

# What Does Research on Child Prodigies Tell Us About Talent Development and Expertise Acquisition?

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**Abstract:** Research on child prodigies in general and the cognitive-developmental theory of the child prodigy phenomenon in particular shed light on the nature of talent development and expertise acquisition. According to the theory, this phenomenon is a result of an exceptionally accelerated mental development during sensitive periods that leads to the fast growth of a child's cognitive resources and their construction into specific cognitive experience. This is how human expertise is acquired. The cognitive experience is a psychological basis of extraordinary intellectually creative achievements, which expresses itself in the prodigy's unique intellectual picture of the world. The psychological nature of the prodigy phenomenon is thus formed by the sensitive periods – which explain prodigious development and talent development – and by cognitive experience, which explains prodigies' exceptional performance and achievements.

**Keywords:**

child prodigy phenomenon, giftedness, talent development, expertise acquisition, cognitive experience, sensitive periods

## Introduction

From all possible types of gifted children, the exceptionally highly developed abilities in very young children – often called 'child prodigies' – attract constant attention of researchers and lay people. The most fascinating thing about child prodigies is that they are able to do something that is usually accomplished only by adults. However, similar talents and gifts in adults are not so impressive. This is exactly where the puzzle is hidden: in the age of child prodigies. Age means development and this is a key to the explanation of the nature of the child prodigy phenomenon.

The significance of the concept of age for explaining the prodigy phenomenon can be found in Feldman's (1986b) definition of prodigy. According to him, "a prodigy is a child, who before the age of 10, performs at a level of an adult professional in some cognitively demanding field" (p.161). Using this age boundary, Shavinina's (1999) definition of child prodigy is as follows: "a prodigy is a child who, before the age of 10, displays extraordinary intellectual-creative performance and/or achievements in any type of a real activity" (p. 26). She differentiates between general and special types of prodigies. Prodigies in art, chess and music belong to special types. Prodigies who manifest advanced level of thinking constitute the general type. At the same time, all prodigies are mental prodigies, because all of them display intellectually creative performance or achievements in various fields of human activity.

The cognitive-developmental theory of the child prodigy phenomenon states that the underlying mechanism of the prodigy phenomenon is characterized by sensitive periods. During children's individual development there are periods of high sensitivity, known as the sensitive periods, during which the cognitive and intellectual development are extremely accelerated. This is why the mental development of gifted and talented children in general – and prodigies in particular – is advanced. It leads to the rapid growth of a child's cognitive resources and their construction into a unique cognitive

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experience. Human expertise is acquired in this way. An individual's cognitive experience is the psychological basis of extraordinary intellectually creative achievements, which expresses itself in the prodigy's specific intellectual picture of the world. The psychological nature of the prodigy phenomenon is thus formed by the sensitive periods – which explain prodigious development and talent development in general – and by cognitive experience, which explains prodigies' exceptional performances and achievements. The same mechanism – sensitive periods-cognitive experience – is behind talent development and expertise acquisition. In other words, the child prodigy phenomenon is a particular case of talent development and expertise acquisition. Therefore, if we fully understand the nature of this phenomenon, we understand how talents develop and expertise is acquired.

In the sections that follow I will analyze the existing publications on child prodigies, present the cognitive-developmental theory of the prodigy phenomenon, and show how this theory explains talent development and expertise acquisition.

## **The Developmental Essence of the Child Prodigy Phenomenon: A New Approach**

It is impossible to understand talent development without understanding the nature of the child prodigy phenomenon. Shavinina's research demonstrates that this phenomenon is a pure developmental phenomenon (1999, 2009). Before presenting the cognitive-developmental theory of the prodigy phenomenon, let's first of all to briefly consider the existing studies in this area. It should be noted that the purpose of my research on the child prodigy phenomenon is more to understand its inner or fundamental mechanism than various external factors or forces (for example, social or historical) that can increase the probability of the appearance of prodigies. To understand the inner/fundamental mechanism of the prodigy phenomenon means to understand how this phenomenon develops *within* the child. Social milieu is important, but it is only an external factor in the development of prodigies. Any external factors or forces do not provide scientific explanations of the prodigy phenomenon. Therefore, the analysis of the existing studies on child prodigies will be made according to how the real nature (i.e., inner mechanism) of the prodigy phenomenon is explained in these studies.

### **What Does Literature Tell Us About Child Prodigies?<sup>1</sup>**

Revesz's (1925) research on a seven-year-old music prodigy and Baumgarten's (1930) study of nine child prodigies were probably the first psychological studies of the prodigy phenomenon. These studies were entirely descriptive and focused mainly on the listing of children's characteristics and traits. Any field of science began from descriptive stages of its development. Nonetheless, listing the various musical, intellectual, emotional, personality, and other characteristics of prodigies constitutes the traditional trait approach in the psychology of giftedness (Shavinina, 1995), which reveals little about the essence of the prodigy phenomenon. This approach is not a promising one, because it is unknown whether the child's various traits predetermine his or her prodigious potential, or whether the latter leads to a specific reorganization of the prodigy's mind and personality that result in his or her exceptional performance and achievements.

In the late 1950s Natan Leites began his research on child prodigies in the former Soviet Union. He found that the prodigy phenomenon can be explained by high mental activity, well-functioning self-regulation, and a child's age sensitivity or developmental sensitivity. High mental activity includes the ability to pursue mental work for a long period of time, a permanent need for intellectual activity, extraordinary curiosity, and a wide range of interests (Leites, 1960, 1971, 1996). Leites's understanding of self-regulation is identical to regulatory processes in the structure of metacognition, which are responsible for planning, monitoring, and executive control (Brown, 1978, 1984; Flavell, 1976; Pressley, Borkowski, & Schneider, 1987; Shavinina & Kholodnaya, 1996; Shore & Dover, 1987; Shore &

Kanevsky, 1993; Sternberg, 1986a). High mental activity and well-functioning self-regulation can be viewed as important manifestations of the prodigy phenomenon, but not as its inner mechanism. Leites's notion of age sensitivity has a great potential to advance psychological knowledge about the nature of the prodigy phenomenon (to be analyzed below).

### **Co-Incidence Theory of the Child Prodigy Phenomenon**

David Feldman (1986b) proposed a co-incidence theory of the prodigy phenomenon as a result of his study of six child prodigies. Co-incidence means "the melding of the many sets of forces that interact in the development and expression of human potential" (Feldman, 1986b, p.11). Among such forces, he distinguished biological qualities, individual psychological qualities, proximal context (i.e., child's external surrounding), intermediate context (i.e., family structure and its traditions), domain and the surrounding field (a key aspect of Feldman's theory), and distinct context (i.e., social-historical factors). The prodigy phenomenon is a result of a concordance of the forces of co-incidence leading to the exceptional manifestation of an individual's potential.

