Chapter 3

Essential Tensions Surrounding the Concept of Giftedness

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Abstract The concept of giftedness has a unique history and its meanings need to be deciphered in a proper cultural context. In this chapter, I first discuss "giftedness" as used in natural language as well as scientific discourse. I then provide an overview of the intellectual history of the concept in terms of construction, deconstruction, and reconstruction of "giftedness," a change from what can be called essentialism to developmentalism. I argue that there are some essential tensions surrounding the concept of giftedness; they involve competing arguments and perspectives on the genesis and development of gifted behaviors and superior achievements. I then elaborate on these tensions and discuss possible ways of resolving and easing these tensions. I end the chapter by suggesting a dialogue between people of differing convictions that would allow us to delve deeper into the intricacies of the issues involved, and reach some degree of consensus as to the conceptual and empirical challenges we are facing.

Keywords Giftedness and exceptional performance/competence · Intelligence · Motivation · Talents and talent development · Expertise · Creativity · Nomothetic versus idiographic approaches · Reductionism versus emergentism

> Things fall apart; the centre cannot hold. . .
> (Borland, 2003, p. 105, quoting Yeats)
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> Within the group, some individuals may be more traditionalistic, others more iconoclastic, and their contributions may differ accordingly.
> (Kuhn, 1977, pp. 227–228)

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Introduction

In a Dell computer catalog published in August 2006, a new model "prodigy" was presented prominently on the cover. Indeed, the advertiser claimed that it is "gifted." Regardless of whether a computer model can be "truly gifted," it reveals a cultural significance of the concept: Giftedness, at least in the Western world, is a commodity that sells well. By claiming that a computer model is gifted, it conveys an unwavering faith in its superiority over other brands or models. The same can be said about a gifted person. Sternberg (1995) summarized people's intuitions or folk beliefs about what makes an individual "gifted" with a pentagonal implicit theory of giftedness. According to this theory, in order to be judged as gifted, a person needs to meet five criteria:

(1) The *Excellence Criterion*, which states that "the individual is superior in some dimension or set of dimensions relative to peers"
(2) The *Rarity Criterion*, which states that "an individual must possess a high level of an attribute that is rare relative to peers"
(3) The *Productivity Criterion*, which states that "the dimension(s) along which the individual is evaluated as superior must lead to or potentially lead to productivity"
(4) The *Demonstrability Criterion*, which states that "superiority of the individual on the dimension(s) which determine 'giftedness' must be demonstrable through one or more tests that are valid assessment"
(5) The *Value Criterion*, which states that "the person must show superior performance in a dimension that is valued for that person by his or her society" (Sternberg, 1995, pp. 66–68)

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If we interpret "test" broadly enough to include any task performance or manifest behavior, and "dimension" to include authentic domains of human activities as well as psychological constructs such as intelligence or creativity, this list of criteria appears to serve us well regarding whether the "gifted" label is warranted for the observed performance and the person who delivers the performance. In actuality, however, these criteria only nominally solve the problem of how "giftedness" is implicitly determined in our natural language. For example, even in scholarly discussion and educational practice, the term is used in somewhat arbitrary ways (see Hertzog, this volume). A notable practice is that different meanings are intended for the term: It can refer to either psychometrically defined abilities or academic achievement (Gallagher & Courtright, 1986); superior potential is implied when used to describe a child, and superior, eminent accomplishments when used to describe an adult (Mayer, 2005). However, do these two qualities necessarily implicate each other? To the extent that they have different underpinnings, the concept "gifted" lacks unity and identity in its referents and meanings, which makes intelligible and intelligent discourse on the nature of giftedness difficult.

What further complicates the matter is the value-laden nature of the term: "gifted" is often preserved for superior performance in domains that enjoy cultural distinction and importance, be it IQ test scores or special talents of cultural value. Theoretically, a gifted burglar or computer hacker is perfectly conceivable (and probably constitutes an interesting gifted phenomenon in its own right; see Heinzen, this volume), but people rarely include them in the public discourse on giftedness. Thus, to promote giftedness is to promote a human value with respect to its instrumental or intrinsic importance, and this is behind the gifted education movement. There is a scientific turn in this endeavor: What we try to promote should be constrained by our knowledge through systematic, rigorous inquiry. Thus, the public discourse on giftedness has been historically shaped by multiple stakeholders with vested interests of the scientific, ethical, social-political, and pragmatic nature. This is a mixed blessing for the field. On the positive side, the field enjoys its cultural importance and practical significance, as the knowledge it produces has important policy and strategic implications and practical utilities. On the negative side, the discourse has become very murky to the point of compromising its own credibility as a source of veridical knowledge.

Human language itself has contributed to the problem of communication. The term "gifted" can be used descriptively and explanatorily, and these two modes of expression have different meanings. Descriptive use of the term remains empirical; for example, "he is a gifted musician" can be just an observation, equivalent to saying that "he performed extremely well." Explanatory use of the term, in contrast, implies a causal relationship; thus, "he is a gifted musician" may imply that he possesses a musical talent that leads to the excellent performance. The latter use involves some level of inference and abstraction beyond the observable. Interestingly, many adjectives suffer from the fate of reification. Thus, "intelligent" gradually gets hardened into "intelligence," and "gifted" into "giftedness"; the descriptive becomes implicitly explanatory. Indeed, some scholars in the field call for an explicit use of the term as explanatory, with "gifted" referring to "natural abilities" and "talent" to systematically developed skills and competencies (e.g., Gagné, 2004, this volume). The ambiguities involved in the descriptive versus explanatory use of the term in our natural language cause much confusion. This is largely due to the fact that the word "gifted" is loaded with varied intended and unintended meanings (Robinson, 2005), and what is intended and what is not intended in a specific context is not always well articulated. It is easy to relapse from a reasoned argument into a leap of faith in our communication. Moreover, the use of giftedness as a causal agent (e.g., the phrase "because of one's giftedness") can be criticized as making a circular or tautological argument: To say that one's giftedness gives rise to her gifted performance is just like saying that someone behaves aggressively because the person is aggressive or possesses aggression; no further insight can be gained about the aggressor (or the gifted).

From a scientific point of view, the descriptive versus explanatory use of the term "gifted" translates into empirical and theoretical questions. Empirically, how do we know that a person is gifted? Which form of assessment is more valid and effective: formal testing or authentic tasks? Should we rely on statistics derived from standardized tests or more up-close clinical judgments? What are the most effective ways of investigating gifted phenomena: psychometric mapping of traits in the population or tracing unique individual history? Theoretically, how do we explicate the origins and

ontogeny of gifted behavior or performance? Should we see relevant phenomena as fundamentally reducible to a set of simple elements or as revealing a form of organized complexity that cannot be explained by simpler elements in isolation?

Historically, three core dimensions have been used to define the substantive nature of giftedness, each constituting a broad, abstract concept itself, a latent construct that can be further scrutinized in terms of social and psychological underpinnings: intelligence, motivation, and creativity (see Robinson & Clinkenbeard, 1998). The order of these dimensions is not arbitrary. Intelligence (human abilities), psychometrically or otherwise defined, is arguably the most stable of the three, having more transferability in terms of enabling acquisition of new knowledge and skills (Messick, 1992). Motivation is considered more fluctuating and situational, depending on personal experiences and history as well as social contexts (Dai, Moon, & Feldhusen, 1998), though longitudinal stability of motivational patterns was also found (e.g., Gottfried, Gottfried, Cook, & Morris, 2005). Lastly, creativity takes a longer developmental trajectory to develop and likely integrates intelligence, motivation, and personality factors, and therefore the least stable and predictable of the three (Renzulli, 1986). The three concepts share a common characteristic with the concept of giftedness: they can refer to either potential (propensity or aptitude) or actual behavioral manifestation. However, the three-construct scheme is still a highly simplified roadmap to understanding giftedness, a first approximation. For the purpose of discussion, I follow the widely accepted convention of defining "gifted" as demonstrated excellence by age-appropriate standards, through authentic, exceptional performance or potential for excellence, demonstrated through aptitude tests, interviews, and clinical observations of behavior and performance (e.g., Marland, 1972; Mayer, 2005).

Construction, Deconstruction, and Reconstruction of Giftedness: A Dialectical Evolution of a Concept

The intellectual history of a concept has its own logic. It evolves and changes through human reflective consciousness, sometimes conscience, as an adaptation to new conditions and demands (Toulmin, 1972). I use the term "dialectical" to denote a human tendency for self-correction (including over-correction), to come back to a better sense of reality through negating, counterarguments, and resolution of conflicts of ideas. A concept tends to evolve in this way due to its internal tension, its failure to capture important aspects of what we sense as "truth" or "reality." While this internal tension is essential, various historical circumstances influence the trajectory and timing of its changes. Therefore, by discussing construction, deconstruction, and reconstruction of giftedness as a logically sequential event, I by no means imply that they happened in an exact chronological order and linear fashion, as they are actually intertwined and mutually stimulating events. As in the case of a volcano, the tension is always there; however, when it reaches the point of eruption depends on many circumstantial factors that crack the structural and functional stability of the system. By structuring these events in these three phases, I try to elucidate the larger context or zeitgeist, the underlying motivations, biases, and logic that seem coherent in (a) the *construction* of core values and beliefs concerning the concept of "giftedness," (b) the *deconstruction* of this core, and (c) the *reconstruction* of new core values and belief systems around it.

