CHAPTER 1

What Is Practical Intelligence?

To do well in any everyday endeavor, whether the endeavor pertains to school, work, or play, requires practical intelligence. Although intelligence as conventionally defined may be useful in everyday life, practical intelligence is indispensable. It is the ability to adapt to, shape, and select everyday environments. Practical intelligence, like most abilities, can be viewed as a form of developing expertise (Sternberg, 1998a). Individuals who have developed the knowledge, skills, and abilities needed to succeed in a particular domain generally are characterized as experts. Therefore, understanding expertise and how it develops provides a method of insight into practical intelligence.

So how do we come to characterize practical intelligence as a form of developing expertise? We begin with a distinction between viewing abilities as relatively stable attributes and viewing them as developing expertise.

CONCEPTIONS OF INTELLIGENCE

The conventional view of intelligence is that it is some relatively stable attribute of individuals, which develops as an interaction between heredity and environment (Sternberg & Grigorenko, 1997b). Conventional tests of intelligence and related abilities measure achievement that individuals should have mastered several years before (Anastasi & Urbina, 1997). Tests such as those of vocabulary, reading comprehension, verbal analogies, arithmetic problem solving, and the like are, in part, all tests of achievement. Even abstract reasoning tests measure achievement in dealing with geometric symbols, which are skills taught in Western schools (Laboratory of Comparative Human Cognition, 1982).

An alternative view is that of intelligence as *developing expertise* and intelligence tests as measuring an aspect, typically a limited aspect, of developing expertise (Sternberg, 1998a, in press-b). Developing expertise is defined here as the ongoing process of the acquisition and consolidation of a set of skills needed for a high level of mastery in one or more domains of life performance. We believe that the problem regarding the traditional model is not in its statement of a correlation between ability tests and other forms of achievement but in its proposal of a causal relation whereby the tests reflect a construct that is somehow causal of, rather than merely temporally antecedent to, later success. The developing expertise view in no way rules out the contribution of genetic factors as a source of individual differences in the ability to develop a given amount of expertise. Many human attributes, including intelligence, reflect the covariation and interaction of genetic and environmental factors. However, the contribution of genes to an individual's intelligence cannot be directly measured or even directly estimated; rather, what is measured is a portion of what is expressed, namely, manifestations of developing expertise.

According to this view, measures of intelligence should be correlated with later success, because both measures of intelligence and various measures of success require developing expertise of related types. For example, performance both on tests of intelligence and on indices of success typically require what Sternberg (1985a) has referred to as *metacomponents* of thinking: recognition of problems, definition of problems, formulation of strategies to solve problems, representation of information, allocation of resources, and monitoring and evaluation of problem solutions. These skills develop as results of gene–environment covariation and interaction. If we consider these skills to reflect intelligence, then we should recognize that what we are calling intelligence is a form of developing expertise.

The developing expertise point of view presented here integrates the study of intelligence and related abilities (Sternberg, 1990a, 1994a, in press-b) with the study of expertise (Chi, Glaser, & Farr, 1988; Ericsson, 1996; Ericsson & Smith, 1991; Hoffman, 1992). These studies, typically viewed as distinct, here are viewed as ultimately involved with the same psychological mechanisms. We review here briefly some of the perspectives and theories on expertise and its development. Then we discuss how the developing expertise view provides a framework for understanding the role of practical intelligence in everyday life.

CONCEPTIONS OF EXPERTISE

Researchers have conceptualized expertise in different ways (Sternberg, 1994a, 1995a). One conception is knowledge-based, defining an expert as someone who knows a lot about a given area of endeavor. It seems likely that knowledge is a necessary condition for expertise; no one would want to go to doctors, lawyers, or psychotherapists who lacked knowledge of their fields. Another conception is that expertise is not just the possession of knowledge, but the flexible application of the knowledge base.

The application of knowledge depends on analytical, creative, and practical skills (Sternberg, 1994a). Experts need to analyze problems that are presented to them. Doctors analyze reports of symptoms and themselves look for diagnostic signs of various illnesses. Musicians need to analyze the pieces they play in order to meet the technical requirements of these pieces. Most kinds of expertise also require the application of some kind of creative skill. Lawyers devise creative legal strategies to free their clients from legal jeopardy. Scientists create new theories and experiments to chart the unknown. Finally, expertise requires practical skills. The successful doctor needs patient skills, that is, ways to reach out to patients, comfort them, and reassure them that they are getting care in which they can have confidence. Lawyers need to convince their clients to tell them the truth so that they can adequately represent these clients. Scientists need to convince a frequently skeptical public, scientific or otherwise, that their ideas are not just some hare-brained concoction of fact and fiction but rather a good representation of scientific facts. Musicians and artists need to reach out to potential audiences so that these audiences will pay attention to their performances or art works.