It looks like this theory has serious limitations. It seems that Feldman's theory can explain everything: the nature of giftedness, talent, genius, creativity, intelligence, and wisdom. Moreover, it can be applied with the same success to a wide range of brilliant manifestations of the human mind (for example, various intellectual traits and characteristics). Feldman stated that the co-incidence theory seeks to explain all human achievement, not only the prodigy phenomenon. Nevertheless, this is not entirely correct, because the above mentioned phenomena – according to the existing research – are not the same. Intelligence, creativity, giftedness, wisdom, talent, and genius are different, at least at the level of their manifestations. Even if we suppose that differences in their natures are not particularly large, the same theoretical framework is insufficient for understanding them, because it is always possible to find something that would be different for each case, as, for example, the level of manifestations. That is, manifestations of wisdom are not identical to those of giftedness, and so on.

Therefore, Feldman's claim about the capacity of the co-incidence theory to explain all human achievement is not correct. In fact, his conclusions are correct in a slightly different sense: namely, that the forces of co-incidence are indeed important factors and probably necessary conditions for the emergence of any human achievement, including a prodigy's performance. Nonetheless, they can be viewed only as factors or conditions, not as something universal that can explain everything.

On the other hand, the following question arises: Are all of Feldman's factors sufficient for the exceptional development of human potential (as, for example, in the case of prodigies)? The answer is not particularly clear. For instance, there are many families providing good external conditions (i.e., proximal and intermediate contexts) for the development of their children. Suppose these children have the necessary individual psychological qualities (in the sense of Feldman). Finally, assume that all the social and historical factors are favorable. However, these children are not prodigies. Therefore, something else predetermines the development of prodigies.

### **The Socio-Cultural and Multidimensional Perspectives**

The social-cultural and multidimensional perspectives can be found in the research literature about child prodigies. The main methodology of these studies is related to the application of the case-study method to famous people who were prodigies in the past. Investigations in the framework of the socio-cultural approach mainly concentrates on the study of social and cultural factors (i.e., family, school, society, and other related environments) contributing to the appearance of child prodigies (Goldsmith, 1990; Howe, 1990, 1993; Radford, 1990). In fact, these studies continue Feldman's tradition by explaining the prodigy phenomenon via his co-incidence theory or its elements.

Certainly, it is interesting to know all possible factors that facilitate the expression of the prodigy's potential, but they are no more than circumstances in which some children become outstandingly accomplished at an early age. Definitely, research on the prodigy phenomenon conducted within the framework of the socio-cultural paradigm contains helpful conclusions for nurturing and education of the gifted. However, the first and the most important question "What is the nature of the prodigy phenomenon?" – does not have answers in Goldsmith's conception or in Radford's (1990) and Howe's (1993) studies.

The multidimensional perspective refers to the analysis of the prodigy phenomenon from different intersected views (e.g., developmental, cognitive, creative, personality, and social; Bamberger, 1982, 1986; Gardner, 1982; 1993a, 1993b). In this case, the inner mechanism of the prodigy phenomenon is generally understood as a sum of various characteristics. Thus, Gardner in his theoretical explorations is a follower of Feldman's theory. In this light, he does not bring anything new to the explanation of the nature of the prodigy phenomenon. Gardner (1993a) conducted his research on the famous prodigy Picasso from interactive and developmental perspectives. Gardner's (1993a) important finding consists in the demonstration of Picasso's totally egocentric behaviour during his whole life, which can be explained by Picasso's extraordinary gifts and talents.

Picasso enjoyed the benefits and liabilities of a prodigious start. His gifts and energies meant that, with few exceptions, he was able to do whatever he wanted, whenever and wherever he wanted, throughout his life. His virtuosity was never seriously challenged, let alone vanquished... Picasso was not able to think beyond his gift. In many ways he remained childish... (Gardner, 1993a, p.184).

Therefore, Gardner pointed out the necessity of personality development for prodigies. His interesting conclusion is that there is a strong contrast between the adult creators (who must discover their own styles of creativity and the domain in which they can excel, and are formed as personalities by their family) and the child prodigy (who must construct a creative personality, having his or her domain as given by the birthright) (Gardner, 1993b).

Bamberger's (1982, 1986) research on the prodigy phenomenon is mainly carried out in the framework of a cognitive-developmental perspective. Studying musical prodigies, she found a "midlife crisis" in their development: the period of the extremely important cognitive re-organization when new forms of internal representations of musical structure appear. This is an interesting finding directly related to the main idea that an individual's unique type of representations is the essence of giftedness (Shavinina, 2008, 2009).

In general, the studies on the prodigy phenomenon within the multidimensional perspective are certainly not numerous. Nonetheless, they reveal some significant findings (e.g., "midlife crisis"), which definitely contribute to the psychological explanation of the fundamental mechanism of this phenomenon. One can predict the appearance of further investigations on child prodigies within the framework of the multidimensional approach.

To sum-up, early research on the prodigy phenomenon described various manifestations (i.e., external traits, characteristics, qualities, properties, and features) of child prodigies. Contemporary studies explore either favorable social factors, which increase the probability of the appearance of prodigies, or a combination of these factors and the numerous manifestations of child prodigies. The analysis of the existing studies on the prodigy phenomenon shows that they do not reveal its inner mechanism. It seems that sensitive periods constitute such a mechanism.

### **Sensitive Periods as an Inner Mechanism of Prodigious Development**

As it was noticed in the introductory section, the prodigy phenomenon is first of all an age phenomenon because it is based on specific features of a child's age. This phenomenon is a result of the unique development, and, consequently, the key to its understanding should be found in the process of the individual growth of a child. Many transformations take place along the way from birth to adulthood (i.e., to age maturity). However, something

unusual happens that in some cases leads to the prodigy phenomenon. What exactly? It looks like the psychological account is the following.

**Unusual Development of the Gifted.** Human development is not a smooth process. Rather, it has certain stages or periods. Many scientific findings, both in general and developmental psychology, testify to it (Ananiev, 1957; Case, 1984a, 1984b; Fischer & Pipp, 1984; Flavell, 1984; Piaget, 1952; Sternberg, 1990a; Vygotsky, 1956, 1972; Wallon, 1945), especially research on giftedness in the framework of the developmental approach, which reveals an uneven development of the gifted (Bamberger, 1982, 1986; Feldman, 1982, 1986a; Gruber, 1982, 1986; Shavinina, 1997; Silverman, 1993, 1994, 1997; Terrassier, 1985, 1992). In this context, the most interesting ideas can be found in the studies on the asynchronous (Silverman, 1993, this volume) and dyssynchronous (Terrassier, 1985) development of gifted children. Moreover, the Columbus group views giftedness in general as an "asynchronous development." (Silverman, 1993, p. 634). The understanding of giftedness as synonymous with asynchronous development indicates the importance of such a development for the understanding of the nature of giftedness. The Columbus group's approach to giftedness is also a strong evidence of the uneven and periodical development of prodigies. Nonetheless, this specificity of the development of the gifted and prodigies has only been described, not explained. It looks like a key to the understanding of the uneven, asynchronous, dyssynchronous, and thus unique and unusual prodigious development should be seen in a child's age sensitivity.