Giftedness Constructed: Lewis Terman's Legacy of Essentialism

Lewis Terman (1877–1956) was a man of his time, for better or for worse. Galton (1869) envisioned a society or nation where a more distinct role be conferred upon the intellectually superior to preserve its greatness. Inspired by Galton, among others, Terman launched the first large-scale study of gifted youths by introducing massive intelligence testing as a major tool for identifying the intellectually gifted. What characterizes Terman's time is the following convictions and motivations, which Terman (1925) held for identifying the gifted:

(1) Intelligence is a general human quality, and it is largely genetically determined. This is a Galtonian doctrine with connotations of Darwinism: Intelligence is a heritable biological trait through natural selection. Note that in Terman's time, the memory of Gregor Mendel's discovery of genetic inheritance in pea plants was still fresh, further reinforcing this Galtonian conviction.

(2) A hierarchy of intellectually superior, mediocre, inferior people can be established in the society. Herbert Spencer's social Darwinism provided justification for the social strata or hierarchy during that historical period in the United States. A moral imperative, shared by Terman and many of his contemporaries, was to "better" the human race, eugenics being part of the solution. While Charles Goddard was working at the low end, how to reduce the negative effects of "the feebleminded" who could not tell right from wrong, Terman mainly worked on the high end, identifying and understanding the gifted (see Hall, 2003).

(3) Intelligence as a general personal quality can be measured objectively with the newly invented intelligence test. Terman believed that, with the birth of the first intelligence test created by French psychologists Binet and Simon, the measurement technology was advanced enough to gauge levels and amounts of this essential quality. The gifted can be defined as top one percent of the population (roughly at or above IQ score of 140), as measured by the Stanford–Binet Intelligence Scale, a modified version of Binet and Simon's test.

It is almost bewildering in historical hindsight as to why Terman and his contemporaries had such confidence in testing and measuring such a complex, abstract human quality. Indeed, they did not even have an elaborated theory of intellectual performance and intelligence, besides its practical importance and potential applications. However, consider the confidence of Charles Spearman (1904) when he entitled his now classic article " 'General Intelligence,' Objectively Determined and Measured" (p. 201). The spell of British empiricism in the American culture should not be underestimated. It entails a minimalist (and often reductionistic) assumption of how the real world operates (e.g., a deterministic world view, including how intellectual performance is determined), availability of effective measurement, and efficient mathematical maneuvering of data to find discernable patterns, all started by Galton. The faith in quantitative measurement at the time (even today) is illustrated best by Thorndike's famous quote: "Whatever exists at all exists in some amount" (quoted in Mayer, 2003, p. 141). Underlying this conviction was the need for control in a Foucaultian sense, for good or ill, with measurement as its technology. It is not accidental that Binet had less intellectual impact on the thinking of Terman and Goddard, among their American contemporaries, other than contributing a crucial empirical tool: an intelligence test. Binet, a more nuanced Continental psychologist, was more intrigued by "idiographic complexity" (Brody, 2000, p. 19) of individual performance than mathematical certainty of the normal distribution of human traits like intelligence, which was the obsession of Spearman.

Terman started what might be called an *essentialist or realist tradition* of defining and explaining gifted potential. Essentialism assumes that there is a unique essence or quality under any manifestation of behaviors seen as "gifted" or within a person so labeled. Intelligence is seen as a trait, a structural, enduring quality of the person; thus high-IQ children are seen as possessing this unique quality that sets them apart from their peers. In its most reductionistic form, giftedness is seen as a natural endowment and neurological advantage (see Geake, this volume). An indication of the movement toward an essentialist construal of giftedness is the change from use of the term as an adjective to as a noun; namely, the term "giftedness" started to hold an explanatory power. This is why Gagné (1999, 2004, this volume) insists that the term giftedness be differentiated from the term talent because such a causal structure and ordering of gifts and talents is important for an essentialist theory. Although there are many variations, the basic assumption of the essentialism is a unitary core of natural endowment that renders a handful of individuals "gifted," and this essence has profound ramifications for their individuality, such as different levels of capacity, different ways of thinking, different social–emotional characteristics, different educational needs, and different developmental trajectories and pathways. The basic essentialist developmental model is how high level of "raw" intelligence or high abilities get "translated" through experience and efforts into specific forms of talent, competence, and expertise in some valued human activities.

Giftedness Deconstructed: Social and Scientific Disenchantment

Even in his heyday, Terman's advocacy for massive intelligence testing and for identifying gifted children was not going uncontested. In an early nature–nurture debate, many people voiced concerns that IQ testing threatened democracy and diminished the role of education (see Feldhusen, 2003 for a historical account).

Lippmann was among the early voices of criticism on intelligence testing; he questioned the scientific validity of IQ tests and consequently ethical implications of making IQ tests "a sort of last judgment of the child's capacity" (Lippmann, 1976, p. 19; see Block & Dworkin, 1976, for the Terman versus Lippmann debate in 1920s). These voices were a prelude to contemporary criticisms of the gifted movement. More direct criticism of using IQ scores as a benchmark of giftedness was made by Getzels and Jackson (1965), who argued that highly creative children would be excluded when IQ was used as a main criterion for identification. However, they only attempted to modify the identification process and criteria, rather than rock the foundation of gifted education. There have been two movements that truly challenge the essentialist conceptions of giftedness. One was launched by social critics and the other by expertise researchers.

Social critique of giftedness largely occurs in the context of gifted education in the United States. The very fact that identification of the gifted was associated with an implicit or explicit social stratification based on IQ reinforced the suspicion that the gifted education movement is a remnant of social elitism. Namely, what were identified as "gifted children" were actually a socially privileged class of children, thus perpetuating the preexisting social inequality (Margolin, 1994, 1996). Persistent efforts to deconstruct the concept of giftedness have been made by Borland (1997; 2003, 2005), largely from a social constructivist perspective. Borland's main argument is that giftedness is conferred, rather than discovered: we invented it to serve a social purpose rather than discover it as an objective reality (Borland, 2003). From this point of view, Borland (2003) puts essentialist conceptions of giftedness into question:

> "Are these two groups—the gifted and the rest—the discrete, discontinuous, structured wholes this crude taxonomy implies? That is, is giftedness really its own thing, qualitatively different and apart from averageness or normality, making those who possess it markedly different, different in kind, from the rest of humanity?" (p. 111).

In short, Borland argued that the way we define giftedness as an essential quality that sets some children apart from the rest is scientifically unwarranted, and practically harmful (particularly for minority, underprivileged students). Borland further resorted to Foucault's argument that knowledge is not neutral but a form of the technology of control. One might extrapolate from this line of thinking that the fiction of general intelligence, the psychometric tests, even factor analytic tools, all conspired to maintain a certain kind of social order. By the same token, the gifted–non-gifted comparison research paradigm helps further perpetuate the bifurcation of the gifted and the non-gifted as two qualitatively different subpopulations.

As if to prove Foucault's point, there has been an undercurrent to break the hegemony of the public discourse on intelligence enjoyed by psychometricians. The most prominent examples are Gardner and Sternberg's theories. Gardner's (1983) theory of multiple intelligences has, for good or ill, successfully pluralized the concept of intelligence. Sternberg (1996) not only differentiates analytic, creative, and practical intelligences, but also has shown that the concepts of intelligence and giftedness, which are often considered universal human qualities, are fundamentally culture bound, reflecting cultural values and belief systems (Sternberg, 2000, 2007). Thus, successful intelligence in different cultures may entail different kinds of human adaptation. Gardner and Sternberg's theories have profoundly changed the way giftedness is conceptualized. But more importantly, their theoretical ideas have in effect promoted a more pluralistic value and a more liberal social order (e.g., compared to the conservative position expressed by Herrnstein & Murray, 1994).

In addition to the support of new intelligence theories, the social constructivist critique of essentialist conceptions of giftedness also found an unexpected ally from the experimental tradition of cognitive psychology, which sees the world quiet differently than differential psychology (Cronbach, 1957). When dealing with issues of alleged gifts and talents, cognitive psychology is mainly concerned with the scientific validity of the claims regarding the existence and importance of native intelligence and natural talents. When Terman defined the gifted as top 1% of the IQ distribution, there was no scientific justification as to why it could not be top 3 or 10%. Thus, such a practice is of mere pragmatic consideration, rather than due to scientific necessity. Grinder (1985), among many scholars, argued that "[t]he psychology of individual differences in intellect, to the extent that its methodology has been dominated by mental tests, never was elevated to the status of a science" (p. 27). While a few psychometrically oriented researchers have attempted to develop a process account of individual differences in intellectual performance by integrating psychometric

and experimental approaches (Hunt, 2006; see also Gustafsson & Undheim, 1996), cognitive researchers have attempted to show that essentialist beliefs about native intelligence and natural talents have no scientific basis (Ericsson et al., 2005, 2007; Howe, 1997; Howe, Davidson, & Sloboda, 1998), and that what used to be attributed to natural talent can now be explained more adequately as a result of years of domain experience and deliberate practice (Ericsson, 2006). These researchers look at contextual experiences for alternative explanations for exceptional competence (e.g., Ceci & Liker, 1986). Although evidence seems to cut both ways, they trust proximal variables (those that link to performance more directly) than distal variables, such as genetic differences. They are eager to outlaw the concept of natural ability or natural talent, very much like trying to dispel a superstition from the scientific parlance.

