Introduction
The Science of the Cultural Mind

The main objective of this book is to draw the readers' attention to some pivotal ideas of what one may call "the science of the cultural mind." Some of these ideas were first introduced almost a century ago, but they still require clarification and identification of their yet unrealized potential. The main idea, of course, is that the human mind and first of all cognition and learning should be considered a sociocultural, rather than a natural or biological, phenomenon. There are many biological and behavioral functions shared by human beings and animals, but the goal of the science of the cultural mind is to explore only the specifically human aspects of the human mind. These exclusively human functions are intimately related to the social and cultural world which constitutes the "natural" environment of human beings.

Far from being only theoretical, the science of the cultural mind has direct practical implications for such areas as child development, new approaches to the assessment of cognitive and learning processes, and future-oriented education. The book is organized around five pivotal ideas and their applications: The idea of human *mediation* (Chapter 1), the concept of *symbolic tools* and their impact on human mental functions (Chapter 2), the idea of *leading activities* that provides a new perspective on the periods of child development (Chapter 3), the concept of *learning potential* and the methods of its assessment (Chapter 4), and the idea of *cognitive education* as a vehicle of the more efficient development of students' conceptual thinking (Chapter 5).

Mediation. This concept helps us to explain the interaction between human beings and their environments. These interactions are rarely immediate, though it is often tempting to see them in this way. We propose to check beyond the apparent immediacy of human interaction with the environment and discover different types of mediators. Some of these mediators are material: The fire mediates between us and the food we eat; glasses mediate between our visual system and distant objects that we would like

to see; mechanical tools mediate between our hands and a material that we would like to shape according to our needs, and so on. There is no end of knowledge accumulated about these material mediators. However, one question that was posed almost a century ago remains mainly unanswered: How do these material mediators influence our thinking? Buildings, clothes, tools, furniture, and vehicles themselves are material, and their interaction with us is also mainly material (providing shelter and helping to create useful goods, transportation, etc.), but it appears that our mind is not immune to the influence of these material mediators. The question is how this influence is taking place. A hint: These mediators are shaped by our cultures, so it is not their physical but rather their cultural aspect that impacts our cultural mind.

The second class of mediators includes symbolic mediators, such as signs, symbols, icons, texts, pictures, formulae, graphs, maps, and diagrams. It is impossible to imagine any culture without at least some of these mediators. Thousands of works are written about them in different specialized areas such as literary theory (about texts), art history (pictures), mathematics (formulae), and musicology (musical notations). In many of these fields, only one representational aspect of symbols is discussed. Symbols, however, not only represent objects, processes, and events but also mediate between the world and the human mind and in the process impact the way our cognitive processes are shaped. Just imagine the difference between the experience of orienting oneself in a new city being armed with such a symbolic mediator as a map or having to rely on direct vision and hearing alone. The use of a map not only changes our perception of the city but also changes the way we think about the space and our place in it. In the theory of the cultural mind, symbolic mediators play a very important role because the study of these mediators helps us to understand how our natural functions of perception, memory, and problem-solving become transformed into cultural mental functions corresponding to the symbolic tools available to us.

The third class of mediators is people. For example, mothers by and large serve as reliable mediators between their young children and the environment. Mothers select objects and events to which children are exposed, sometimes emphasize or on the contrary downplay certain aspects of the exposure, interpret environmental events to children, prevent children from entering into dangerous situations, etc. Of course, parents are not the only human mediators: Teachers and other mentors take over some of the functions of human mediators by guiding children through the cultural environment of formal and informal learning. The examination of the role

of human mediators helps us to understand better such phenomena as learning deprivation, developmental difficulties, and alienation.