**Age Sensitivity and the Prodigy Phenomenon.** Following Leites (1971), I suggested that a child's sensitivity plays a central role in the emergence of prodigies (Shavinina, 1997). *Age sensitivity* is defined as a specific, heightened, and very selective responsiveness of an individual to everything what is going on around him or her (Leites, 1996; Shavinina, 1999). Indications that age sensitivity takes a certain place in the appearance of prodigies and gifted children can be found in the literature (Feldman, 1986b; Jellen & Verduin, 1986; Leites, 1960, 1971, 1996; Kholodnaya, 1993; Piechowski, 1979, 1986, 1991; Silverman, 1993, 1994, 1997; Sternberg, 1986a). Leites (1971) asserted that the child's sensitivity and sensitive periods are critical phenomena in the development of prodigies. Kholodnaya (1993) viewed prodigy phenomenon as a result of the specific development of a child during the early years. Piechowski (1991) considered sensitivity as an individual's heightened response to selective sensory or intellectual experiences. He emphasized that unusual sensitivity reveals the potential for high levels of development, especially for self-actualization and moral vigour (Piechowski, 1979, 1986). Feldman (1986b) included unusual sensitivity in his theory of prodigy phenomenon, in the "individual psychological qualities" component. Sternberg (1986a) considered "sensitivity to external feedback" as one of the metacomponents of his theory of intellectual giftedness. Sensitivity is one of the main elements in Jellen and Verduin's (1986) conception of giftedness.

Shavinina (1997) distinguishes between cognitive (i.e., sensitivity to any new information), emotional (i.e., sensitivity to one's own inner world and to the inner worlds of other people), and social kinds of sensitivity, which intersect with one another, forming mixed kinds of sensitivity. Leites (1971) pointed out many times that each child's age is characterized by one or numerous kinds of sensitivity. Vulnerability, fragility, empathy, and social responsiveness are the manifestations of sensitivity. Cognitive sensitivity is extremely important in a child's development in general and in the development of the gifted in particular. For instance, the first years of a child's life are characterized by the ease and stability of the formation of many abilities, skills, and habits (for example, linguistic abilities; Leites, 1996). Probably, because of cognitive sensitivity, children's knowledge acquisition is very quick; it may take place even from the very first experience. This is very much true in the case of prodigies (see examples below).

**Sensitive Periods in Prodigy Development: The Case-Studies.** An individual's sensitivity is not always the same, it changes with age. Special age periods of the child's heightened sensitivity are defined as *sensitive periods*<sup>2</sup>. Exceptionally favorable inner

conditions and extraordinary possibilities for cognitive and intellectual development are presented during sensitive periods (Leites, 1996). The early years of language acquisition by children is a widely cited example of sensitive periods (Shavinina, 1997). Examples of sensitive periods are especially impressive in the case of prodigies<sup>3</sup>.

Five-and-a-half-year-old Serge learned the alphabet when he was only two years old. At the age of three, he was able to read well and even a lot. At that time, he began to write and was able to write quite correctly. By three years of age, he had started to solve mathematical problems designed for eight-year-old children. He knew quite well the natural world of our planet (i.e., plants and animals). At five years of age, Serge saw textbooks on geography and history written for 11-year-olds. He learned all the Russian Czars and governors in chronological order, as well as the wars in which Russia participated and the stages of the French Revolution. At that point, the period of classification and systematization began, which can be considered a sensitive period. Serge drew tables on paper and put into the columns everything he knew (countries, their capitals, big cities, historical personalities, animals, plants, cars, and people's names). The child used various principles to create columns: his columns corresponded to continents, states, alphabetical or chronological order, and so on. All newly acquired information was immediately put into the tables in the corresponding columns. Very often the same information was placed in many different tables. He spent all his time classifying and systematizing almost everything. After some time, however, this period ended and a period of interest in foreign languages started, which can be considered a new sensitive period. Serge learned the Latin alphabet in two days and could read Latin, German, and English words. He asked his parents to teach him foreign languages. Individual differences in sensitivity is therefore a very real phenomenon.

Sensitive periods reveal the uniqueness of certain stages in a child's development and the tremendous potential of childhood. Sensitive periods provide temporary favourable conditions for accelerated intellectual development. Such periods occur in each child's age, even at the earliest years. For example, Skuse, Pickles, Wolke, & Reilly (1994) found that the first few postnatal months constitute a sensitive period for the relationship between growth and mental development. It looks like childhood periods prepare and temporarily conserve great internal possibilities for the development of exceptional early abilities.

Another example of a child at a sensitive period is three-and-a-half-year-old Alexei. He began to read when he was only two and can now read rather well. The child especially likes numbers and is extraordinarily good at memorizing them. He remembers the numbers of buildings, apartments, cars, and the like. Alexei's answers to the question "What time is it now?" are always correct. The parents reported that they had not taught their son to write numbers and the alphabet; the child learned the digits and letters himself, just memorizing them and writing them down. A few days ago, another manifestation of his unusual mental development appeared: adults told him any date (for example, January 19, February 5, or March 27) and Alexei could say what day of the week it was (Monday, Friday, etc.). He was always right.

We can see that each child is sensitive in his or her own way. Based on such examples of sensitive periods in prodigies, Leites (1971, 1996) concluded that the specificity of a child's mind depends on the age period in which mind's qualities appear. He found that in childhood years, the specific "temporary states" – sensitive periods – emerge at each age stage, which manifest significant opportunities for advanced mental development. Zaporozhets (1964) pointed out that "each period of a child's development has its own age sensitivity, and because of that learning... is more successful in the early years, than in the elder ones" (p.678).

Rosenblatt (1976) also noticed the existence of sensitive periods and emphasized that all behavioral development (both in people and animals) is divided into sensitive periods, among which there are internal relations and mutual transitions. He found that the rapidity of the appearance, effectiveness, and duration of a sensitive period depended on the

specificity of the previous periods. Furthermore, Rosenblatt has shown that certain stages of development appear within a sensitive period itself. The change of sensitive periods interrupts and, at the same time, continues the course of the individual's development.

