the above-presented principles can thus be categorized as the methodological and procedural principles.

Psychological mental context

The first and the most fundamental methodological principle of a new approach to the development of new intelligence tests is the requirement to examine the *psychological mental context* that is generated by an individual (Shavinina & Kholodnaya, 1996). Oatley (1978) first mentioned this idea in his research on human representations. The need to examine the psychological mental context generated by people themselves implies that new intelligence tests do not contain tasks or problems already prepared by test developers.

The ability to solve problems is one of the important manifestations of intellectual giftedness. Nevertheless, it is not a reason to include items on problem solving in intelligence

tests. First, giftedness has a lot of its internal and external manifestations and it is not possible to assess all of them by any intelligence test. Second, and the most important, as it follows from the above presented definition, giftedness is not problem solving. Therefore, the new generation of intelligence tests should not examine human ability to *solve* problems. Or, on the other hand, tests that estimate problem solving abilities should be called appropriately: tests of problem solving abilities, but not intelligence tests.

Performing on new intelligence tests, examinees should not find any correct or quick solutions. Instead, they are asked to generate something that has never existed before; that is, the individual mental context. Examinees are free in their choice of the direction of the generation of their mental contexts. They are also not limited in the content of their mental contexts. Because of that each mental context is really the *individual* mental context. Basing intelligence testing on the examination of people's mental context allows psychologists to avoid many misunderstandings, which occur in standardized intelligence tests.

For instance, criticizing the conventional intelligence tests, Olson (1986) reasonably noted that there is a difference between the meaning of a written word for test developer(s) and how it will be understood by examinee(s). Unfortunately, the absolute coincidence of the interpretations of test developer(s) and examinee(s) is not a case of traditional intelligence tests. This "dissonance of understandings" was also underlined by Sternberg (1985), when he concluded that very low scores on IQ tests "often result from an examinee not quite understanding what is required by the tasks at hand" (p. 300).

Another example of misunderstanding in IQ tests is a situation when "in figural reasoning items, examinees sometimes find that none of the answer options appears to be correct; such an outcome often results from representing the geometric structure of the item in a way different from that intended by the item writer" (Sternberg, 1985, p. 300). It looks like the best way to overcome these problems of misunderstanding is to provide an opportunity for examinees to generate their individual mental contexts by themselves.

The possible examples of new intelligence tests directed to measure an examinee's mental context are such tests as "Ideal Computer" and "Conceptual Synthesis." They will be presented below as I used them in the experimental studies with intellectually gifted adolescents. The results of these investigations with a detail description of new assessment methods were presented in Shavinina & Kholodnaya (1996).

The "Ideal Computer" test (Shavinina & Kholodnaya, 1996) is used to examine how the gifted see, understand, and interpret the world around as a whole; that is, to assess their individual representations in general. To measure this type of representations, examinees are instructed in the following way: "Just imagine that there is an ideal computer of the latest generation that knows absolutely everything about everything and can answer any of your questions. You can communicate with it for ten minutes. Please, write down any questions you would like answered."

Scores are based on the following parameters:

a) general number of questions;
b) the number of objective questions, which are directed to the understanding of problems of the external world and which are connected to the actualization of certain elements of objective knowledge about the world (e.g.: "Is there an end of the Universe?", "Will new inexhaustible sources of energy be discovered?", "How can military conflicts be prevented?", "Are there any inhabited worlds in the Universe?");

c) the number of subjective questions, which are related to the actualization of personal problems and which focus on personally important situations (e.g.: "When will I get married?", "What will my faith be?", "How many children will I have?", "How can I overcome the negative features of my character?");
d) the number of categorical questions, which are characterized by the most general consideration of all aspects of the surrounding reality and the world around us (e.g.: "What will happen to mankind in the future?", "What are the rules of people's relationships?", "What are the natural laws of the structure of the Universe?", "Is there the most general principle in the organization of nature?");
e) the number of concrete questions, which are related to a single concrete fact (e.g.: "How many stars are there in the sky?", "When will I die?", "How much does the most modern stereo-system cost?", "What will I get on the mathematics exam?").

"Conceptual Synthesis" is used to examine the conceptual representations of intellectually gifted individuals. This test is Shavinina & Kholodnaya's (1996) modification of Abracham's test of cognitive synthesis (Arina & Koloskova, 1989). The essence of the test is that examinees are given three words that are not connected to each other by meaning. They belong to three different, remote semantic categories (for example, "sandstorm – computer – safety pin", "lightning – ruler – wheel", "chain – fire – watch," and others). According to the instruction, examinees should establish any possible kinds of connections between these words that would have meaning and write the connections down. The test is proposed five times (three new words are given every time). The scores are for:
a) the complexity of established connections (i.e., total number of all connections in quantitative marks); and
b) the number of connections, which are evaluated by maximum mark.