The fourth class of mediators is activities. Of course, activities do not exist without some material, symbolic, and human mediators, and yet activities cannot be reduced to any one of the previous types of mediators. Just imagine any ritual, even such an ordinary one as a weekend evening dinner for the entire family. The dinner ritual includes such material mediators as furniture, tools, and food; it may also have some symbolic objects and recitation of texts. Adults play an important role as mediators to the children participating in the dinner, and beyond all of this there is a "weekend dinner" as a form of collective activity that cannot be reduced to any of the previously mentioned mediators. Daily or festive rituals, of course, constitute just one type of activity. Formal education, on the one hand, and professional work, on the other, are among the main forms of activity in technologically developed societies. The question is how these activities impact the development of the human cultural mind. For example, how does such an activity as formal learning shape the type of learning abilities appropriated by the students? On the other hand, how does the activity of professional work impact our cognition?

While not many people would question the importance of mediation for human development, the majority of research methodologies still assume that human cognition can be investigated by registering a direct response of a person to a task provided by the researchers. For example, in a study of a child's orientation in space, it is tacitly assumed that this ability is a product of maturation on the one hand and the child's own experience on the other. As a result, typical research in this area would check only children's spontaneously acquired orientation abilities. What, however, about first providing children with relevant mediation via symbolic tools, human mediation, or specific activities relevant to spatial orientation and only then checking their orientation in space? Unfortunately, such an approach, which is consistent with the principles of the science of the cultural mind, rarely appears in the research literature. In other words, though no one would deny that human beings are cultural beings, they are still investigated as if they are only natural beings.

Symbolic tools. The already-mentioned concept of symbolic mediation is further elaborated in Chapter 2. There we focus on the following sequence of steps leading from symbolic mediators to the development of human thinking. First of all, it should be acknowledged that cultures differ in the kind of symbolic mediators available to them. In addition, even within the same culture, some ethnic or socioeconomic subgroups are exposed

to a different range of symbolic mediators than other subgroups. Not all children (or adults) in a given subgroup have equal success in the acquisition of certain symbolic mediators. This process depends, of course, on the skills and motivation of human mediators: first of all parents and teachers, who are expected to make these symbolic mediators available to children.

The next step is an actual acquisition of symbolic mediators as symbolic tools. A better understanding of this process requires a more detailed elaboration of the notion of the systems of symbols (graphic, pictorial, verbal, schematic, etc.), on the one hand, and the distinction between symbolic tools and material tools, on the other. Too often symbolic tools are presented to the learners (children and adults) as a part of the content material. As a result, only the representational role of symbols is revealed, while their instrumental role remains obscure. There is no doubt that symbols represent objects and processes, but their role is much wider. For example, if such a symbolic tool as a data table "represents" something, this something definitely is not the content that appears in the table. What the table "represents" is a particular way of organizing and thinking about any type of data. If so, then it is more relevant to discuss tables, graphs, and other symbols as potential tools. It is in the instrumental action, in their ability to shape, organize, and change information, that these symbols demonstrate their real power. On the individual level, the learning process moves from the acquisition of a data table as an external symbol to the realization of its instrumental function as an external symbolic tool and further to the internalization and transformation of this symbolic tool into the inner cognitive tool. One example of such a process is first learning how to use a clock as an external symbolic tool for telling the time and then internalizing and transforming this tool into an inner cognitive tool that allows perceiving time as divided into twenty-four-hour units.

The process of internalization of symbolic tools leads to the development of higher mental functions. Here we confront a serious terminology problem because cognitive specialists tend to use the same terms, such as "memory" or "attention," for both direct memorization and spontaneous attention and complex mental functions dependent on symbolic systems such as literacy and numeracy. It would be more appropriate to differentiate terminologically such basic cognitive functions as "direct memory" and the higher mental function of "mediated memory." The same distinction has to be made regarding other functions as well, such as direct perception vs. mediated perception, direct attention vs. mediated attention, and so on.

The concept of symbolic tools helps us to clarify numerous issues in three areas: Cross-cultural differences in cognition, higher mental

processes of children and adults, and formal education understood as a system based on the learners' acquisition and internalization of symbolic tools. Cross-cultural differences that are often presented in terms of the average IQ scores of ethnic or cultural groups acquire new meaning when differences in symbolic tools available to various groups are taken into account. Moreover, the process of acculturation to a new environment associated with migration can be operationalized, at least in part, as a process of acquisition and mastery of the new system of symbolic tools.