Alexander displayed his unusual abilities at a very early age. He started to read very well and to calculate before he was four years old. His interest in numbers probably indicated the first sensitive period. The boy continually demanded that all adults around him set up simple arithmetic tasks for him; he was hungry for them. In this period, he also liked to write various numbers. The number seven (7) was especially attractive for Alexander: he wrote it everywhere in different forms and sizes painted in various colors. This "digital" period eventually came to the end.

Just over four, Alexander had a new sensitive period – the "geographical" one. He read a lot about continents, countries, cities, seas, mountains, and rivers. All his questions to adults concerned only geographical issues. He asked his parents to buy geographical books for him and looked for geographical articles in the newspapers. He watched TV programs that were about travels around the globe and weather forecasts so that he could see a map of his country. As a result, his acquired knowledge of geography was very impressive. Nonetheless, his new sensitive period did not consist only of the acquisition of new knowledge of geography. All Alexander's cognitive activity was directed to achieve one clear goal: to make a map of the world. All his time was devoted to this task. He prepared the map, conveying shapes and names of geographical objects (i.e., continents, countries, etc.) with amazing accuracy. Such an activity certainly required his artistic skills in drawing and painting, which were significantly developed during this period. In a few months, Alexander's second – "geographical" – sensitive period was almost over.

These cases of sensitive periods in prodigies demonstrate that a child's heightened level of sensitivity is extremely important for understanding prodigious development. Vygotsky (1956) acknowledged the existence of sensitive periods and asserted that:

"in these periods certain influences have big impact on all course of the individual development by provoking one or other deep changes. In other periods, the same influences can be neutral or even give opposite impact on child development. Sensitive periods coincide fully with... the optimal terms of learning" (p.278).

Daniel (an eight-year-old boy) once learned from science fiction that there might be a 10<sup>th</sup> planet in the solar system. The planet has the same size and moves along the same orbit as the earth. However, this planet is invisible from the earth because it is always behind the sun. This information immediately provoked a spark of Daniel's intellectual activity. He could not resist thinking about this planet all the time. He imagined people living on the planet and he began to invent their languages (i.e., new alphabets). The period of geographical discovery on the planet was next. The boy left the shapes of the continents on the planet the same as on the map of the Earth, but the mountains, seas, rivers, countries, and cities were reinvented. At that point, he applied all his knowledge of geography. Furthermore, Daniel realized that his mathematical skills could also be used. He began to calculate how many people would live on this planet in 10, 20, or 50 years. His initial knowledge of geometry was used to measure the territories of the continents, states, cities, and seas. All his time was devoted to this activity. Interestingly, his parents noted that never before their son had been so impressed by any reading, although he had read a lot earlier. They also pointed out that Daniel had never before been involved in such an intense mental activity.

The unusual three-week period of intensive and non-child questioning (about God, life, the universe, death, her own mortality, and similar questions) in four-and-a-half-year-old Jennie studied by Morelock and described by Silverman (1993) is another example of a prodigy's sensitive period. This period of questioning can be explained by a three-week period of heightened sensitivity to everything unknown to her (Shavinina, 1997). It should be added that the following stage in Jennie's mental development was also a clearly distinct period, with a change in her external behavior (e.g., she became quiet) and an incredible shift in her reading ability. Probably, it was her second sensitive period that

explains Jennie's transformed behavior. The change of sensitive periods was very positive for her intellectual development, since Jennie reached new levels of cognition. It is not surprising that psychologists use a "cognitive leap" notion to describe her brilliant cognitive growth (Silverman, 1993).

These remarkable and numerous examples of sensitive periods in prodigies led Leites (1996) to conclude that even a child's age sensitivity itself can be considered a special kind of giftedness. Taken together, these findings demonstrate that the changes of age bring unrepeatable determinants of the individual development: sensitive periods. Sensitive periods mean a qualitatively new strengthening of the possibilities for mental growth, which appear during the early childhood years. The strengthening of such possibilities leads to the general heightening of a child's cognitive resources (as in the cases of Alexander, Alexei, Daniel, Jennie, and Serge). Therefore, the above considered findings demonstrate that sensitive periods are indeed a very real developmental phenomenon. It is not a fiction, nor a general psychological category for the combination of all the necessary conditions for the development of child prodigies<sup>4</sup>.

**The Developmental Trajectory of Sensitive Periods: What Is Lost and What Is Gained?** The favorable opportunities for the development of a child's mind provided by sensitive periods can be seen very clearly in prodigies as the above considered cases demonstrate. However, the sad thing is that later such favorable possibilities for individual development will weaken at a fast or slow rate (Leites, 1971). The following questions arise: if I assert that such periods should be considered as an inner mechanism of the prodigy phenomenon and of the development of the gifted, can a child be named as a prodigy or as the gifted if he or she had one or a few sensitive periods? Similarly, can sensitive periods experienced by a child be the predictors of his or her intellectually creative productivity in adulthood? Definitely, sensitive periods indicate that exceptional development can be possible. Nevertheless, it is not enough. The answer to these questions will be "yes" only if two important requirements are fulfilled in the individual development of a child. First, all *developmental* capacities (i.e., new abilities, habits, skills, qualities, traits, and characteristics acquired during sensitive periods; these capacities can be called *developmental* capacities or acquisitions because sensitive periods are a *developmental* phenomenon in the life of a child; a manifestation of a child's development) should be transformed into the stable *individual* acquisitions. Second, these acquired individual capacities should, in turn, be transformed into the unique cognitive experience of a child.

In spite of the fact that all stages of childhood can be distinguished by the heightened sensitivity of a child, sensitive periods have their own "life story." Sensitive periods emerge, exist, and even disappear during a child's development (Leites, 1971). What is important is what remains in the child at the end of sensitive period(s) when these periods are already over and favorable opportunities for mental development are getting weak either suddenly or gradually. It seems paradoxical, but it is a fact: the favorable possibilities opened up by sensitive periods allow a child to advance significantly in his or her intellectual development by acquiring something new and valuable (i.e., knowledge, skills, habits, and so on), but he or she can also lose these acquisitions when a sensitive period is over. This is a real problem of sensitive periods. Psychologists differentiate between *developmental* and *individual* aspects of sensitive periods (Leites, 1996).

If at the end of a sensitive period a child loses almost all the exceptional capacities that he or she acquired during the given period, then one can assert that these capacities were mainly a *developmental* phenomenon (i.e., *developmental* capacities). In other words, if a certain stage in the development of a child is over and all the extraordinary acquisitions accumulated during this stage via sensitive period(s) are lost. It is a key to the explanation of why so many gifted individuals who manifested exceptional abilities in their childhood become ordinary adults who do not express extraordinary talents and outstanding



creativity. Gifted children lose their unusual abilities and talents in the process of their own individual development.