The crisis is also brewing from within. Close scrutiny of the intelligence tests raises serious questions about the essentialist definition of giftedness. Stephen Jay Gould, renowned biologist, joined the ranks of deconstructivists with his book entitled *The Mismeasure of Man* (1981). He particularly pointed out the gap between a measured quantity (IQ scores) and the theoretical construct "intelligence" the test is purported to measure. He argued that the whole enterprise of measuring human intelligence as a normative trait committed the error of reification. Intelligence seems to be too broad, abstract, and elusive a concept to be amenable to psychometric testing. At the face value, standard intelligence tests provide a composite score by sampling a variety of task performance (mostly an academic kind). This is an empirical approach to test development deliberately used by Binet to represent a wide variety of task conditions for the sake of enhancing its practical utility in educational settings. However, precisely because of the empirical approach, there is a level of arbitrariness as to what to include in such a test; in other words, the measurement is atheoretical. The paradox is that the broader range of tasks a test covers, the better its predictive power across situations (Gustafsson & Undheim, 1996), but the less psychologically meaningful the test becomes (Lohman & Rocklin, 1995).

Other stories also came out of closet. The traditional IQ definition of "giftedness" is predicated on the assumption that IQ tests measure natural aptitude apart from achievement, and its correlation with achievement reflects a cause–effect relationship. Now this assumption has been challenged (e.g., Lohman, 2006; Sternberg, 1999a). Theoretically, only by holding two persons' experiences constant can one infer differing "natural aptitude" in a specific learning or performance context. Mental testing simply does not afford such a stringent controlled condition. New evidence shows that with low socio-economical samples, the heritability estimate of IQ was zero and the variation of IQ was largely due to environmental factors; the opposite was the case for high SES samples (Turkheimer, Haley, Waldron, D'Onofrio, & Gottesman, 2003). While the finding begs the question of whether SES variations contain a genetic component, the study does raise the issue of differential meanings of IQ scores at different levels of SES. Sternberg (1999a) argued that no causal priority can be established for intelligence measures over achievement measures. Abilities measured by intelligence tests are forms of developing expertise, subject to environmental influences, including education (Ceci & Williams, 1997). Such an argument blurs the traditional line between aptitude and achievement, a distinction crucial for an essentialist view of giftedness (Gagné, 2004, this volume). There is also emergent evidence that psychometrically defined intelligence is more differentiated at the high end of the spectrum (Hunt, 2006); that is, at the high end of the IQ distribution (i.e., those with gifted IQs), there are more discrepancies between subtest scores. Thus, two persons with the same high IQ scores have, more often than not, different cognitive profiles. One may still see them as equally "gifted" but it means different things to each person, another uncertainty to be reckoned with. Other problems with equating high IQ and giftedness include instrument dependency, stability of high IQ (e.g., the issue of regression to the mean; see Lohman & Korb, 2006), and different developmental schedules, such as early versus late bloomers. What appears to be objectively measured "natural abilities" turns out to depend on many factors, genetic, developmental, environmental, and technical (e.g., instrument dependency).

Deconstruction of giftedness is in a sense to demystify the process of how "giftedness" is constructed, even how we created a fiction that came to be accepted over time as a reality in a Foucaultian fashion. On a positive note, deconstruction is a force of anti-reification and anti-essentialism. It has a potentially constructive impact on how we understand gift-

edness by forcing us to examine our deeply held, often taken-for-granted assumptions. It alerts us to a reality that is more complex and uncertain than we believe. It removes the guise of objective truth regarding intelligence, giftedness, and talent, and reveals possible subjectivity, biases, arbitrariness, even hidden social motivations involved in the construction of these "psychological realities." In its radical form, however, deconstruction and anti-essentialism, represented by Foucault and Derrida, can also border on nihilism and cynicism: All forms of knowledge are nothing but devices of social control, of gaining economic advantages, or simply a language game. From this extreme point of view, the rationality of scientific endeavor is simply an illusion (see Phillips & Burbules, 2000). The temptation toward this direction should be resisted, in my opinion.

On the other front, cognitive science has introduced a new level of rigor and a new set of criteria for judging claims about giftedness that are often based on intuitions and implicit assumptions, rather than solid scientific research and evidence. However, scientific adjudication of a possible role of genetically based individual differences for gifted behavior and performance (or the lack of thereof), when pushed to the extreme, can run the risk of radical positivism and environmentalism. After all, a cognitive science approach to giftedness, expertise, and creativity (e.g., Langley, Simon, Bradshaw, & Zytkow, 1987) has its own conceptual and methodological biases (e.g., a mechanical outlook on human functioning, emphasizing "computability," the "reproducible," and the "observable"; Ericsson et al., 2007). The challenge is clearly not to throw away evidence regarding individual differences accumulated by psychometric researchers in the past century, but to understand the discrepancies in the findings of different research traditions and theoretical persuasions (psychometric, cognitive, developmental, etc.), and how these discrepancies might be explained, even resolved, in light of the totality of evidence.

Giftedness Reconstructed: From Essentialism to Developmentalism

Terman's influence is still palpable today in terms of how we understand giftedness. Some of the basic essentialist tenets of Terman's legacy are still accepted by many contemporary students of intelligence in general and giftedness in particular. For example,

(1) Many scholars still believe that intelligence is a general, stable quality that has pervasive impact on one's success in life (Gottfredson, 1997; cf. Neisser et al., 1996), although they may not accept the proposition that it is genetically determined, or that there is a distinct racial hierarchy regarding intelligence.

(2) Many scholars still believe that IQ tests, despite their fallibility, provide the best measures around of this essential human quality, and high IQ is a good indicator of intellectual giftedness, predictive of long-term development and achievement (e.g., Gagné, 2004; Gallagher, 2000; Lubinski et al., 2004; Robinson, 2005), though they may differ in terms of whether a more conservative or liberal cutoffs should be used in identification of the gifted.

(3) Many scholars still believe, along with Terman, that high intelligence is a necessary, but not sufficient, condition for ultimate adult achievement and eminence; non-intellective and environmental catalysts play an important role (e.g., Gagné, 2004; Lubinski et al., 2004).

However, dissatisfaction with the rigidity of IQ-based definition of giftedness and the central doctrines of essentialism has also led people to search for alternative ways of thinking about giftedness. Back in the mid-20th century, Witty (1958) argued for a more inclusive definition of giftedness:

> "There are children whose outstanding potentialities in art, in writing, or in social leadership can be recognized largely by their performance. Hence, we have recommended that the definition of giftedness be expanded and that we consider any child gifted whose performance, in a potentially valuable line of human activity, is consistently remarkable (p. 62)"

In this new definition, not only were domains broadened to include artistic and social endeavors, but criteria for determining giftedness also shifted from test performance to authentic tasks (see also DeHaan, & Havighurst, 1957). Historical linkage is discernable between Witty's definition and that offered by Marland's (1972) report, which provided the first "official" definition of giftedness. Interestingly, the motivations driving this new approach to giftedness are pragmatic in nature. First, there was an increasing realization that "the gifted and talented come in a tremendous variety of shapes, forms, and sizes" (Passow, 1981, p. 8). Such diversity and heterogeneity simply defies the

Procrustean bed of IQ tests. Second, intelligence tests as selection/placement tools have little to say about how instruction can be differentiated for a selected group of children (Lohman & Rocklin, 1995).