As mentioned earlier, the distinction between more basic cognitive processes and mediated higher mental functions allows us to clarify some issues related to the disparity between the abilities identified with the help of tests probing basic cognitive processes and abilities revealed in more complex tasks that require higher mental functions. The case in point is children with relatively weak direct perception, memory, and attention, some of whom manage to achieve remarkable results through the acquisition and implementation of symbolic tools leading to the development of higher mental functions stronger than those of their peers. The opposite situation is with children who demonstrate very good results with the tasks that require direct perception, memory, and attention, but then fall behind because more complex tasks require mediated, rather than direct, mental functions.

This point naturally leads to the third area of application of the concept of symbolic tools: formal education. Despite the cognitive reorientation of contemporary education that lists the development of learning strategies and cognitive skills among the main objectives of the educational process, the role of symbolic tools remains insufficiently elaborated. Symbolic tools that permeate school learning – tables, graphs, diagrams, plans, and maps – often appear as an integral part of the content material. As a result, students perceive them as a part of a specific material rather than tools whose role is to organize this material. The role of symbols as active cognitive tools thus remains underappreciated by the learners. An additional problem stems from the fact that when the educational role of symbolic tools is discussed this is usually done in a narrow disciplinary framework. In the absence of a common theoretical basis, symbolic tools become "assigned" to a particular curricular area. For example, the use of maps remains confined to geography, while the use of tables and graphs is limited to mathematics and physics. We propose a way for positioning symbolic tools at the center of the educational process, facilitating in this way the more efficient development of the learners' higher mental functions.

Leading activities. As mentioned earlier, one of the forms of mediation is mediation via specially organized activities. In the course of their development children become engaged in different age-appropriate activities. Though at a given age children are involved in various activities, it is still possible to argue that for each developmental period there is one leading activity. The role of a leading activity is to develop some of the core psychological functions that are most important at a given stage of child development. Unlike such popular developmental models as that of Piaget that present developmental stages as universal, the leading activities model is culturally specific. In the form presented here, it applies only to child (and adult) development in industrialized societies that have a formal educational system. The culturally specific character of the leading activities model finds its expression in presenting the developmental event as a joint action in which the child's emerging abilities (sensory, motor, cognitive, and emotional) meet the socioculturally constructed activities (different forms of play, formal learning, social group activities, work, etc.) provided by a given community. As a result of such a meeting, the child's abilities mature in the direction supported by the community while simultaneously paving the way to the child's transition to the next developmental period.

During each one of the developmental periods, the progression of the child's cognitive and interpersonal skills leads to the formation of a new motive that corresponds to the new leading activity in the next developmental period. For example, the emotional component is central during the earliest period in child development, while the manipulation of objects (toys) plays a subdominant role. Gradually, however, the object-centered joint activity with adults becomes a new motive of the child and at a certain moment assumes the role of the leading activity while the emotional contact becomes subdominant. Similarly, the leading activity of object-centered play gradually prepares the child for the transition to sociodramatic play. While during the first of these two periods, manipulation with a toy car is focal, in the second period the imaginary role of a driver becomes the main interest of the child, with a toy car relegated to the subdominant role of one of the play's physical prompts. Sociodramatic play has an important role in preparing children for formal education. On the one hand, symbolic aspects of such play enrich children's ability to assign certain meanings to objects beyond their superficial physical properties. The development of play-based imagination will pay off later via children's emerging ability to use written texts for imagining remote places, different historical periods, or unobservable physical conditions. Moreover, sociodramatic play "teaches" children how to switch from one role to another,

for example, from the role of a truck driver to that of a policeman and then back. Such flexibility in switching roles will become indispensable when children enter a formal education framework and switches from the family-based role of a son or daughter to the role of a pupil.