Expertise may be viewed as an attribute not just of a person but of the way the person is perceived by other persons – as an interaction between a person and a situation. In this case, expertise can be seen as in part a labeling phenomenon whereby some group of people declares a person an expert (Sternberg, 1994a). Without that declaration, the person may have difficulty in exercising expertise. For example, an individual trained in medicine cannot practice without a license; an individual trained in the law cannot represent clients without having passed the bar. A scientist can engage in science without academic credentials but may have difficulty obtaining an academic job or research funding without those credentials. In chess, expertise is often recognized in terms of a person's numerical rating according to a system of evaluation of how well the person plays chess. Becoming labeled as an expert may require practical skills in the sense that others need to be convinced of one's expert status.

Theories of Expertise

Theories of expertise focus primarily on either the mental processes underlying performance or the knowledge resulting from those processes and its organization. These factors are studied in trying to distinguish individuals with more from those with less expertise. We shall now briefly characterize these theories, which have been reviewed by Ericsson and Smith (1991), Sternberg & Ben Zeev (in press), and Sternberg, Grigorenko, and Ferrari (in press).

THEORIES FOCUSING ON MENTAL PROCESSES. Some theories of expertise emphasize the role of planning, problem solving, and reasoning processes (Charness, 1981, 1991; Charness, Krampe, & Mayr, 1996). Other theories emphasize information processing (Lesgold et al., 1985; Patel & Groen, 1991; Sternberg, 1985b). Sternberg identified metacomponential processes, such as planning, monitoring, and evaluating one's problem solving and decision making, as distinguishing experts from novices. Experts and novices represent information differently, and experts engage in more sophisticated strategies and performance monitoring than do novices.

Experts also spend relatively more time than do novices in *global planning*, or strategic planning for solving a problem as a whole. Novices, in contrast, are more likely to begin problem solution relatively quickly but with the result that later on during problem solving they are more likely to have to restart their work. The dividends of more time spent in global planning are later paid in less time that needs to be devoted to *local planning*, the tactical planning that needs to be done as one proceeds through the steps of problem solving. In the long run, local planning likely will drain more time from the problem solving process when global planning was incomplete or inadequate (Sternberg, 1981).

Because experts can recognize the deep structure of the problem they are able to solve problems by working forward, whereas novices are much more likely to solve problems working backward. In other words, experts look at the terms of the problem and then proceed forward from the problem statement to a conclusion. Novices are more likely to start with the known or intended solution and then to work backward to try to figure out how they could get to the terms of the problem, given where they are trying to go.

The persistent difference in representation of problems (Chi et al., 1988) is crucial for understanding an important aspect of the difference between experts and novices. Although the apparent problem being solved by the expert and the novice is the same, the psychological problem being solved, or at least the representation of it, is different. The problem that an expert physicist sees as being about a principle of physics might be seen by a novice physicist as being about a mechanical device. The problem a layperson might see as being about a person's mood swings might be seen by a psychiatrist as being about a manic–depressive personality. The differences in representation show how difficult it is to separate knowledge from information processing; the representations that experts construct typically would not be possible without very extensive and well organized knowledge bases.

THEORIES FOCUSING ON KNOWLEDGE. Theories focusing on the role of the knowledge base and its organization often stress the role of stored information in long-term memory as a key to understanding expertise. These theories generally have their origins in the work of de Groot (1978) and of Chase and Simon (1973).

De Groot (1978) asked chess players of differing levels of expertise to think aloud while they contemplated the next moves they would make from several different presented chess positions. In most cases, grand masters and chess experts not at the grand master level evaluated moves similarly. There was no difference in the number of moves considered by the groups of differing levels of expertise, but grand masters arrived at the best move earlier in their consideration of moves than did the more typical experts. De Groot concluded that the grand masters rely on a more extensive knowledge base than do the more typical chess experts. They recognized the presented position as similar or identical to one they had seen before and hence were able to zero in rapidly on the optimal move. Knowledge acquired through experience rather than any special kind of information processing seemed to be what distinguished the chess grand master from the other experts.

Chase and Simon (1973) suggested that the grand masters simply may have better memories than do the more common experts. They tested this hypothesis by presenting grand masters and experts with chess configurations for 5 sec and then asking the two groups to recall them. They included both configurations of pieces from real games and random configurations of pieces. If the grand masters simply had better memories for pieces than the experts, their recall should have been better for all chess board configurations, regardless of whether they were real or not. However, the level of chess expertise influenced recall only of sensible (real game) configurations of chess pieces; it had no influence on recall for random chess positions. In other words, what distinguished the experts from the novices and the grand masters from the experts was not overall superior recall abilities but rather the extent and organization of their knowledge base.