The estimation criteria (on the example of "chain – fire – watch") are: 0 mark – if only two words are connected to each other (for example, "A chain can be changed by fire"; "A wrist-watch can be on the chain", and so on); one mark – if connection is established only on the basis of simple enumeration of objects and phenomena or their formal contradiction (for example, "A wrist-watch can be changed in the fire, but a chain cannot;" "Fire can be blown out by chain and a wrist-watch can be broken by a chain"); two marks – all three words included in a certain concrete situation (for example, "I see such a picture: Prometheus stands near Olympus with a golden watch on the hand; he shackled in the chains and his death from fire is coming soon"); three marks – all three words connected with a help of some general categorical concept or with a help of some reason-consequences connections (for example, "Fire is a chain of the subsequent processes of oxidation; a watch is a chain of the subsequent positions of pendulum; and a chain consists of a few connected subsequent links").

One can see that performing these tests examinees do really generate some individual mental context, instead of task or problem solving that constitutes the essence of conventional intelligence testing. Traditional intelligence tests are closed with respect to people's possibility to generate subjective mental context.

"Open character"

The next principle is closely related to the first one. It states that new *intelligence tests should have an "open character."* It means that their instructions should not indicate or predetermine the possible "space" or direction for the generating of individual mental context. Any such indications can lead to the limited "framework" within which an examinee will attempt to produce his or her mental context. Thus, according to the instruction of the "Ideal Computer" test, examinees can write down any questions they want. It is not to say, for example, that examinees should write questions concerning some concrete topic. In the same way, according to the instruction of the "Conceptual Synthesis" test, examinees can establish any possible kinds of connections between three words, as many as they want. Definitely, the more restrictions will be in the instruction, the less complete and rich mental contexts will be produced by examinees.

This principle fits well into the numerous observations of psychologists (Csikszentmihalyi, 1992; Dewey, 1919; 1938; Getzels & Csikszentmihalyi, 1976; Wertheimer, 1959) and outstanding genius scientists (Einstein & Infeld, 1938; Vernadsky, 1988) about the specificity of their exceptional intellectual functioning and the importance of certain kinds of mental activity for extraordinary intellectual achievements. Thus, they pointed out that an individual's abilities to problem finding and posing the right questions are more important in prominent scientific discoveries than reaching the right solutions to the problems. For example, Albert Einstein (Einstein & Infeld, 1938) asserted that "the formulation of a problem is often more essential than its solution, which may be merely a matter of mathematical or experimental skill. To raise new questions, new problems, to regard old problems from a new angle, require creative imagination and mark real advances in science" (p.92).

Unfortunately, conventional intelligence tests are mainly directed to the solving of the already formulated – by others – problems and/or tasks. Traditional IQ tests do not have an open character: they do not provide a maximal "space" for examinees' mental initiative that can express itself in problem finding, new ideas generation, raising new questions, and so on, beyond which is the individual mental context. Examinees should be free to produce their mental context without any restrictions. In this light it seems appropriate to give an example of another test, the "Formulation of Problems" test, which is used to measure conceptual representations or conceptual thinking of intellectually gifted adolescents (Shavinina & Kholodnaya, 1996).

According to the instruction of the "Formulation of Problems" test, (Kholodnaya, 1983), the examinee is an investigator and the word, given by tester, is the subject of his or her research. The examinee formulates problems, which occur in his or her mind in connection with a given subject. Two words, for example, "illness" and "soil", can be the subjects. Examinees are instructed as follows: "Imagine, that you are a scientist. "Illness" is the subject of your research. Please, write down the problems, which you would study in connection with this subject." The parameters considered are:

a) the complexity of all formulated problems in quantitative marks; and
b) the number of problems, which are evaluated by the maximum mark.

The scoring for word "illness" is as follows: 0 mark – the problem is being formed on the basis of the examinee's evaluation and subjective impression (e.g., "Where and how is it better to train doctors?", "What is the influence of part of the day on a sick man?"); one

mark – the problem is being formed by grouping some particular characteristics or properties of the proposed object (i.e., of the term "illness." For example, "What are the reasons for illness?", "What are the methods of illness prevention?"); two marks – the problem is being formed through the conjunction of the term "illness" to another semantic field, which is quite remote from the considered term (for example, "What is the connection between "illness" and the way of life and profession?", "What is going on with illness on different stages of the development of human being?"). Examinees are given as much time as they need to perform the "Conceptual Synthesis" and "Formulation of Problems" tests.