In societies with formal education systems, the leading activity during the period approximately coinciding with elementary school age is the activity of formal learning. Formal learning as a leading activity should be distinguished from the generic form of learning. Generic learning is ubiquitous at every stage of child (and adult) development. Generic learning is an integral part of other activities, such as emotional interaction, play, and work. However, according to the leading activity model, only during the period of formal education does learning becomes a leading activity. The specificity of this period is determined by the fact that the goal of formal learning is to transform a child into a self-directed learner. The main goal of formal education is in helping the child "learn how to learn." Learning here is not a supporting element of some other activity; the products of formal learning – written essays, solved math tasks, or results of lab experiments – do not have any value in themselves but only as means for the transformation of a child into a "universal learner": a learner who can learn anything. This feature of formal learning becomes particularly relevant in the context of the fundamental uncertainty regarding the future occupations of children who started their formal education in the twenty-first century. The most valuable skill that they can acquire at school is the ability to learn something new and unpredictable. Some of the practical educational applications of this type of leading activity are discussed in Chapter 5.

Though we focus mainly on the two types of leading activity – sociodramatic play and formal learning – it is important to understand that the leading activity model assumes that formal learning does not remain the leading activity for the entire period of schooling. Already at the middle school age, the youngsters' leading activity shifts from that of formal learning to the activity of interpersonal relationships leading to the formation of the youngster's mature personality. Such a shift creates a problem for an educational system that is rather uniformly built around learning tasks while the students focus on interpersonal relationships. We discuss how more flexible forms of learning, such as projects, may utilize the students' desire for interpersonal interaction as a motor for their further scholastic development.

Learning potential. Though thousands of books have been written about learning, the concept of learning potential (LP) remains insufficiently elaborated. One of the possible reasons for such a state of affairs is the

tendency to view learning only through its products. When a math or history exam is given to students it is assumed that the results of the exam will reveal the efficiency of students' previous learning. In other words, what we can see in such an exam is only the result rather than the process of learning. Moreover, such an exam provides us with relatively little information about each student's potential for learning something new. For example, one student can achieve good exam results by investing much more time in learning than another student who achieved the same result. The efficiency of the first one is thus lower than that of the second student, but this factor is "hidden" in a typical exam. The situation is even more complicated in the case of so-called intelligence tests. Some psychologists insist that properly designed intelligence test taps into the individual's innate abilities that are unrelated to his or her learning experiences. Others, however, define intelligence itself as a "general learning ability" and claim that intelligence tests provide us with a pretty accurate estimate of not only personal knowledge but also the person's learning ability. Irrespective of the definition, however, the results of intelligence tests provide information only about people's current knowledge and problem-solving skills but say little about their LP.

The situation can be changed rather radically if active learning is included as an integral element in the assessment procedure itself. This can be done in a variety of ways. For example, the LP test can be designed as a test–teach–test sequence. First, the entire test or exam is given to a person, then the assessor examines the results, identifies more salient mistakes, and then gives a teaching session focusing on the knowledge or/and skills responsible for the mistakes. After such a teaching session, an examinee is given a post-test that is parallel to the pre-test. The level of a person's LP can thus be determined by the difference between pre- and post-test scores and the change in the types of mistakes made before and after the teaching session. Another possibility is to divide the test or exam into separate questions and prepare a sequence of cues or prompts to be given after a specific mistake is made in response to each one of the questions. In the end, the examinee always reaches the correct answer because the last cue actually provides the correct solution. In this case, the examinee's LP is estimated as the opposite of the number of received cues. The fewer cues a person needs for responding correctly to the question, the higher his/her LP.

These LP assessment procedures can be used with test materials similar to those of standard cognitive tests, such as sequences of numbers or figures, matrices, and verbal or pictorial analogies. The LP assessment can also be carried out with tasks reflecting practically any curricular material: language,

mathematics, history, science, and so on. Once the idea of LP assessment entered the field of the school curriculum, an interesting dialogue started between it and the following, somewhat related, assessment approaches in contemporary education: formative assessment, adaptive assessment, and response to intervention.