Chase and Simon (1973) found also that the more expert players were able to use their knowledge base to retrieve large amounts of information in each recall of chess pieces. Simon and Gilmartin (1973) confirmed via computer simulation that chess experts draw on huge knowledge bases unavailable to novices in doing the chess-related tasks. These knowledge bases may be organized into *problem schemas*, or organized bodies of knowledge on which people can draw to help them represent and then solve a problem.

The same basic finding regarding the role of the knowledge base has been replicated in a number of other domains, such as the game of Go (Reitman, 1976), electronic circuit diagrams (Egan & Schwartz, 1979), and bridge (Charness, 1979; Engle & Bukstel, 1978). Thus, a vast and organized knowledge base and the problem schemas that come with it seem to be of fundamental importance to many different kinds of expertise. Such schemas and the information within them are not rapidly acquired. Simon and Chase (1973) estimated that it would take about 3,000 hours of play to become a chess expert and 30,000 hours to become a chess master. But how does the acquisition of expertise take place?

The Acquisition of Expertise

A number of theories have been proposed of how people may become experts, whether in music, athletics, art, or whatever (Anderson, 1987, 1993; Newell, 1990; Sternberg & Ben Zeev, in press). We consider two primary approaches to understanding the acquisition of expertise. One approach addresses the stages involved in acquiring expertise, and the other considers the contributing factors in developing expertise.

THE ACT* THEORY OF SKILL ACQUISITION. Anderson's theory, which is embedded within his ACT* theory of cognition, represents a stage model. (ACT stands for "A Cognitive Theory.") According to Anderson

CAMBRIDGE

Cambridge University Press
978-0-521-65958-1 - Practical Intelligence in Everyday Life
Robert J. Sternberg, George B. Forsythe, Jennifer Hedlund, Joseph A. Horvath, Richard K. Wagner, Wendy M. Williams, Scott A. Snook and Elena L. Grigorenko
Excerpt
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(1987, 1993), skill acquisition proceeds through three main stages, which represent successive levels in the development of expertise.

In the first stage, the kind of situation that evokes the skill and the method for solving problems in that situation are encoded as declarative knowledge. Usually, this declarative knowledge derives from explicit instruction, which may include an abstract presentation of the type of problem situation and how to solve it as well as examples of problem solving in action. In this stage of development, problem solving is relatively slow and deliberate. The more a given problem departs from the exact way in which its solution was taught, the harder is the problem, to the point that even minor levels of transfer may fail to occur.

In the second stage, knowledge comes to be represented procedurally, in the form of *productions*, or condition–action statements, that can be used in the performance of a task. For example, one such production might be, "If you see a dot over a note, play that note in staccato (short and punctuated) fashion."

In the third stage, the productions are combined into successively more elaborated production systems, or sequences of condition–action statements that can be used to execute a complex series of task requirements. Now, performance of the task becomes more highly automated and requires less conscious effort on the part of the individual doing the task.

Although these stages may characterize the development of expertise, there are individual differences in terms of the progression through the stages. In other words, some individuals are more likely to acquire expert skill level than others. We next consider the factors that contribute to this distinction.

THE ROLE OF DELIBERATE PRACTICE AND INNATE ABILITIES. Opinions differ regarding whether expertise is a function of deliberate practice, innate abilities, or some combination of the two. We consider two views, one emphasizing the role of deliberate practice and the other emphasizing the joint roles of deliberate practice and talent.

One view of the development of expertise is that it requires deliberate practice. Deliberate practice is not just any old practice, but rather practice in which the task is at an appropriate level of difficulty for the individual, it provides informative feedback to the individual, it provides opportunities for repetition, and it allows correction of errors (Ericsson, 1996).

Ericsson (1996) argues that deliberate practice is not just a necessary condition for the development of expertise but a sufficient condition as well. In other words, engaging in sufficient deliberate practice will, under normal conditions, produce an expert. Ericsson and his colleagues (Chase & Ericsson, 1982; Ericsson, Krampe, & Tesch-Römer, 1993) have pointed to studies with musicians and students to support their claim. They found, for example, that top violinists spend more hours in deliberate practice than do their less expert cohorts. Chase and Ericsson (1982) showed that individuals can develop exceptional memory through extensive training.

Many theorists believe that talent, or innate ability, plays an important role in the development of expertise, not just deliberate practice (Bloom, 1985; Shiffrin, 1996; Simonton, 1996; Sternberg, 1996; Winner, 1996a, 1996b). They argue that although deliberate practice is likely to be a necessary condition for the development of expertise, it is not likely to be a sufficient one.