It can be argued that two pragmatic movements in educating the gifted prompted the reconstruction of giftedness. The first was the Study of Mathematically Precocious Youth (SMPY) at Johns Hopkins University and subsequently the Talent Search model across the United States (Stanley, 1996; Lubinski & Benbow, 2006). A fortuitous event of trying to meet educational needs of a mathematically precocious child by a professor (Julian Stanley) eventually led to the establishment of the SMPY in 1971, and has proved to have historical importance in understanding and serving gifted children. This model bypassed the IQ criterion altogether and defined giftedness in terms of precocity, based on "out-of-level" testing, in an authentic domain of cultural importance. Epistemological and methodological significance lies in the fact that it starts with a genuine gifted phenomenon rather than a generalized assumption about giftedness based on IQ test performance. Years later, Keating, quoted by Stanley (1996), reflected on what SMPY brought to the field:

> "[O]ne of the important principles advanced (in theory, research, and practice) by SMPY is a workable model of educating for individual development, as opposed to categorically placement approaches that dominate most of contemporary education. I think this is a potentially generalizable way of dealing with developmental diversity." (p. 232; see also Keating, in press)

The second movement was the development of enrichment models for gifted education by Renzulli (1977) and Passow (1981), among others. Just as the Talent Search model is an implicitly developmental model, Renzulli's (1977) "triad model" also treats "giftedness" as a dynamic state: several qualities need to come together to create a mesh. In his three-ring conception of giftedness, while high abilities are stable individual differences, task commitment and creativity are largely developmental tasks and goals that education should facilitate in children, rather than well-formed traits prior to educational provision. By the same token, Passow also challenged the standard two-step, identification-differentiation approach. Instead, he suggested that prescribed enrichment be used as a vehicle for identification in as much as identification informs enrichment. Thus:

> "Identification of the gifted and talented is related not only to systematic observation of and intelligent interpretation of observational data, but to the creation of the right kinds of opportunities which facilitate self-identification—identification by performance and product which results in the manifestation of gifted or talented behaviors." (Passow, 1981, pp. 10)

The pragmatic concern over how to effectively identify gifted children for proper educational interventions has led to new understandings of giftedness as a dynamic rather than static phenomenon, as a functional state rather than a trait. In the same vein, Renzulli (1986) argued that "gifted behaviors take place in certain people (not all people), at certain times (not all the time), and under certain circumstances (not all circumstances)" (p. 76). Contrary to the standard image of high intelligence translated into real-life excellence or giftedness translated into talent, these efforts were charting a new way of defining giftedness as a more dynamic, contextual quality. In effect, this new approach to giftedness as an emergent, relational, changing property of person–environment interaction that grows and becomes more differentiated over time signals what can be called a developmentalist view of giftedness. However, as should be expected, the pragmatic approaches often fell short of articulating in depth what developmental changes occur and how they occur. After reviewing various proposed definitions, Siegler and Kotovsky (1986) suggested that an optimal approach to theory and research on giftedness is not to take a psychometric, trait approach, but to focus on the developmental processes in an authentic performance context; that is, studying giftedness in the making.

It was not until late 1980s and early 1990s that a significant body of developmental research has accumulated to provide a solid foundation for explicit developmental conceptions of giftedness (e.g., Bloom, 1985; Bamberger, 1986; Feldman, 1986; Gruber, 1981, 1986; Lubinski & Benbow, 1992). There was a surge of talent development models in the same period (Feldhusen, 1992; Gagné, 1985; Mönks & Mason, 1993; Piirto, 1994; Renzulli, 1994; Feldman, 1992). In general, most developmentalists see giftedness not as a static quality in the head but as a result of the confluence of several forces, endogenous and exogenous, coming together in the right place at the right time. For example, Simonton (1999, 2005) delineates a complex emergenic–epigenetic model. According to this model, giftedness is relative to the nature of a given domain.

Whether gifted behaviors will emerge depend on (a) whether the domain involved is simple or complex, (b) whether the person in question has the right combination of genetic (trait) components vis-à-vis the domain, (c) whether these functional components for the domain operate at an additive or multiplicative fashion, and (d) whether all the components relative to the domain come into place (i.e., developmentally matured) at the right time. In other words, what kind of giftedness will emerge is not prespecified or pre-ordained in biology but determined by a combination of multiple factors: person (biology), domain (culture), social context (relative advantages vis-à-vis age peers), and developmental timing (epigenetic). The model also predicts that gifted behaviors can emerge and disappear, depending on individuals' developmental timing and related population characteristics.

Simonton's model, however, still leans toward a biological explanation of giftedness, in terms of the right genetic-based traits coming together at the right time to give expression to a specific talent. Environmental factors still play a backstage role. In most developmentalist models, however, emergence of giftedness is typically described as an outcome of the confluence of environmental and personal factors, a co-incidence (Feldman, 1986). In that sense, no one knows what Bobby Fischer would have been up to if there were no chess around. Also, the traditional boundary of giftedness as within the head or within the skin is broken, as the emergence of gifted behaviors or performance can be due to the synergy of many individuals' efforts, and the creative contributions can be socially distributed within a group of contributors (Sawyer, 2003). This kind of collective giftedness or excellence has received less attention than it deserves even to date.

In its most distinct form, developmentalism has some core assumptions about the nature of giftedness that sets it apart from essentialism:

(1) *Giftedness as developmental diversity* (as opposed to the essentialist core of giftedness). This assumption not only treats giftedness as a form of deviation in development, but also implies a variety of niche potentials and developmental pathways that do not share the same essential characteristics, cognitively or affectively. If one further factors environmental conditions and opportunities into the developmental diversity, phenotypic manifestations of giftedness are even more diverse (different domains, different social contexts, and different cultures). Many forms of giftedness belong to what Feldman (1994) called *non-universal development*. Non-universal development has two important characteristics: first, it has unique individuality in development, a unique set of sensibilities and propensities; second, it only occurs under particular environmental conditions, and in the case of a culturally defined talent, with instructional and training provisions. Hence, other than denoting some form of excellence or potential for excellence (to use Sternberg's excellence and rarity criteria), the concept of giftedness is not unitary and does not imply a set of shared core attributes. Such developmental pluralism is in sharp contrast to the essentialist doctrine that stipulates specific formulas for defining and measuring giftedness.

(2) *Giftedness as a developmental state* (as opposed to giftedness as a static trait or a constellation of traits). Developmentalists tend to see giftedness not as a biologically constitutional, but rather, as a specific developmental and functional state vis-à-vis adaptive challenges in a specific context, subject to further adaptive changes. Thus, giftedness is seen not as an attribute but as a critical state in some important aspects of development (Ziegler, 2005; Ziegler & Heller, 2000), or a point of advanced intellectual or artistic development (Coleman & Cross, 2005; Robinson, 2005; Subotnik & Jarvin, 2005). In contrast to a trait definition, what is seen as "gifted" is dynamic, contextual, and emergent: through interest and passion, through honing of advanced skills, and through maintaining a creative tension (Dai & Renzulli, 2008). The image of being gifted is no longer a set of static traits but a state of sustained mastery and transformation, and the eventual productive use of knowledge and skills in building one's unique vision of world and life.

(3) *Giftedness as a process and product of structural and functional changes through differentiation and integration*. A developmentalist model of giftedness cannot be content with the status of an implicit theory, making assumptions largely based on intuitions and convictions without explicating what develops and how it develops. Such specification can be as detailed as at a neural level, such as structural and functional adaptations occurring in the brain as a result of musical training (Schlaug, 2001). Various attempts have been made in the talent development research to specify what is an initial state and what is a developed state that evolved from the previous one (e.g., Bamberger, 1986; Bloom, 1985; Csikszentmihalyi, Rathunde, & Whalen, 1993). The expertise research

has also made headway in making the developmental changes in mental structures and functions explicit (see Ericsson, 2006).

(4) *Giftedness as an interaction of affordances and effectivities*. In contrast to a structural construal of giftedness, developmentalists tend to see giftedness as functional states that cannot be dissociated with functional contexts (Barab & Plucker, 2002). This is in line with the argument advanced by ecological psychology that environmental and social affordances are contingent on the individual's readiness to perceive and act upon them (i.e., effectivities); conversely, the individual's effectivities or abilities are induced and shaped by environmental and social affordances or opportunities. Many developmentalists attempt to specify the role of environmental conditions, in interaction or reciprocation with genetic dispositions, in a specific line of the development of exceptional performance and competence (Bloom, 1985; Csikszentmihalyi et al., 1993; Papierno, Ceci, Makel, & Williams, 2005). For some, the task of finding exceptional individuals becomes that of finding exceptional conditions (Soniak, 2006), the right proximal processes (Bronfenbrenner & Ceci, 1994), and enabling and facilitative conditions (Keating, in press).

(5) *Giftedness as time-sensitive, task-specific performance (as opposed to an absolute state of being)*. Developmentalists have introduced the temporal dimension into the discourse and research on giftedness. They attempt to specify developmental timing, sensitive periods, and the age of peak performance in a given domain, to name a few, as significant developmental events that can have make-or-break effects on sustained engagement in a specific line of talent development (e.g., Ericsson, 2006; Shavinina, 1999; Simonton, 1999, 2005). Early manifestations of giftedness do not guarantee later success, as task environments at a higher level impose new demands and constraints. As a result, some stand out while others opt out. Being gifted has different meanings at different stages of talent development (Dai & Renzulli, 2008; Subotnik & Jarvin, 2005).