Basis of giftedness

The third principle states that new intelligence tests should first of all be directed to the versatile examination of the various aspects of the basis of giftedness considered above (see the section on the cognitive-developmental theory of giftedness), but not its numerous manifestations. As it is well known, giftedness has so many internal and external manifestations (Shavinina, 1995, 1997) that it is difficult to take all of them into account in any test. In such a case the above-proposed distinction between the "manifestations" of giftedness and its "basis" (i.e., the psychological carrier of these manifestations) is very useful. In accordance with the cognitive developmental theory of giftedness (Shavinina, 2007, 2008a), a need to examine the basis of giftedness means a need to examine an individual's cognitive experience that expresses itself in unique representations.

It seems that one of the main factors generating many shortcomings of IQ tests is related to the fact that characteristics, features, properties, and qualities of giftedness (i.e., its manifestations) have been the focal point of intelligence testing; but the psychological basis (or psychological carrier) of these manifestations has not been examined. Working on the development of new intelligence tests, psychologists should make assessment of the basis of giftedness – that is, a psychological carrier of its numerous manifestations – a priority.

Thus, the above-described tests are addressed to the measurement of the fundamental components of an individual's cognitive experience that forms the basis of giftedness. For instance, the "Ideal Computer" test is mainly directed to the evaluation of a global type of representations (i.e., how an individual sees, understands, and interprets the world around as a whole) and to the estimation of the degree of objectivization-subjectivization of cognition (Shavinina, 1996). The "Formulation of Problems" and "Conceptual Synthesis" tests examine conceptual representations that underlie conceptual thinking.

The "Ecological Forecast of Future Development of the Earth" test (Shavinina, 1993) is used to study representations of future events. Polak's (1973) research demonstrated the importance of the concrete and rich images of the future for the advanced development of human civilization. In turn, Torrance (1979, 1980) found that gifted adolescents are distinguished by an amazing ability to forecast future events (Cramond, 2008). The following instruction is given to examinees: "Imagine that you are a science fiction writer who is able to predict future events. Please describe your predictions about the ecology of the Earth 50 years from now." Scores are for:

a) the differentiation of forecast (i.e., the number of those concrete aspects of the future that have been predicted); and

b) the optimistic, pessimistic, or neutral forecast (i.e., positive, negative, or neutral vision of the future).

Does not test psychological processes or functions

According to the fourth principle, new intelligence tests should *not examine the development of psychological functions* (for example, attention or memory). Any psychological function or process or even their combination (i.e., all possible processes of human cognitive system) do not adequately reflect the essence of giftedness. It means that psychological processes or functions and the nature of giftedness are not the same. Therefore, they cannot be viewed as synonyms and, moreover, they cannot be substituted for one another.

As one can see from the above examples of new intelligence tests, they do not measure an individual's concentration of attention or short- and long-term memory, as many sub-tests of virtually all current IQ tests do. The "Digit Span" subtest of the WISC-III is the example of such a subtest devoted to assess children's mnemonic functions. However, the results of child's short- and long-term memory test tell us very little, if anything, about the essence of his or her intelligence or giftedness and certainly nothing about his or her hidden, intellectual potential.

Conventional intelligence tests can be called "tests of psychological functions," because they mainly examine the extent to which any given psychological function is developed. This is why it was emphasized above that traditional intelligence tests evaluate those manifestations of intelligence that are strongly related to academic success. This is also why IQ tests measure learning ability and academic achievement, but not intelligence.

When conventional intelligence tests are viewed as "tests of psychological functions," they have a certain value. For instance, sometimes it is necessary, for a number of purposes (e.g., school admission, clinical diagnosis, and so on), to know the achieved level of development of a child's psychological functions. In this case standardized intelligence tests measure the important things (e.g., memory processes). Nevertheless, the word "intelligence" should be eliminated in the title of these tests. Adherents of psychometric intelligence testing must call things by their real names: they should acknowledge that they deal with "tests of psychological functions," but not with intelligence tests.