At the same time, sensitive periods form a foundation for the powerful *individual* acquisitions. If new extraordinary capacities acquired during a certain sensitive period remain in the developing child after this period, then one can assert that these capacities have been transformed into the *individual* acquisitions. Only in this case one can assume to a significant extent that the child can be called a prodigy or a gifted that he or she has the potential to be an intellectually creative adult.

Let's get back to the example of Alexander. When he was a five-and-a-half-year-old boy, a seven-years-old girl began to live temporarily in their family. She was admitted to school and a new educational period started for Alexander. The children did exercises together, solved mathematical problems, and learned poems by heart. Alexander started to go to kindergarten. His teacher was impressed both by Alexander's mental development and his artistic abilities in drawing and painting. The accuracy of the presentation of even the smallest details was a distinguishing characteristic of his paintings. When he was seven, Alexander successfully passed all examinations and was admitted directly from the kindergarten into the fourth-grade class of school for 11-year-old students. All of his school grades were "excellent." At that time, the third sensitive period started, which can be called an "ornithological" period.

At the age of seven, Alexander read three volumes of Brem's book for university students, entitled *The Life of Animals*. This was the beginning of his interest in zoology; birds were especially attractive to him. The essence of a new sensitive period consisted in his writing (or, more precisely, creating) a book about birds. Alexander wrote down the summary of the corresponding chapters of Brem's volumes and made many illustrations for them. He also used two lengthy articles about birds that he found. The scale of his work was impressive: the manuscript ran more than 300 pages with more than 100 drawings. The text was divided into chapters, and all chapters were interconnected with an internal integrity. Alexander had an extensive vocabulary. His linguistic abilities were manifested themselves in the absence of mistakes in the writing of his manuscript, which included many foreign words and biological terms. Alexander continued to read a lot; preferring scientific literature. He often used encyclopaedias and dictionaries of foreign languages.

It is interesting to mention what happened once: a psychologist, an expert on giftedness, opened the first chapter of Alexander's manuscript and began to read the description of a bird. Alexander had not looked at this chapter for a few months. Then, the psychologist asked Alexander to continue the description. The boy recalled the subsequent text by heart correctly and in detail. Note that he used other words to express the essence of the text (not the same words that he had used to write this chapter). This clearly testifies to his completely conscious work (in contrast to simple memorization).

Alexander's drawings of birds were not copies of those he had already seen; they were his drawings based on the verbal descriptions of birds. In other words, all his reading about birds was immediately transformed into drawings of birds. Alexander's manuscript had more illustrations than three volumes of Brem. The psychologist emphasized that the boy had a strongly developed visual memory and the visual (i.e., external) descriptions of birds were the main characteristic of Alexander's "ornithology." He was not much interested in birds' instincts and their way of life; instead, he was very interested in form and size of beak, color of feather, and so forth. He constantly drew and re-drew the birds for his book. When Alexander visited the zoo or zoological museum, he also made many drawings. There were so many drawings in the manuscript of his book that the psychologist concluded that they probably are the essence of his work: the drawings were not the illustrations to the text, but rather the text was the illustration to the drawings. The order of Alexander's activity supported this conclusion: the boy first made drawings of birds, and then he wrote the text.

In summer, being in a country village, Alexander was fascinated by birds and butterflies. (He had read the book *Life of Insects* before summer, which probably stimulated his new interest). The boy gathered a large collection of various kinds of butterflies and made numerous and accurate drawings of them. His ability to see even the small differences in the color and form of butterflies was as obvious in these drawings as in his drawings of birds. It was Alexander's fourth sensitive period. However, his previous "ornithological" sensitive period also continued.

Alexander's knowledge of birds was getting more differentiated and enriched by his personal natural observations. In summer, the boy constantly observed birds in the forest and drew pictures of them. Using his own accumulated knowledge, he began to recognize birds in nature (according to their songs, color, etc.). Every day he observed the behaviour of birds for many hours. He also found their nests and fed small birds. Remember that at that time Alexander was only a seven-year-old child.

**Sensitive Periods in Prodigies: How Do They Function?** The case of Alexander and the other cases presented above indicate the chain of sensitive periods in prodigies, which allows me to assume that the prodigies' sensitivity does not disappear completely. In this light, Silverman's (1993) conclusion concerning emotional sensitivity seems to be correct. She asserted that "extraordinary levels of sensitivity and compassion do not disappear with maturity. A capacity for rich, intense emotions remains in the personality throughout the lifespan" (p. 642). In my opinion, this depends on the kind of sensitivity (i.e., cognitive, emotional, or social). Perhaps emotional sensitivity, more than any other kind of sensitivity, remains in the individual during his or her life, whereas cognitive sensitivity changes periodically (but certainly it does not disappear in prodigies and the gifted). Such characteristics of the gifted as sensitivity to a new experience and openness of mind (i.e., manifestations of cognitive sensitivity) can be regarded as evidence of this tendency of cognitive sensitivity. Perhaps the availability of cognitive sensitivity throughout the lifespan determines the exceptional mental abilities of an individual.

It was concluded that if sensitivity remains in prodigies for a long time, then it is possible to assert that new capacities acquired during a certain sensitive period will also remain in prodigies for a long time (Shavinina, 1999). These capacities are fortified and developed later, and finally they are transformed into really *individual* acquisitions that have a potential to remain in the person throughout the lifespan. Consequently, one can predict the transition of a child prodigy into an outstanding adult who will be able to produce extraordinarily high intellectual and creative performance(s) and achievement(s).

Alexander must be mentioned briefly once again. At 14 and a half years of age, he graduated from the school with "excellent" grades. He graduated with equal success from the biological faculty of the Moscow State University and became a distinguished scientist. He participated in many expeditions, mainly to the North, related to the investigations of various birds. His adult life was characterized by the ability to work very hard, an intense interest in learning, the talent to make good drawings (especially of birds), high capacity to learn foreign languages, and an extremely clear and detailed memory. He was a great ornithologist<sup>5</sup>. Alexander's colleagues wrote:

"He was characterized by a combination of abstract thinking with deep knowledge of ecology and birds that he had learned during his numerous expeditions... He had strong will, excellent memory, and was able to work hard... He was also able to read in many European languages including Scandinavian languages; he was perfect in English. Alexander was an excellent scientist, untiring, purposeful, and persistent. He could make an instant draft of a bird or landscape... He had an unlimited ability to work... He created his own scientific school" (Leites, 1996, p.156).

What is impressive is a complete coincidence of the description of 43-year-old Alexander as a scientist by his colleagues with the description of Alexander as a prodigy done by the psychologist (Leites, 1960, 1996). The case of Alexander demonstrates that his *developmental* capacities (i.e., those new capacities acquired during sensitive periods in childhood) were indeed transformed into powerful *individual* abilities that remained throughout the lifespan. Therefore, all the above written concerning sensitive periods

demonstrates that they are not a factor, condition, characteristic, feature, or trait in a child's development. They should be understood as an inner mechanism of prodigious development and the development of the gifted.