(6) *Giftedness as an immediate phenomenology* (as opposed to an a priori assumption about the nature of giftedness). A major change from essentialism to developmentalism is an epistemological shift, from an a priori assumption of what constitutes giftedness to a focus on immediate phenomena of gifted behavior and performance in authentic functional contexts and how it develops. Therefore, the predictive validity of high IQ or other psychometric test scores and justification of their use for identification is no longer a research priority. Rather, understanding the phenomenology of how individuals achieve high-level expertise and creative productivity every step of the way becomes a focus in its own right. This epistemological shift has led to methodological innovations, such as retrospective interviews (e.g., Sosniak, 2006), biographical studies (Gardner, 1993; Gruber, 1981), experiential sampling (Csikszentmihalyi et al., 1993). The developing person as a whole becomes the focal point, instead of some isolated variables, measured in a decontextualized fashion. The focus is no longer ability-centric, but integrating cognitive, affective, and motivational processes (e.g., Shavinina & Seeratan, 2004; Winner, 1996).

Essential Tensions

I have thus far delineated a capsule history of the concept of giftedness in terms of construction of the core meaning of giftedness (essentialism) and reconstruction of the core (developmentalism), from monolithic to pluralistic, from static to dynamic, with deconstruction efforts mediating the process. I have also alluded to motivations and impetuses driving these changes, including deep epistemological changes (e.g., understandings of developmental principles), the increasing diversity of populations, a democratic imperative that demands equal opportunities for all, and scientific rigor brought in by various research traditions. Although the trend is unmistakably clear, the tensions and disagreements are far from resolved. On the contrary, coexistence of many competing ideas and conceptions is likely to be a normal state of the field for many years to come. It creates tensions and conflicts that call for solutions (see Mayer, 2005, for a review). This is to be expected, as the giftedness research as a field has such a diverse group of stakeholders and diverse interests and concerns, and is yet to become a mature interdisciplinary field of studies. On the other hand, confronting those tensions and conflicts, and hopefully resolving some of them, also become important if the field is to develop a clear identity (or even a commonly accepted nomenclature) and a relatively coherent set of agendas for research.

Fortunately, it is possible that a meta-level discussion of different ideas provides some degree of coherence and commensurability to the seemingly incoherent and incommensurable ideas. In the following section, I attempt to provide such a framework in a fair-minded manner, without being swayed by my own biases, which I readily admit. I base my discussion on an important premise: scientific inquiry involves creative interpretation of systematic observations regarding a class of objects or phenomena (often drawing inferences and conclusions from limited, often insufficient, evidence). This view is supported by Holton (1981), a scientific historian, who argued that science is more than impersonal, mechanical exercise of hypothetical-deductive logic and inductive reasoning based on empirical evidence. There is a third force, a more subjective one: scientists' ontological convictions about certain phenomena and commitments to pursuing along these lines of inquiry, what he dubbed *themata*. More formally, themata are thematic dimensions or continuities along which people place their ontological commitment and allegiance in a domain or about a class of phenomena. For example, Holton identified in Einstein's belief systems a deep commitment to unity, continuity, logical parsimony, and necessity, and mathematical certainty (p. 15), which set him on a conflicting course with those thinking along the line of quantum mechanics, such as the probabilistic nature of quantum dynamics, discontinuity in measurement. Similarly, scholarly conceptions of giftedness represent a form of motivated reasoning of various persuasions on epistemic, ethic, political, or pragmatic grounds, constrained by logic and evidence (Kunda, 1990).

Unlike Kuhn (1962), Holton (1981) believed that scientific advances are better characterized as evolutionary rather than revolutionary, continuous rather than discontinuous, as the notion of incommensurability implies. In other words, the Kuhnian notion of a wholesale Gestalt change or "paradigm shift" disguises the complexity of the issues involved (see also Toulmin, 1972, p. 128). Instead, Holton believed that "major scientific advance can be understood in terms of an evolutionary process that involves battles over only a few but by no means all of the recurrent themata" (p. 25). He further suggested that scientific advances may not hinge on consensus building, as Kuhn (1962) argued, but on "an enterprise whose saving pluralism resides in its many internal degrees of freedom" (Holton, 1981, p. 25).

In psychology, various themata roughly fall into two distinct philosophic traditions: scientism and humanism (Kimble, 1984). C. P. Snow (1967) treated them as two distinct cultures. Wherever the issue of conceptions of giftedness is concerned, at the first blush, there are scholars who have an ontological commitment that giftedness is by and large a neurological advantage vis-à-vis specific or general functional and developmental contexts (e.g., Gagné, 2004; Geake, this volume). There are others who either remain agnostic in terms of biological origins of giftedness (e.g., Renzulli, 1999) or take more or less a developmental view (e.g., Feldhusen, 1992; Feldman, 2003; Subotnik & Jarvin, 2005). The reasons for this epistemic pluralism are multifaceted. First, psychology, like meteorology or medicine, is an inexact science. Psychologists and gifted researchers/educators alike do not have a crystal ball in hand when identifying gifted potential and needs and predicting long-term outcomes.

Second, gifted manifestations are diverse, and their etiologies and ontogenies are likely diverse as well. Therefore, diverse, sometimes competing, ontological commitments may serve their respective phenomena, constituencies, and stakeholders well, and thus complement each other (in this sense, a truly "saving pluralism" at a epistemic or pragmatic level).

Third, our conceptual and methodological tools are more sophisticated than decades ago, which allow us to capture the complexity of the "gifted" phenomena in greater detail, and recognize the virtues and weaknesses of various perspectives and approaches in a more refined manner, rather than categorically accept or reject a theory or argument. In this sense, the field is truly evolutionary rather than revolutionary; the notion of gestalt-like "paradigm shift" may emphasize the discontinuity at the expense of obscuring the continuity of systematic efforts to understand "giftedness." Scholars and researchers in the field tend to agree on some aspects of the nature of giftedness but disagree on others. Rather than tangled up with ideological battles, a more productive strategy is to turn ideological differences into more nuanced, tractable scholarly exchanges, which potentially lead to some degree of consensus and agreement. Although leaving "many internal degrees of freedom" (Holton, 1981, p. 25) may still be useful for a field that is still mapping its territory, it seems important to walk a fine line between hasty consensus seeking on the one hand and the anarchy of proliferations and conflations of ideas and models on

the other. One way of doing this is to identify a set of themata that seem to be the central issues of how we understand "giftedness," and how we should cultivate this quality for the welfare of individuals involved and the society at large.

A refined, scientific understanding entails addressing three canonical questions that unpack "giftedness" in terms of its constituents and underlying processes; various themata simply reflect some aspects of these fundamental questions:

(1) *The Nature–Nurture Question*. Can gifted behavior or performance ultimately be traced to natural endowment, that is, individual differences in genetic and constitutional makeup and biological preparedness, cognitive as well as affective; and to what extent can it be explained by experience, effort, and contextual support, such as instruction and mentoring)? How do nature and nurture contribute to the emergence of intelligent behavior, motivation, domain expertise, and creativity, and possibly ultimate eminent achievements? Moreover, the question also concerns whether those who have attained gifted performance or have potential for gifted performance are fundamentally different from the rest of the population in terms of how they perceive feel, think, learn, and develop, and consequently their educational needs. (See later discussion of the essential tensions of aptitude versus achievement, being versus doing/becoming, qualitative versus quantitative differences.)

(2) *The Range of Adaptation/Innovation Question*. To what extent is gifted potential versatile in terms of its capability of adapting to a wide range of functional niches, and to what extent is gifted potential specific to a particular niche and/or is relatively canalized in its development, in terms of its range and direction of adaptation? In other words, should gifted behaviors be seen as a fundamentally domain-specific or domain-general phenomenon? This question can also be broken down to domain-generality-specificity of intelligence (human abilities), motivation, and creativity. Casting this question in the framework of the nature–nurture question, one may ask to what extent does the individual's inner environment, through its brain mechanisms, selectively attends to, choose, and organizes environmental features in forming a unique developmental trajectory (a domain-specific view), or to what extent does the biology of brain organization show versatility, through its neural plasticity and cognitive flexibility, in response to environmental opportunities and challenges (a domain-general view)? (See later discussion of the essential tensions of domain-general versus domain-specific, expertise versus creativity.)

(3) *The Process/Development Question*. What is the process of the development of gifted potential or exceptional competence (maturation, neural hard-wiring, deliberate practice, sustained interest, systematic inquiry, conceptual development and organization, development of expertise, etc.)? What is it that develops (sensitivities, mental representations, reasoning skills, dispositions, etc.)? These questions deepen the nature–nurture question by asking how do the person and the environment interact as *proximal processes* (Bronfenbrenner & Ceci, 1994), and how is nature (e.g., genetic expressions) contingent on nurture, and how does nature constrain nurture (see Dai & Coleman, 2005)? These "process" questions deepen the domain-generality-specificity question by elucidating in what exact manner domain-relevant resources are channeled into domain-specific development, and how various components are co-opted to produce what is manifested as gifted behavior or performance. Along this line of thinking, further questions can be asked. For instance, does timing of the onset of a specific line of talent development matter? Are there sensitive periods for a specific line of talent development? Are there distinct developmental stages or phases? At what age does performance peak (i.e., reaching its asymptote) for a specific domain? To what extent does cognitive aging constrain the creative performance and expressions? Although current debates focus more on the nature–nurture issue (see Dai & Coleman, 2005), one may argue that it is at this level of analysis that we can formulate truly explanatory theories, rather than merely descriptive theories and theoretical conjectures about causal structures and relationships underlying various gifted phenomena. Ultimately, the task of scientific understanding of giftedness is to demystify, rather than reify (and sometimes deify), giftedness.