LP and formative assessment share a common orientation toward the future of students' learning rather than their past. While so-called summative assessment aims at taking stock of the knowledge and skills already acquired by students, formative assessment aims at providing guidance for future teaching and learning. In a sense, formative assessments can be imagined as a series of test–teach–test episodes that provide teachers with ongoing information about the effectiveness of their teaching and the responsiveness of students. The main difference between LP and formative assessments is related to their history. The concept of LP assessment originally emerged in response to dissatisfaction with static intelligence tests and only later "drifted" to the curricular areas. It is still firmly connected to its roots in psychological and developmental theories. Formative assessment in its turn emerged from the classroom practice in response to dissatisfaction with summative exams aimed at ranking students' subject achievements but providing little information for changing the course of instruction. It is difficult to discern a common theoretical basis for different formative assessments that are often created in a rather intuitive way by teachers themselves for their specific teaching needs (Greenstein, 2010).

The second form of assessment to be compared to LP is the so-called adaptive assessment. This type of assessment emerged in response to the problem of using the same test or exam with students of different performance levels. For some of the students, a given exam could be too difficult and lead to frustration; for others it could be too easy and thus fail to evaluate their true ability. The availability of computers as a medium for storing a large number of tasks and displaying them to students provided further impetus for adaptive assessment, particularly in mathematics. The adaptive assessment starts with a presentation to a student of the task of average difficulty for his or her age group. If the student fails to solve the problem, an easier task of the same type is presented. If the second, easier task is also not solved, even the simpler task is provided. After each correct solution, the student is given a more challenging task. In this way assessment via computer becomes individualized and its results provide richer information about students' problem-solving abilities. At a certain moment, adaptive assessment procedures started acquiring features that bring them closer to LP assessment. This happened when instead of simply

providing the student with the easier task the computer program provided him or her with hints or cues that "matched" the mistake that has been made. In this way, the learning phase has been effectively introduced into the adaptive assessment procedure so that the students' LP could be evaluated through the type and number of cues or hints needed to solve a problem of a certain level of difficulty. Two main differences between adaptive assessment and LP are the content area and the use of computers. While LP assessments span a wide range of areas, from intelligence tests to school subject exams, so far adaptive assessments have been used almost exclusively in math teaching. Moreover, while LP assessment usually involves a human mediator, the advantage of adaptive assessments is in their computer-based nature.

Finally, the response to intervention (RTI) methodology emerged primarily in response to the need for early detection and prevention of learning disabilities in children at the beginning of formal education. Some of the sources of this methodology are more pragmatic, while others are more theoretical. The pragmatic aspect is related to the difficulty in providing all children who demonstrate some literacy or numeracy problems with professional assessments carried out by psychologists or reading/math specialists. As a result, some of the children remain without proper intervention, while others are erroneously labeled as "learning disabled." The theoretical basis of RTI is related to dissatisfaction with the so-called achievement gap definition of learning disability. The "gap" is between the school achievement expected of the child with a given level of intelligence and his or her actual low achievement. One of the problems with the "gap" definition is that it not only depends on the availability of intelligence testing of all "at-risk" children but also on the actual school failure of the child. Instead of waiting for a child to show the gap, the RTI methodology proposes to start the process of intervention as early as possible and to watch for the level of children's response to intervention. Those children who respond positively to intervention may have some learning difficulties, but they should not be labeled as disabled. Only those children who fail to respond positively to increasingly intensive and individualized forms of intervention can indeed be classified as learning disabled and be provided with appropriate special education treatment.

There is a certain affinity between RTI and LP assessment, but they are not identical. First of all, while RTI follows the teach–test–teach sequence, the LP assessment is based on the test–teach–test model. Second, RTI focuses on offering an alternative to the prevention of learning disabilities while LP has a much broader range of goals. In addition, so far the RTI