No emphasis on mental speed

The fifth principle asserts that new intelligence tests should *avoid the emphasis on speed or speed responses* that characterize many psychometric and even information-processing measurements of intelligence. Silverman (2008) analyzed this issue very well. Although good speed responses can have great value (e.g., for air traffic controllers), in reality any important intellectual achievement cannot be obtained during seconds, minutes, hours, or even days (Davidson, 1986; Kholodnaya, 1997; Shavinina & Kholodnaya, 1996; Sternberg, 1985, 1988). Even our daily decisions need and take much more time than is allowed by many items on conventional intelligence tests. This fact should be taken into account by the developers of new intelligence tests.

Sternberg (1985) pointed out that one of the critical shortcomings of psychometric intelligence tests is their reliance upon the incorrect view that the speed of mental functioning is a crucial aspect of intelligence. It is often claimed that "the strict timing of such tests merely mirrors the requirements of our highly pressured and productive society. But for most of us, these seem to be few significant problems encountered in work or professional life that permit no more than the 5 to 50 seconds allowed for a typical test problem on a standardized test" (Sternberg, 1985, p. 302). Furthermore, "the assumption that more intelligent people are rapid information processors also underlies the overwhelming majority of tests used in identification of the gifted, including creativity as well as intelligence tests" (Sternberg, 1985, p. 301).

Rabbitt's (1996) studies have found that speed is not a global performance characteristic of the cognitive system: in other words, intelligence is not just mental speed. Even much more early, the classic research on reflectivity-impulsivity cognitive style demonstrated that a reflective cognitive style is connected to greater intelligence in comparison with an impulsive cognitive style (Baron, 1982; Kagan, 1966; Kagan, Rosman, Day, Albert, & Phillips, 1964). Recent investigations on reflectivity-impulsivity cognitive style and its relationship to intelligence and intellectual giftedness support this finding (Kholodnaya, 1990; Shavinina & Kholodnaya, 1996).

Any orientation of psychologists on speed parameters leads to the substitution of the real nature of giftedness by people's rapid responses. The above-mentioned theoretical foundations of my approach to the assessment of intellectually-creative abilities have nothing in common with rapid responses. In new intelligence tests examinees have either (1) as much time as they need (e.g., "Formulation of Problems" and "Conceptual Synthesis" tests), or (2) a certain time – for example, ten minutes – to accomplish some tests (e.g., the "Ecological Forecast of Future Development of the Earth" and "Ideal Computer" tests). Nonetheless, time restrains are very flexible in the latter case; the tester may allow additional 1-3 minutes. After the frequent administration of these tests, I concluded that ten minutes is enough, because about 97% of all examinees finish them during this time period. It should be noted that for the most part I do not say before the administration of these tests that examinees have 10 minutes. After ten minutes I simply say that they should already finish. Moreover, the experience demonstrates that there is nothing wrong in interrupting an examinee's work on these tests after ten minutes, because they have already generated a certain mental context and its basic characteristics are clear. In other words, an individual can present a real "picture" of his or her mental context, generating something essential even within a limited period of time. Silverman (2008) excellently described how users of traditional intelligence tests can avoid an extreme emphasis on mental speed when they deal with gifted children.

Both retrospective and prospective assessment

Conventional intelligence tests measure an individual's *actual* intelligence. Test makers assert that these tests assess intellectual *abilities*, basic intellectual *processes* or *functions,* intellectual *qualities* and *properties,* and so on. These assertions are not important in the context of this section. The principal thesis here is that all IQ tests examine *actual* (i.e., existing at the time of measurement) intelligence of a person. In addition, new intelligence tests should also assess *intellectual potential,* not only *actual intellectual abilities.* Therefore,

according to the sixth principle of a given approach, intelligence testing should not be exclusively *retrospective* in its measurement of an individual's intellectual resources; it should also be *prospective.* In other words, testers should try to predict the further development of an individual's abilities, explaining the conditions under which this development will be possible.

This principle, as well as the trajectory of the actualization and development of hidden abilities, is closely related to Lev Vygotsky's notion of the "zone of potential (or proximal) development." He defined it as "the distance between the actual developmental level and the level of potential development" (Vygotsky, 1978, p. 86). He insisted that psychologists should be prospective as well as retrospective in the understanding and assessment of an individual's abilities. "The zone of proximal development defines those functions that have not yet matured but are in the process of maturation, functions that will mature tomorrow but are currently in an embryonic state. These functions could be termed the "buds" or "flowers" of development rather than the "fruits" of development. The actual developmental level characterizes mental development retrospectively, while the zone of proximal development characterizes mental development prospectively" (Vygotsky, 1978, pp. 86-87).