In the following section, I identify some of these themata, and provide an admittedly personal perspective on them for the sake of provoking more thoughts on inherent tensions, dilemmas, and conflicts underlying what I identify as the traditions of essentialism and developmentalism in the field. As one shall see, some of them are conceptual issues, others concerning values, and still others epistemic. I suggest that these themata constitute essential tensions revolving around the concept of giftedness, and that finding proper solutions

or at least easing these tensions would help achieve some degree of synthesis and move the field forward (Table 3.1).

Aptitude Versus Achievement

Scholars in the field differ in whether giftedness can be better determined through testing of aptitude or putative "potential," or actual excellent achievement and performance in an authentic context by age-appropriate standards. The use of the aptitude (or ability) versus achievement criterion creates a tension regarding how giftedness manifested itself, and how we can best determine its presence, nature, and degree.

Evidence of the tension. Since Galton, and particularly since the invention of mental testing, mental abilities have been thought as normally distributed within a population; thus giftedness and mental retardation constitute two ends of the intelligence continuum. Determining giftedness by mental testing started with Terman, and still constitutes a mainstream perspective (e.g., Robinson, Zigler, & Gallagher, 2000). However, as early as late 1950s, achievement or performance in an authentic domain or social context was proposed as a major criterion for determined gifted potential (DeHaan, & Havighurst, 1957; Witty, 1958). In several major conceptions of giftedness, ambiguities were almost deliberately built into the definition to allow for both psychometrically defined mental abilities, indicating latent potential for excellence, and outstanding domain-specific performance and achievement, indicating demonstrated excellence (e.g., Renzulli, 1978; Marland, 1972). There are several competing strategies to resolve this tension. One calls for a sharp distinction between natural abilities and achievement or systematically developed competence; only the former, measured by aptitude tests, warrants the label "gifted" (e.g., Gagné, 1999, 2004). Another approach is to view only authentic performance or mastery as evidence of giftedness and see measures of mental abilities as unreliable, and often invalid indicators of giftedness (e.g., Ericsson et al., 2005; Matthews & Foster, 2006). Still another strategy simply treats all mental abilities as developed competence or developing expertise, therefore, enjoying no psychological priority over achievement (e.g., Lohman, 2006; Sternberg, 1999a).

The problem. This controversy brings to the forefront the issue of whether the conceptual distinction we make between aptitude and achievement is still valid at an empirical level; namely, whether we can ascertain certain mental capacity as indeed an antecedent of, even a precondition for, actual excellence in a given domain. Most extant models, such as Gagné's (2004) differentiated model and the Munich Dynamic Ability–Achievement Model (Heller, Perleth, & Lim, 2005), represent various mental abilities as a *precondition or prerequisite* for later achievement, implicitly or explicitly assuming a causal link between abilities and achievement. As these models have been challenged by the expertise researchers (see Ericsson, 2006), conceptualizing mental capacity as a prerequisite for achieving domain excellence hinges on evidence of the predictive validity of measurements involved (i.e., "productivity" criterion; Sternberg, 1995). Although the research findings are mixed and do not provide a clear-cut answer either way, there are several concerns over using aptitude measures as the sole indicator of giftedness. They include the following: (a) aptitude tests are not fine-tuned to differential domain requirements, and therefore they are relatively poor predictors of domain-specific achievement (Lohman, 2005); (b) different domains likely have different threshold requirements (Simonton, 1999) for mental abilities; (c) inferring a causal relationship between measures of mental abilities and achievement could be problematic (Sternberg, 1999a), a commitment of *jangle fallacy*, that is, labeling one as a test of intelligence and the other as a test of achievement while the two tests have a large overlap in construct representation (Kelley, 1927; see Lohman, 2006); and (d) exclusively using mental abilities as aptitude measures neglects non-cognitive personal factors such as intrinsic motivation as high potential or aptitude for achievement (Gottfried & Gottfried, 2004; Dai, 2004). On the other side of the story, there are concerns over using domain achievement as the main indicator of giftedness. Using achievement and expert performance as an indication of giftedness (i.e., demonstrated excellence), though authentic and free of some shaky assumptions about "latent capacity" (Ericsson et al., 2005, 2007), naturally biased in favor of those who have the necessary experiential exposure, opportunity, and technical and social support to get that far. It is conceivable that many individuals are "gifted" but lack such exposure, opportunity, and support to

Table 3.1 A summary of eight tensions surrounding the concept of giftedness

Thesis	Antithesis
Aptitude versus achievement	
Potential for excellence (i.e., giftedness) is best evidenced in performance conditions that can differentiate ability (aptitude) from achievement	We will never know whether a person is gifted unless the person demonstrates superior mastery of skills and knowledge in authentic domains or contexts
Being versus doing/becoming	
Giftedness is a structural property of the person in question, because what within the person ultimately explains gifted performance and behaviors	Giftedness is a functional state of person–environment transaction and interaction, and thus is relative to tasks and contexts involved, and subject to further change
Domain-general versus domain specific	
Giftedness is not confined to any single domain, because abilities can be flexibly channeled and utilized in multiple ways, depending on environmental circumstances and motivations	Giftedness is domain-specific, because each domain has its own unique set of demands in terms of sensitivities, inclinations, and abilities
Qualitative versus quantitative differences	
Gifted individuals are different from their average peers *in kind*, because the structural and functional organization of their mind is different, and their developmental trajectories are unique	Giftedness individuals differ from their average peers only *in degree*, because they only show relative strengths and advantages rather than absolute ones
Expertise versus creativity	
High-level expertise (proficiency) in a given domain should be the hallmark of giftedness and goal of gifted education, because only this form of excellence can be scientifically verified, and educationally promoted	Creative productivity (innovation) should be the hallmark of giftedness and goal of gifted education, because giftedness is not about mastery of the already known, but exploring, discovering, and inventing the unknown
Nomothetic versus idiographic	
Manifestations of gifted behaviors are subject to a set of universally valid laws and principles; therefore, we can determine who are gifted and how the gifted develop by applying these universal principles	Manifestations of gifted behaviors are diverse and unique phenomena, and have their own underlying logic, not subject to predetermined universal principles; therefore, the uniqueness of each manifestation needs to be closely examined
Reductionism versus emergentism	
The complexity of gifted manifestations can be explained by simpler components at a more basic level of analysis; higher-level phenomena can be causally reduced to lower-level structures and processes	The complexity of gifted manifestations reflects higher-order organizational principles in the organism and functional regularities, and shows emergent properties that cannot be reduced to lower-level individual components
Excellence versus equity	
Identifying and cultivating high potential for excellence is a society's responsibility for the welfare of individuals as well as the society at large. Rewarding excellence reflects a cultural value that is important for democracy and civilization	Singling out the "gifted" for special treatment and unequal access to excellence perpetuates existing social inequality, and creates a new social "elite," thus violating the democratic principle of equal rights and opportunity, and fair allocation of public resources

demonstrate their "latent capacities." This empirical issue reflects an epistemological dilemma: teasing apart "natural ability" and developed skills and knowledge is almost impossible. One cannot demonstrate high-level "capacity" in academic or other domains without substantial experience, intentional learning, and practice (the same can be said about performance on IQ tests). However, to argue that the only things that matter are experience, learning, resources, and support also runs counter to a widely accepted notion that the ease of learning is a hallmark of giftedness (Gagné, 2004). Furthermore, the concept of "latent capacity" or potential, as long as it is not seen as "fixed", still seems useful for several reasons. First, it is unrealistic to expect mature, full-blown gifted and talented achievements at a very young age, barring few cases of child prodigies (e.g., Feldman, 1986). Many times, signs of giftedness and early talent still need to be recognized through testing or observation outside a specific domain of interest. Second, one can make a distinction between content mastery (product) and mental structures and operations (process) leading to mastery; it is the latter that often underlies the concept of gifted potential and related individual differences (e.g., the ease of learning), so that we still can conceive of unrealized gifted potential or "gifted underachievement" as quite prevalent, rather than an oxymoron. Finally, at a pragmatic level, it allows for discretion and expert judgment of gifted behaviors and potential in informal settings (e.g., through conversations and anecdotal evidence), without strictly adhering to the domain excellence criterion.