**Explaining Exceptional Development.** Any development leading to the significant expression of an individual's potential (in the forms of giftedness, creativity, extraordinary intelligence, or genius) and resulting in any human achievement is influenced by a number of periods of heightened sensitivity. Probably, the stages or levels of the gifted's development (Feldman, 1982, 1986a; Gruber, 1982, 1986) as well as prodigies' "mid-life" crisis (Bamberger, 1986) and "crystallizing experience" phenomenon (Walters & Gardner, 1986) correspond to certain sensitive periods (Shavinina, 1997).

Also, if we ask ourselves what is behind "asynchrony" and "dyssynchrony" mentioned above, the answer probably is "sensitive periods." It is interesting to note that there are some indications to sensitive periods in the definition of giftedness given by the Columbus group<sup>6</sup>. For example, "advanced" (that means that something might not be advanced) and "heightened" (correspondingly, something might not be heightened). Furthermore, the asynchrony term itself is also connected to the very essence of sensitive periods in the following way: asynchrony assumes the emergence and disappearance (i.e., beginning and end) of certain qualities forming to some extent a disproportionality in child development. Sensitive periods also have a beginning and end.

**Understanding Prodigies' Extraordinary Performance.** Sensitive periods predetermine prodigious development as a fundamental mechanism: that is, they greatly accelerate and, therefore, advance intellectual development of prodigies. However, do sensitive periods directly determine prodigies' incredible achievements? What permits a child prodigy to be at the level of the professional performance of an adult before the age of 10, as it was asserted in the above-mentioned definition of prodigy?

Shavinina (1999) concluded that prodigies' unique cognitive experience (i.e., experience of the cognitive interaction of an individual with the external world) is responsible for their extraordinary performances. The cognitive experience forms the cognitive basis of giftedness, which I will analyze in details below.

## **Paradigm Change in Addressing the Issue of the Nature of Giftedness**

Before analyzing the cognitive basis, it is essential to mention the following. Kholodnaya (1993) emphasized that the main difficulty in understanding the nature of giftedness is that the external manifestations of giftedness (e.g., personality characteristics, traits, and qualities) in any real activity have been the subject of psychological research; but the psychological basis (or psychical carrier) of these manifestations has not been studied. Understanding the nature of any psychological phenomenon using only its own characteristics is unproductive. Contradictions and crises in psychology testify to it (Vekker, 1981). An entirely new research direction is needed that looks at giftedness as the unity of its two important parts: the manifestations of giftedness (i.e., traits, characteristics, qualities, properties, etc.) and the psychical carrier of these manifestations (that is, the psychological basis of giftedness).

It means that there is a need to fundamentally re-examine the question of the nature of giftedness as a psychological phenomenon. That is, psychologists should not answer the question: "What is giftedness?" by listing its various traits and characteristics (i.e., its external manifestations). Rather, they should answer the question: "What is the basis (a carrier) of those traits and characteristics associated with giftedness?" From this fundamentally changed point of view, researchers should examine the subjective experience of an individual and first of all his or her cognitive experience: the experience of the cognitive interaction of a person with the world around him or her, which is the psychological basis of giftedness or the psychological carrier of its manifestations (Shavinina & Kholodnaya, 1996).

## **Cognitive Basis of the Child Prodigy Phenomenon and Giftedness**

If we look at the existing approaches to the understanding of the nature of giftedness, then we will see that they touch the concept of “individual subjective experience” to a certain extent. For example, Sternberg’s conception of intellectual giftedness includes processes in the areas of the “internal” and “external” experience of an individual (1986).

The concept of “experience” can also be found in the creative approach. For instance, the existing definitions of creativity might be read in a slightly different way, such as creativity is the saturation of an individual’s experience by a new content (Stein, 1967) or creativity is the process of the reorganization of experience (Mednick, 1962). Shavinina & Kholodnaya (1996) suggested that the cognitive experience of an individual is responsible for the ability to generate new and original ideas.

Although the number of publications is not very large yet, research into the topic of experience was begun in developmental, cognitive and expertise approaches. Walters & Gardner’s (1986) investigation of the phenomenon of “crystallising experience” seems to be important. They define “crystallising experience” as remarkable and memorable unusual encounters between a developing person and a particular field of endeavour (p.307). This phenomenon manifests itself in changes in “an individual’s concept of the domain, his performance in it, and his view of himself” (p.309). This reorganization of the individual experience later becomes a foundation for creative discoveries. DeGroot’s (1978) pioneering study allowed him to conclude that any creative product is not a consequence of a magical intuition, miraculous inspiration, or inborn genius. Rather, it is a result of a specific self-development of an individual, which is connected to rapid accumulation of fertile, differentiated, and useful experience in a certain field of human activity.

Gruber (1986) asserts that human extraordinariness in its important creative achievements is a consequence of “protracted and repeated encounters of the creative person with the task he or she has undertaken” (p.252). He notices that these encounters “deal rather with some ideas about the construction of social relations and of the self,” than with the changes in cognition (p.254). In this period the possibility of extraordinary creative solutions depends upon surrendering himself or herself to the requirements of the task and self-mobilisation of every personal resource.

Representatives of the expertise approach, such as Horgan and Morgan (1990), have shown that one of the important results of their longitudinal study of child chess experts is that improvement in chess skill significantly correlates with experience.

Albert and Runco (1986) emphasise that non-cognitive early family experiences are involved in the achievement of eminence. They found in their longitudinal study of exceptionally gifted boys and their families that experience-selecting agents play an important role in the development of giftedness, which itself is a creative experience-producing phenomenon.

Therefore, the available research on experience in the area of giftedness (Albert, 1992; Albert & Runco, 1986; DeGroot, 1978; Gruber, 1986; Horgan & Morgan, 1990; Sternberg, 1986; Walters & Gardner, 1986) allowed Kholodnaya (1993) and Shavinina & Kholodnaya (1996) to conclude that a subjective experience of an individual plays an important role in the understanding of the nature of giftedness. Kholodnaya (1993) suggested that cognitive experience – and especially its structural organization – is a psychological basis of giftedness or a psychical carrier of all manifestations of giftedness.

### **Cognitive Experience and Prodigies’ Unique Representations**

Cognitive experience is formed by conceptual structures (i.e., conceptual thinking), knowledge base, and subjective mental space (Kholodnaya, 1993). Why do conceptual structures, knowledge base, and mental space compose cognitive experience?