Definitely, it is not easy to develop such tests that could assess the intellectually-creative *potential* or hidden abilities. Brown and her colleagues have made a well-known attempt in this direction trying to measure the "zone of proximal development" (Brown, 1979). This is one of the possible directions for the development of new intelligence tests. Other ways also exist. As it follows from the theoretical foundations that underline the considered approach to the assessment of intellectual abilities, one of its fundamental ideas is a need to examine an individual's representations (i.e., both verbal and visual representations, representations of the future, representations of the world as a whole, and so on). A comprehensive "picture" of the individual pattern of representations – that is, his or her unique point of view – should be one of the results of the psychological measurement of giftedness.

As the individual type of representations is a proto-phenomenon of the intellectual life of a person (Shavinina & Kholodnaya, 1996), this "picture" sheds light on his or her intellectual *potential* or hidden abilities. Therefore, one can predict the further development of an individual's intelligence on the basis of the information about his or her potential intellectual abilities. For instance, research demonstrates that objective representations are highly associated with giftedness (Shavinina, 1996; Shavinina & Kholodnaya, 1996). Consequently, if an examinee's pattern of individual representations is highly objective (for example, on the "Ideal Computer" test), then this is a powerful predictor of his or her developing giftedness. Certainly, in order to be more precise about the specificity of the subsequent intellectual growth of a person, psychologists should have as many of these powerful predictors as possible. A given approach to the assessment of intellectual abilities allows developers of new intelligence tests to develop a wide range of such predictors (Shavinina, 1996, 1997, 2003).

Cognitive styles as an important part of intelligence testing

Although cognitive styles belong to the manifestations of giftedness in accordance with the cognitive-developmental theory (Shavinina, 2007, 2008a), it is expedient to include the measurement of cognitive styles in new intelligence tests. Cognitive styles refer to individual differences in human information processing. They thus provide valuable information about

the fundamental cognitive mechanisms, which influence the specificity of an individual's cognitive experience (Shavinina & Kholodnaya, 1996). The seventh principle, therefore, states that new intelligence tests should examine people's *cognitive styles.*

For example, originally introduced by Kagan, Rosman, Day, Albert, & Phillips (1964), reflectivity-impulsivity cognitive style displays individual differences in the speed and accuracy with which people propose and formulate hypotheses and make decisions under conditions of uncertainty. Experimental studies showed that intellectually gifted individuals are distinguished by reflective cognitive style (Shavinina & Kholodnaya, 1996). They make fewer errors in the situation of multiple choices according to Kagan's Matching Familiar Figures (MFF) Test. From the viewpoint of basic cognitive mechanisms it means the gifted's accurate analysis of visual space up to the moment of making decisions. The explanation is that probably the gifted are more careful in evaluating alternatives, hence making few errors; whereas average people presumably hurry their evaluation and thereby make numerous mistakes. The active character of visual scanning by the gifted indicates, in particular, a capacity to delay or inhibit a solution in MFF test performance containing response uncertainty, and also a capacity to differentiate unimportant and essential features of the external stimulus. Because of that Kagan's MFF test can be included in new intelligence tests. Other cognitive styles (e.g., cognitive complexity-simplicity) are also important for the understanding of an individual's cognitive experience and, consequently, his or her intellectual abilities.

Metacognitive and extracognitive abilities as integral part of intelligence testing

Although the cognitive-developmental theory of giftedness views metacognitive abilities among the manifestations of giftedness, according to many psychological accounts, these abilities form the basis of intelligence (Brown, 1978, 1987; Butterfield, 1986; Campione & Brown, 1978; Flavell, 1976; Sternberg, 1985, 1988). Metacognition really provides a lot of important information about an individual's giftedness. Knowledge about one's own intellectual creative abilities and the whole cognitive set-up, evaluating their efficiency, advantages and limitations, as well as planning, monitoring, and executive control are among important metacognitive abilities (Brown, 1978, 1987; Flavell, 1976; Pressley, Borkowski, & Schneider, 1987; Shavinina & Kholodnaya, 1996; Shore & Dover, 1987; Shore & Kanevsky, 1993; Sternberg, 1985).