Solutions. A conservative solution is offered by Angoff (1988), who suggested that we shift the focus from nature–nurture debate to the issue of stability, malleability, and transferability in conceptualizing aptitude. According to him, while aptitude, like achievement, is a developed, rather than innate, quality, it differs from achievement in several important ways: (1) aptitude grows more slowly than achievement, the latter of which is likely a direct result of formal exposure to a specific content area; (2) aptitude tends to resist short-term interventions to hasten its growth, while achievement is more amenable or receptive to such interventions; (3) aptitude mainly concerns potential (e.g., rate of learning), and achievement provides a measure of how much is learned; (4) aptitude tests sample a wider range of behaviors than achievement tests, therefore indicative of a more generalizable capability than achievement measures; (5) since aptitude does not particularly rely on formal schooling, evaluation of general intellectual functioning is made possible with aptitude tests regardless of school experience and achievement (thus, a school drop-out can theoretically still get high scores on IQ tests); (6) aptitude as a measure of potential is still useful, when the learner whose aptitude is being evaluated has not yet been exposed to the learning material (see also Cleary, Humphreys, Kendrick, and Wesman, 1975). Although many points of justification Angoff offered here for the distinction between aptitude and achievement are debatable (e.g., Ceci & Williams, 1997), to the extent that we still make a distinction between how individuals differ in their ease of learning and performance (process), and how much they gain as result of their efforts (product), the aptitude–achievement distinction is still warranted. In this regard, traditional aptitude tests can be criticized to some extent as focusing too much on how much one already knows (i.e., achievement), not on how apt one is to know something (aptitude); the latter can be better assessed through dynamic assessment (Kanevsky, 2000).

In view of limitations of the traditional view of aptitude as a latent capacity, perceived by some scholars as a mysterious quality (e.g., Ericsson et al., 2005, in press; Matthews & Foster, 2006), Snow (1992, 1994) offered an alternative view of aptitude as the readiness to deal with situational demands and benefit from situational opportunities. Instead of a wide-open promise or even a blank check, as it were, aptitude so defined is a highly circumscribed, proximal potential, sitting right at the person–situation interface, rather than solely referring to a personal trait, validated by its predictive validity. In other words, aptitude indicates the fitness to learn or perform well given a specific situation versus inapt to do so, in which case the term *inaptitude* is used. Such a situational definition of giftedness is close to domain-specific mastery models in a sense that it favors evidence of proximal mastery over generic aptitude measures (e.g., Matthews & Foster, 2006). It is different from domain mastery models in that aptitudes and inaptitudes are still seen as "proneness" or "propensity" rather than actual performance levels.

From a more pragmatic viewpoint, Coleman and Cross (2005) offered a developmentalist solution: in childhood, giftedness may be defined as psychometrically or otherwise measured "potential," but, as the child reaches adolescence, there should be

evidence that the alleged potential is substantiated by age-appropriate accomplishments in specific culturally valued areas of human endeavor. Their definition represents a compromise between aptitude (ability) and achievement. Mayer (2005) extended Coleman and Cross's definition to include adult creative productivity by providing a life-span formula that defines giftedness as "an age-specific term that refers to potential for the beginning stage, achievement for the intermediate stage, and eminence for the advanced stage" (p. 439).

In sum, we can roughly identify three major categories of conceptions of giftedness based on the aptitude–achievement tension: (a) *person-centered conceptions* (hence, the gifted child), which emphasize the centrality of aptitude as a latent potential; (b) *domain-centered conceptions*, which emphasize domain-specific manifestations as the sine qua non of giftedness for a given domain (thus, giftedness is relative to the domain in question and relative to levels and stages of talent development), and (c) culture-*centered conceptions*, which treat giftedness as involving an interaction of person, domain, and field, allowing for the role of multiple endogenous and exogenous factors, such as natural endowment, personal initiative, and social-contextual facilitation, but ultimately see gifted development and eminent accomplishments as socio-culturally mediated and conferred (Csikszentmihalyi & Robinson, 1986). Each type of conceptions makes slightly different ontological commitments as to the locus of giftedness, leading to the aptitude–achievement tension.

In sum, while achievements in authentic human activities clearly provide the best evidence for human exceptional competencies, it appears that the concept of giftedness as high potential or aptitude is worth preserving for pragmatic as well as epistemological reasons. Working with human functioning means working under uncertainties. Just as equating giftedness with some aptitude measures risks losing their legitimacy as a proxy measure of "potential" for excellence, equating giftedness with high achievement also risks masking differential underpinnings (e.g., comparing one person who may have just overlearned the material and another who is able to achieve deeper insights into the problem through the material).

Using eminence as a marker of giftedness has its own drawbacks. Eminence is often based on social prestige and reputation, and therefore may or may not reflect true excellence by objective professional standards and scientifically credible evidence, unless social appeal is an inherent part of the criteria for excellence (e.g., arts, oration, social leadership). It is important, therefore, to use more rigorous criteria and procedures for judging the degrees and levels of excellence, rather than relying on procedures and criteria such as nomination or public accolades (Ericsson, 1996). Another reason that eminence may not be the best criterion is the chance factor. Two persons may be equally brilliant or may have equally contributed to a field, but only one has gained fame and social distinction because he or she happened to be in the right place at the right time.

Being Versus Doing/Becoming

The use of aptitude versus achievement as a marker of giftedness is an empirical issue of how we know that some behavior or performance is so exceptional as to be worthy of the term "gifted," indicating excellence or potential for excellence. The tension mainly concerns the "demonstrability" and "productivity" criteria (Sternberg, 1995). The issue of being versus doing/becoming goes deeper into the ontological issues of how the unusual manifestations of gifts and talents at various points of the life span come about. It is the nature–nurture issue underlying the aptitude–achievement tension. It is much easier to describe what can be seen as "gifted," invoking the "excellence," "rarity," and "demonstrability" criteria (Sternberg, 1995) than explaining it. The task of explaining (not merely describing) "gifted" manifestations amounts to specifying mediating mechanisms and processes in the influx of a multitude of enabling and constraining forces, both endogenous and exogenous. It involves mappings of complex structure–function, person–process–context, and functioning–development relationships. As it currently stands, most scholars make two competing theoretical or ontological commitments: either defining giftedness as a trait or a constellation of traits (i.e., as *being*), or defining giftedness as a functional, developing state, situated in action-in-context (i.e., as *doing/becoming*).

Evidence of the tension. Historically, the issue of how giftedness comes about is simply explained as a matter of being (constitutional or developmentally calibrated individual differences), and falling into the area of differential psychology. Now this view is challenged

by developmentalists, as delineated earlier in this chapter. An instructive historical anecdote is a friendly altercation between Darwin and his cousin Galton. When Darwin argued that "excepting fools, men did not differ much in intellect, only on zeal and hard work," Galton rebutted that "character, including aptitude for hard work, is heritable like every other faculty" (quoted in Gould, 1981, p. 77). The contemporary form of this debate is manifested in several ways. In gifted education, it is the issue of emphasizing the unique traits of gifted children and advanced cognitive development (Delisle, 2003; Robinson et al., 2000) versus stressing a child's active engagement in specific lines of talent development as a sine qua non of giftedness (Subotnik, 2003; Coleman & Cross, 2005). In the psychological research, there are firm believers that the ultimate answer to the mystery of giftedness lies in the brain structure and biological differences (Geake, this volume; Gershwind & Galaburda, 1987; Vandervert & Liu, this volume), and there are also staunch champions of gifted development as a personal enterprise and purposeful endeavor for a prolonged period of time (Ericsson, 1996; Ericsson et al., 2007; Gruber, 1986).

The problem. The tension is part of a perennial debate on whether gifted behavior can be traced to its biological roots or reflects a more complex interplay of genetic and environmental forces, and most of all, the emergent role of personal agency in terms of reflective consciousness, decisions, and actions (Bidell & Fischer, 1997). This is the key difference between essentialism and developmentalism. Categorical or essentialist conceptions of giftedness are possible only when potential for excellence is defined as a fixed or at least enduring property of the person. On the other hand, if potential for higher levels of excellence fluctuates and depends on specific contexts and one's actions, then one can *achieve* and *maintain* or sometimes *lose* a "gifted edge," so to speak, but cannot *possess* it (Barab & Plucker, 2002; Ziegler, 2005). In a larger context of human development, it involves a basic conception of individual differences as static versus dynamic, trait versus state, born versus made. Similar debates occurred in other fields. For instance, in personality psychology, there was a prolonged debate on personality functioning as "having" (e.g., Big-Five) versus as "doing" (e.g., using constructs such as "personal strivings"), namely, whether we should characterize personality as stable structures (traits) or habitual patterns of behaviors, or as a set of cognitive and motivational processes in social interaction that serve adaptive functions and undergo adaptive changes (Cantor, 1990). In language development, there are people who see language development as a biologically preordained process, only to be unfolded as an infant matures, and there are people who hold a functional perspective, namely, the process of "doing" (communicating with adults) helps assemble and organize many relevant linguistic and cognitive components and enables language development (see Tomasello & Slobin, 2004).

However, from the being versus doing/becoming perspective, we can identify two types of developmentalism: one based on the metaphor of development as *unfolding* and the other on the metaphor of development as *emergence,* which I will discuss in a section on emergentism. According to the unfolding model or metaphor, giftedness is, to some extent, preordained, as in the case of an innate structure, or what Piaget (1972) called *mental embryology*, only to be unfolded with the facilitation of environmental conditions, such as opportunities to develop talents, and catalytic role of intrapersonal forces, such as motivation and personality traits (Gagné, 2004). The unfolding model can be seen as a modified version of essentialism. In a refined unfolding model, several psychometrically defined abilities are coalesced to create differential-developmental trajectories (e.g., Lubinski & Benbow, 2006). Such a model can be seen as combining both being and doing/becoming, since the essentialist definition of giftedness is retained within a developmental approach, though more complex and refined than more generic models of giftedness (e.g., intellectual giftedness or artistic giftedness).