First, behavior–genetic studies show a role for genetic factors in interaction with environmental ones in the development of various kinds of expertise (Plomin & McClearn, 1993). Many different types of abilities seem to have at least some heritable component as a source of individual differences, and the kinds of expertise studied by psychologists seem to be no exception.

Second, advocates of the talent plus practice position argue that the deliberate practice view is just not plausible. Is one to believe that anyone could become a Mozart only by putting in the time? Or that anyone could reach the level of skill shown by Michael Jordan in basketball just by working hard enough at it? Although this argument is one of plausibility rather than data, on its face it is not a simple matter to refute. Many people have tried to reach the exceptional levels of accomplishment shown by the top people in a given field and most have given up in disappointment.

Third, the advocates of the mixed position argue that the demonstrations of deliberate practice lack control groups or contain inadequate ones. They speculate that other people who do not become experts may put in the same hours of deliberate practice as the experts, but because these nonexperts disappear from view, they may never make it into studies of expertise.

Fourth, the advocates of the mixed position argue that deliberate practice is itself a confounded measure, representing talent as well as practice. How could deliberate practice be a function of talent? The idea (Sternberg, 1996; Winner, 1996b) is that only those with high levels of talent continue to put in the deliberate practice it takes to reach high levels of expertise. Their talent motivates them to try harder and thus rack up more hours of deliberate practice. Consider music lessons, for example. Many millions of children over the years take music lessons, but many of those quit. Why? Perhaps because they discover that they lack the talent to become professional or even skilled musicians. So they never put in many hours of practice over the course of their lifetime. The result is that the correlation between deliberate practice and expertise may in part be affected by levels of talent.

Having considered some of the different views of expertise and how it is acquired, we now discuss a view of intelligence and in particular, practical intelligence, as a form of developing expertise.

PRACTICAL INTELLIGENCE AS A FORM OF DEVELOPING EXPERTISE

Some intelligence theorists point to the stability of the alleged general factor of human intelligence as evidence for the existence of some kind of stable and overriding structure of human intelligence. But the existence of a *g* factor may reflect little more than an interaction between whatever latent (and not directly measurable) abilities individuals may have and the kinds of expertise that are developed in school. With different forms of schooling, *g* could be made either stronger or weaker. In effect, Western and related forms of schooling may, in part, create the *g* phenomenon by providing a kind of schooling that teaches in conjunction the various kinds of skills measured by tests of intellectual abilities.

Thus, conventional tests may unduly favor a small segment of the population by virtue of the narrow kind of developing expertise they measure. When one measures a broader range of developing expertise, the results look quite different. Moreover, the broader range of expertise includes kinds of skills that will be important in the world of work and in the world of the family.

Analytical, creative, and practical abilities, as measured by our tests or anyone else's, can be viewed as forms of developing expertise (Sternberg, 1998a). All are useful in various kinds of life tasks. However, conventional tests may unfairly disadvantage those students who do not do well in a fairly narrow range of kinds of expertise. By expanding the range of developing expertise that we measure, we discover that many children not now identified as able have, in fact, developed important kinds of expertise. The abilities that conventional tests measure are important for school and life performance, but they are not the only abilities that are important.

We have conducted studies in which we have measured informal, procedural knowledge in children and adults. We have found in studies with business managers, college professors, elementary school students, salespeople, college students, and general populations that this important aspect of practical intelligence is generally uncorrelated with academic intelligence as measured by conventional tests (Sternberg, Wagner, Williams, & Horvath, 1995). Moreover, the tests predict performance as well as or better than do tests of intelligence quotients. The lack of correlation between the two kinds of ability tests suggests that the best prediction of job performance will result when both academic and practical intelligence tests are used as predictors. Most recently, we have developed a test of common sense for the workplace (e.g., how to handle oneself in a job interview) that predicts self-ratings of common sense but not self-ratings of various kinds of academic abilities.

Both conventional academic tests and our tests of practical intelligence measure forms of developing expertise that matter in school and on the job. The reason the correlations are often null is that the kinds of developing expertise they measure are quite different. The people who are good at abstract, academic kinds of expertise are often people who have not emphasized learning practical, everyday kinds of expertise, and vice versa.

In this volume, we address the practical kind of expertise that contributes to successful performance in school, work, and any life endeavor. In the first half of the book, we consider the diverse views on intelligence and the increasing recognition in both research and practice that practical abilities are important to success. In the second half of the book, we describe a program of research that seeks to understand practical intelligence from the perspective of the knowledge acquired and used by experts (i.e., successful individuals) in a given domain.