The importance of conceptual structures is determined by scientific findings that indicate that conceptual thinking is the integrated cognitive formation (i.e., a form of the integrated functioning of human intelligence). The more conceptual thinking is a form of the integrated work of intelligence, the better organization of an individual's intellectual activity will be (i.e., intelligence perfectly functions; see Kholodnaya, 1983; Vekker, 1981)

The knowledge base is the second component in the structure of cognitive experience. Many psychologists stress the important role of the knowledge base in the development of intellectual giftedness (Bjorklund & Schneider, 1996; Chi & Ceci, 1987; Chi & Greeno, 1987; Chi & Koeske, 1983; Kholodnaya, 1993; Pressley, Borkowski, & Schneider, 1987; Rabinowitz & Glaser, 1985; Schneider, 1993; Shavinina & Kholodnaya, 1996; Shore & Kanevsky, 1993; Sternberg, 1985, 1990a). It was demonstrated that the quantity and quality of specialized knowledge play a critical part in highly intellectual performance and in the process of acquiring new knowledge (Bjorklund & Schneider, 1996). For example, productive problem-solving cannot occur without relevant prior knowledge (Chi & Ceci, 1987). The knowledge base can facilitate the use of particular strategies, generalize strategy use to related domains, or even diminish the need for strategy activation (Schneider, 1993). The gifted are distinguished by an adequate, well-structured, well-functioning, and elaborate knowledge base, which is easily accessible for actualization at any time (Kholodnaya, 1993; Rabinowitz & Glaser, 1985). Moreover, this rich knowledge base can sometimes compensate for overall lack of general cognitive abilities (Pressley, Borkowski, & Schneider, 1987; Schneider, 1993).

Conceptual structures and knowledge base generate subjective mental space, the third component in the structural organization of cognitive experience. Individual differences in flexibility, differentiation, integration, and hierarchy of the boundaries of the mental space influence a person's cognitive attitude to the world around and, therefore, predetermine his or her intellectual abilities.

Cognitive experience – formed by these three components – expresses itself in a specific type of the objective representations of reality (i.e., how an individual sees, understands, and interprets what is going on in the surrounding reality and in the world around him or her). It was shown that an individual's type of representations is the basic phenomenon of human intelligence (Kholodnaya, 1990, 1997). Child prodigies and the gifted see, understand, and interpret everything around them by constructing an individual intellectual picture of the world (of event, action, situation, idea, problem, and any aspects of reality) in a manner different from the rest of the people. It means that child prodigies and the gifted have a unique intellectual picture of the world; that is, a unique point of view or a unique vision. This is exactly what the essence of giftedness is all about (Shavinina, 2009).

Experimental study of the individual cognitive experience of gifted adolescents and those who were not identified as gifted found that there are some essential differences in the cognitive experience of the two groups of adolescents (Shavinina & Kholodnaya, 1996). Specifically, differences in the degree of the development of their intellectual giftedness manifest themselves in their individual representations: the representations of the world as a whole, the representations of future events, and conceptual representations. For example, gifted adolescents' specificity of the individual representations of the reality as a whole consists in the predominance of categorical (generalized) cognition. The gifted group's representations of the future are characterized by the differentiation of the vision of future events. Gifted adolescents are also distinguished by more complex and rich conceptual representations (i.e., their representations are rather unfolded and articulated phenomena). Furthermore, the correlation and factor analysis demonstrated a special character of correlations and a relative independence of the factor structural components in the cognitive sphere of the gifted group. This is the evidence of a specific integration of the cognitive experience of the gifted. To sum-up, the cognitive experience of the gifted has more categorized, integrated, differentiated and unfolded organization than the

cognitive experience of those who were not identified as gifted. This specific structural organization of the cognitive experience of the gifted determines their unique intellectual picture of the world.

Taken together, these findings provide further evidence that cognitive experience is a psychological basis of giftedness, which manifests itself in the gifted's unique type of representation of everything what is going on around them. It should be noted that the mechanisms of the construction of these unique representations of the gifted play a key role in the organization of their experience. That is, those cognitive mechanisms, which are responsible for the construction of an individual's more categorical, differentiated, integrated and conceptually complex intellectual picture of the world. It is appropriate to mention here that the nature of cognitive experience (i.e., the individual differences in the extent of the development of this experience) is an important factor in the identification of gifted individuals.

The most important aspect of the uniqueness of the gifted's intellectual picture of the world is the objectivization of their cognition. It means that gifted individuals see, understand, and interpret everything in highly objective manner. The significance of the gifted in society "should be seen not only in that they solve problems well and create new knowledge, but mainly in the fact that they have the ability to create an intellectually *objective picture of the world*, i.e., they can see the world as it was, as it is, and as it will be in its reality" (Kholodnaya, 1990, p.128; italics added).

### **Explaining the Prodigy Phenomenon and the Nature of Giftedness**

Taking into account the findings presented up to this point, I am now going to explain how it happens that the gifted – and in some cases even the extremely gifted: child prodigies – appear. The age or developmental foundation (i.e., exceptional opportunities for the accelerated individual development determined by age sensitivity) is a key to this explanation. It seems that in prodigies and the gifted – as a result of advanced development – the overlapping of age sensitivity occurs. In this case, sensitivity originates from different (i.e., previous, current, and subsequent) childhood periods. The description of Alexander's summer life in his childhood supports this assumption. At that time, he had at least two sensitive periods: the "bird" period and the "butterfly" period. His interest in birds can be considered a previous (his intense interest at the age of seven), current (his summertime interest in the observation of birds), and subsequent (his renewed intense interest as a variation on his previous interest makes it new) sensitive period at the same time. A new – and also current – sensitive period was the period of his interest in butterflies. One can see the coexistence of two sensitive periods. Such an overlapping of a child's sensitivity determines duplication and even multiple strengthening of the foundations for the rapid intellectual growth that finally leads to the appearance of prodigies and the gifted. Because of the overlapping of age sensitivity, a child prodigy or the gifted is always distinguished by cognitive sensitivity or any other kind of sensitivity. In this case, the probability of the transformation of all *developmental* acquisitions (i.e., all new capacities of a child's cognitive experience that are acquired during sensitive periods) into the stable *individual* abilities is getting high. In other words, the gifted and prodigies are almost always in sensitive periods that actualize their cognitive potential and accelerate their mental development. The latter implies rapid accumulation of prodigies' cognitive resources and the construction of those resources into the unusual cognitive experience that continues to enrich itself in the process of the further advanced development governed mainly by a heightened cognitive sensitivity.