Moreover, research showed that less intelligent persons are characterized by less metacognitive understanding of their own cognitive processes and of how the functioning of these processes depends upon the environment. It is also found that less intelligent people use less complete and flexible executive processes for controlling their thinking (Butterfield, 1986). Furthermore, it is important to know not only what we know, but also what we do not know and how to compensate for what we do not know. New intelligence tests should, therefore, provide important information about an individual's compensatory mechanisms. Because of this, the eighth principle asserts that the *assessment of metacognitive abilities should be an integral part of intelligence testing.* Kagan's MFF test can be used to measure some aspects of metacognitive abilities. Extracognitive abilities (i.e., specific feelings, intentions, beliefs, preferences, values, and intuition) constitute the highest level of the manifestations of giftedness (Shavinina, 2007; 2008a). Intelligence tests should thus measure various aspects of extracognitive abilities (Shavinina & Ferrari, 2004; Shavinina & Sheeratan, 2004).

Intelligence tests should not be very long or time consuming

According to the ninth principle of a given approach to the psychological assessment of intellectually-creative abilities, new intelligence tests and their subtests *should not be very long* and time-consuming. Long tests can be increasingly boring for examinees. The absence of the elementary interest in tests implies the emergence of such shortcomings as non-actualization of intellectual potential, incomplete display of available abilities, and various manifestations of psychological defense. With respect to the above mentioned new intelligence tests (or their subtests), the performance time for each of them should not exceed 10 or 20 minutes.

Some tests do not require any time prescription at all, because they are performed extremely rapidly due to their essence. An example of such type of test is the "Grouping Dots" test, Shavinina & Kholodnaya's (1996) modification of Frumkina's (1984) test. This test is used to measure visual representations. As human cognitive experience expresses itself not only in the verbal-oral register, visual representations should also be examined. We have found that intellectually gifted individuals see, understand, and interpret the surrounding reality and the world around uniquely in the different cognitive registers: in verbal-oral, visual-spatial, and sensitive-sensory (Shavinina & Kholodnaya, 1996). Therefore, it is not possible to understand the nature of an individual's cognitive experience and, consequently, his or her giftedness without examining the visual type of representations.

"Grouping Dots" test is directed to assessing perceptual structuring under conditions of perceptual uncertainty. Examinees are given a piece of paper (15 x 10 cm) with some multitude of dots on it. The dots are arranged in the following way. Some dots are located close to each other forming gestalts; other dots are randomly placed throughout the piece of paper. According to the instruction, each examinee should group these dots by any convenient and natural way according to his or her point of view. The parameter considered is: the complexity of the accomplished structural reorganizations (in quantitative marks). The scoring criteria are: one mark – global grouping (i.e., any attempts of structuring of a given multitude of dots absent); two marks – the unclear grouping of three basic gestalts; three marks – the clear structuring on the basis of grouping of three basic gestalts including the organization of other dots in certain structures (forms); four marks – the multidimensional structuring (i.e., the grouping of three gestalts, overlapping of multitudes of grouped dots, combining the same dots, which have already been attributed, to different groups).

Summary

This article presented a new approach to the psychological assessment of intellectually-creative abilities of the gifted that is based on the cognitive developmental theory of giftedness. The approach consists of nine fundamental principles. These principles underlie the development of new intelligence tests and sub-tests, some of which were described above. Definitely, a lot of work has to be done on the standardization, reliability, and validity of these tests. It should be emphasized that due to the fundamentally changed approach to the assessment of intellectual abilities (for example, in these tests examinees themselves should generate some psychological mental context), traditional procedures – IQ tests or reasoning tests – cannot serve as an external validity criteria. In my experimental studies of intellectu-

ally gifted adolescents their real intellectual achievements in mathematics and physics were used as external validity criteria. It was argued that new intelligence tests have discriminant validity because they allow us to differentiate between ordinary students and students who are the winners and participants in the international Olympiads on mathematics or physics (Shavinina & Kholodnaya, 1996). Certainly, research on external and discriminant validity must be done.

In accordance with the cognitive-developmental theory of giftedness three levels of the manifestations of giftedness should also be assessed (e.g., metacognitive and extracognitive abilities). The information about a child's sensitive periods and his or her strong interests should be gathered from parents and other caregivers. These findings are important for understanding the developmental basis of each child's giftedness.

To sum-up, this article offered a new approach to the identification of gifted individuals via the measurement of their hidden or potential intellectually-creative abilities. This approach opens a new direction in the development of intelligence testing. Definitely, the approach does not account for all possible facets of the measurement of giftedness, and sometimes it is both vague and speculative in some of its formulations. Nevertheless, it provides a useful attempt to understand how the psychological assessment of intellectual and creative abilities of the gifted can be developed in the future.

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