Prodigies' and the gifted's cognitive experiences most likely will quickly become differentiated, integrated, and unfolded phenomena (Shavinina & Kholodnaya, 1996). Correspondingly, the character of their representations will be generalized, categorical, conceptually rich, and complex from the very early years. This allows child prodigies and the gifted to have a unique "intellectual picture of the world," which expresses itself in

their exceptional performance and achievement. For example, although Alexander's "ornithological" sensitive period was very long, his cognitive experience was certainly different in each stage of childhood. For instance, his initial drawings of birds were based on verbal descriptions from books because Alexander's initial ornithological knowledge was from books, whereas his "summer" drawings were based on his personal experience of natural observations. As mentioned above, at that time his knowledge of birds reached a new level. Because of this, one can assert that Alexander had, in fact, a few "ornithological" sensitive periods. These periods can be considered as previous, current, and subsequent sensitive periods at the same time.

The proposed explanation of the nature of the prodigy phenomenon and of giftedness as whole – via the specificity of a child's age, which manifests itself in sensitive periods, and cognitive experience – is supported by the following psychological findings. For example, Silverman (1993) concluded that the heightened emotional sensitivity and responsiveness of the gifted are "directly related to their advanced cognitive development" (p. 637). The Columbus Group also pointed out that asynchronous development increases with higher intellectual capacity (Silverman, 1993). Similarly, Roedell (1984) asserted that highly gifted children will be more vulnerable with increased intellectual advancement.

Therefore, the presented theory of the child prodigy phenomenon and of giftedness states that the key to the explanation of their nature should be seen in the hidden possibilities of a child's age. The prodigy phenomenon and giftedness should be explained by their inner mechanisms. They cannot be understood in terms of various forces and factors, which are in fact social influences. According to the proposed explanation, the prodigy phenomenon and giftedness in general is a consequence of a specific development of a child. This specificity consists in the uneven, asynchronous, dyssynchronous, and, hence, unusual development, beyond which there are periods of heightened cognitive sensitivity. Sensitive periods accelerate a child's mental development through the actualization of his or her intellectual potential and the growth of the individual's cognitive resources, which leads to the appearance of a unique cognitive experience. The latter expresses itself in prodigies' and the gifted's unrepeatable intellectual picture of the world or their unique point of view and is responsible for their exceptional performance and/or achievements.

It should be emphasized that this account is true with respect to all types of giftedness or high ability. The only difference is that a specific cognitive experience, which manifests itself in unique representations, is the most important in the case of the gifted; whereas the accelerated development during early childhood is the most important in the cases of prodigies. This is why the child prodigy phenomenon is a pure developmental phenomenon. The development of all human talents follows the same developmental pattern as it was just described. Successful acquisition of human expertise is nothing else but the development of an individual's cognitive experience as presented above.

Consequently, the proposed approach to the understanding of the essence of the prodigy phenomenon and giftedness as a whole explains both the process/dynamic aspect of these phenomena (i.e., prodigious and gifted development or talent development in general) and their productive or resulted aspect (i.e., exceptional prodigies' and the gifted's achievements and performances or extraordinary acquisition of expertise).

## **To Sum-Up**

The cognitive-developmental theory of the child prodigy phenomenon presented in this article sheds light on the nature of talent development and expertise acquisition. The theory states that 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 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 child prodigies during sensitive periods explains why prodigious development is the uneven,

asynchronous, or dyssynchronous, and, hence, unusual development. Periods of heightened (cognitive, emotional, and social) sensitivity are beyond this specific development of all types of gifted individuals including prodigies and talented people (Shavinina, 1997, 1999).

The accelerated intellectual development of the gifted and talented leads to the appearance of their unique cognitive experience. This is exactly how expertise is acquired. The cognitive experience – which consists of conceptual structures, knowledge base, and subjective mental space – is a basis of the child prodigy phenomenon, giftedness, and talent (Kholodnaya, 1993; Shavinina & Kholodnaya, 1996). This uniqueness consists in a more complex, rich, integrated, differentiated and unfolded structural organization of the cognitive experience of the gifted in comparison with the cognitive experience of those who were not identified as gifted (Shavinina & Kholodnaya, 1996). In other words, exceptional experts have a complex, rich, integrated, differentiated and unfolded structure of their experience. Expertise acquisition means the development of such cognitive experience.

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 and talented 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 and talented see, understand, and interpret everything differently. This is their unique point of view or a unique vision. The unique type of representations is the essence of giftedness and talent. This is true for all categories of the gifted, including child prodigies, talented scientists of Nobel calibre, and great entrepreneurs (Shavinina, 2003, 2004, 2006a, 2006b).

Therefore, according to the cognitive-developmental theory of the child prodigy phenomenon – which is a particular case of giftedness and talent in general – this phenomenon 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 prodigies' unique intellectual picture of the world. The essence of the child prodigy phenomenon, giftedness, and talent is all about a unique point of view or a unique vision of gifted and talented individuals. One of the most important aspects of this uniqueness is their ability to see everything in a highly objective manner.

The presented theory explains the process or dynamic aspect of giftedness (i.e., talent development) and its productive or resulted aspect (i.e., the talented individuals' exceptional achievements and/or performance determined by a unique structure of their cognitive experience). Successful acquisition of human expertise is nothing but the development of an individual's unique cognitive experience.



## Notes

- <sup>1</sup> Sometimes one can find statements such as the following: “The literature contains only three systematic scientific studies of child prodigies” (Morelock & Feldman, 1993; p.162), which refer to studies of Ravesz, Baumgarten, and Feldman. This is not true, since in this case Leites's research was not taken into account. Unfortunately, his investigations are absent from the American literature and rarely cited in most European publications published in English.
- <sup>2</sup> Certainly, such a definition of sensitive periods is rather general and other definitions of this construct can also exist in psychology. But, the current state of research on sensitive periods of the gifted is not very advanced; therefore, this definition seems to be appropriate.
- <sup>3</sup> This example of a gifted child's periods is taken from Leites (1996).
- <sup>4</sup> Of course, the following question can arise: “What is behind a child's sensitivity and sensitive periods?” The scientific analysis of this question leads me to the consideration of the specificity of the development of the nervous system of children. The neurological, physiological, physical, and genetic specificity of child development constitutes the “biological mechanism” underlying the emergence of sensitivity and sensitive periods. Biological correlates of sensitivity and sensitive periods will not be discussed in this chapter (except the neurological basis of giftedness briefly mentioned at the beginning), because its aim is to mostly consider the psychological essence of sensitivity and sensitive periods (i.e., their “psychological mechanism”). The issue of biological correlates of sensitivity was briefly analyzed by Leites (1996) and by Henderson & Ebner (1997).
- <sup>5</sup> Unfortunately, Alexander died at the age of 43 when he contracted a fatal disease in one of his numerous scientific trips to Siberia.
- <sup>6</sup> According to this definition, “giftedness is asynchronous development in which advanced cognitive abilities and heightened intensity combine to create inner experiences and awareness that are qualitatively different from the norm. This asynchrony increases with higher intellectual capacity” (Silverman, 1993, p. 634).

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