From a more general epistemological point of view, scholars who hold a "being" view of giftedness tend to hold an objectivist view of development. Like Terman's longitudinal research, research models of unfolded giftedness have a distinct placement/prediction design, portraying gifted development in terms of an objective, long-term, probabilistic estimate of trajectories, pathways, and attainments (e.g., Heller et al., 2005; Lubinski & Benbow, 2006). In contrast, developmentalist models that stress sustained and extended mastery and transformation tend to provide a more intimate, micro-level, real-time account of the processes and mediating mechanisms leading to the next level of expertise or creativity (Fischer & Yan, 2002; Gruber, 1986). In other words, they are more inclined to delve into the subjective experiences

of the person in question (see Cross, 2003). Thus, the being–doing debate reveals an epistemological paradox or dilemma: should we assume an objective or subjective (i.e., intentional) stance when we approach human development? Should we make a subjective account by resorting to personal intentions (desires, beliefs, and aspirations) and efforts, or invoking "natural laws" and attribute the subjectivity as merely the nature's trick, as Galton suggested when he argued with Darwin? To what extent can we see subjective experience and reflective consciousness as having a causal influence on our functioning and development? (See Searle, 2002; see also later discussion of selfhood by Edelman, 1995.)

The being versus doing tension also connotes two differing beliefs regarding stability and change in gifted potential. Do we believe that gifted potential can fluctuate (even losing the "gifted" edge), depending on domain, social context, and time (Simonton, 2005)? If we agree that motivation is relatively a malleable quality relative to differences in mental abilities, then can focused efforts and deliberate practice compensate for the lack of high abilities (Schneider, 2000)? Or will such efforts be fundamentally constrained by natural capacity or "abilities," depending on what domain is involved and what levels of excellence one is striving for? Ericsson (2006) argued that, except for few physical characteristics, such as height and body size, which are genetically determined and difficult to change, most human characteristics, physical or mental, can be enhanced and significantly modified through deliberate practice (see also Schlaug, 2001). Likewise, Gottfried et al. (2005) provide evidence supporting an equipotential view of giftedness; they showed that early manifestation of high intrinsic academic motivation predicts high academic achievement several years later, despite the fact that most of these highly motivated students did not have IQ scores in the "gifted" range by the traditional top 3% criterion. Different beliefs held by scholars resemble folk beliefs regarding whether human abilities are incremental or fixed (Dweck, 1999; Freeman, 2005). The paradox is that, while our biology may not be easily succumbed to our willful control, we can effect changes in ourselves, including developing knowledge, skills, and dispositions through self-initiated actions.

From a scientific point of view, the current problem regarding the nature–nurture of giftedness is the lack of intermediate models, that is, models that connect and integrate being and doing/becoming. For example, Gagné's (2004) model of how giftedness (i.e., natural endowment) gets "transformed" into systematically developed talents in culturally valued domains operates at a metaphorical level, thus not only impervious to scientific verification, but lacking in specification of fine-grained intermediate processes and levels. In other words, it is still an implicit, rather than explicit, theory (Sternberg & Davidson, 1986). In general, the field of giftedness research is deeply rooted in faculty psychology and the psychometric tradition (including mapping human abilities through the factor analytic technique; e.g., Carroll, 1993), and has limited communication with modern cognitive psychology that emphasizes the transformational power of knowledge representation in reasoning and problem solving (Ceci & Liker, 1986; Chi, Feltovich, & Glaser, 1981). Efforts to elucidate cognitive processes underlying individual differences in intellectual functioning have not met with much success (Lohman, 2001). Many potent personal factors, such as intellectual dispositions (Stanovich & West, 1997; Perkins & Ritchhart, 2004) and personal identity (Renzulli, 2002) have not been effectively integrated into the traditional ability-centric framework guiding conceptions of giftedness. The nurture part of giftedness, such as how deep conceptual learning and the development of expertise can be facilitated through instruction (Bonsangue & Drew, 1995, Schoenfeld, 1992; Wineburg, 1991), is often ignored altogether when giftedness is conceptualized as a property of the person involved. If the essence of intellectual giftedness lies, as Shavinina and Kholodnaja (1996) argued, in a unique type of cognitive representation(s) or intellectual or artistic visions of the world, we need to understand how this unique cognitive representation is developed in every step of the way; to what extent it reflects unique set of personal traits (i.e., being) and to what extent it reflects organization of intentions and search for the truth at a highly personal level (i.e., doing/becoming; e.g., Gruber, 1986).

Solutions. Renzulli's (1978) model provided an earlier compromise on the being–doing issue, combining both abilities and processes, but deliberately making status information (i.e., being, including prior performance and personal history) secondary compared to action information (i.e., doing/becoming, including dynamic assessment and clinical observations). His rationale is that while human abilities are quite stable

and work across situations, motivation (task commitment) and creative expressions are highly sensitive to contexts and developed over time. The three-ring conception is a pragmatic way of providing mediation between being and doing/becoming. However, his recent work (1999, 2005) seemed to give priority to doing/becoming rather than being.

A viable answer to the nature–nurture challenge is to provide a differential-developmental theory (e.g., McCall, 1981) that not only accounts for the rarity (and different degrees of rarity; Tannenbaum, 1983) of advanced development and outstanding accomplishments, but explicates intermediate stages and processes, while avoiding the shortcomings of trait theories underlying the essentialist construal of giftedness. Conceptual and empirical work has been done in that direction (e.g., Bloom, 1985; Csikszentmihalyi et al., 1993). More recent examples include, but not limited to, Subotnik and Jarvin (2005) concerning musical development; Ziegler's (2005) Actiotope Model, which stresses the importance of continual expansion of action repertoires through actions; and Ceci's (1996) bioecological model of development, which includes a differential provision (see Papierno et al., 2005). Snow's (1992, 1994) approach, which treats aptitude as a person–situation interface, was also an attempt to provide a differential-developmental account that potentially can explain the rarity of gifted development without committing an error of reification, namely, resorting to faculty psychology with respect to gifted potential (see also Dai & Renzulli, 2008).

In short, the tension between "being" accounts and "doing" accounts of giftedness can be reconciled by developing more circumscribed (and modest), mid-range theories (e.g., Subotnik & Jarvin, 2005), rather than grand theory of giftedness as most theorists of giftedness have seemed to aspire for. Such a theory would specify how an initial state of being (likely some type of sensitivities and propensities) triggers what one is doing (i.e., structure–functioning mapping) and how one's doing contributes to a new state of being (i.e., becoming; Ackerman, 1999), in other words, how the initial structure enables functions and how the functioning helps bootstrap new, more complex structure. A metaphor of Neurath's boat from the conceptual change literature (Carey, 1999) is relevant here: Building a boat in the midst of traveling in the water. It sounds paradoxical but reveals the dialectical nature of the nature–nurture and structure–function interaction. Simonton's (2005) emergenic–epigenetic model of giftedness, though biased in favor of genetics (i.e., being), provides a good theoretical framework guiding theorizing. In essence, he argues that a model of how giftedness comes about needs to consider four main factors: domain, person, context, and time. Note that domain comes first in his framework, as it imposes differential demands on the person, and have profound implications as to *where* a talent will emerge (context) and *when* it will emerge and grow or fail to emerge (developmental timing). It is the issue of domain that we now turn to.

Domain-General Versus Domain-Specific

As there is no such a thing as domain-free achievement, the focus of this tension is (1) to what extent an individual's potential is versatile in terms of its capability of learning different things and adapting to a wide range of functional niches with equal facility and (2) to what extent the potential is specific to a particular niche or class of activities, and if so, (3) to what extent cognitive structures and mechanisms attuned to a given domain are preordained or canalized in its development?

Evidence of the tension. As discussed earlier, the changes in the field of psychology in general and giftedness in particular over the second half of the 20th century can be characterized as taking a domain-specific turn. Gardner's (1983) theory of multiple intelligences was but a most salient milestone of this movement. Rediscovery of domain knowledge in cognitive functioning is another (Chi et al., 1981). Although some theorists claimed that the tension has been resolved by factor-analytically derived hierarchical model of cognitive abilities, incorporating both domain-general and domain-specific abilities (e.g., Messick, 1992), the issue of domain-specificity-generality of gifted potential is far from resolved, and the tension is still palpable. For example, while the talent development movement has been gaining more following, the traditional IQ-based "gifted child" approach still has many adherents (e.g., Gallagher, 2000; Robinson et al., 2000; see Morelock, 1996 for a review). The tension is also reflected in the creativity research. In an edited volume, Sternberg, Grigorenko, and Singer (2004) especially focused on whether processes and developmental patterns leading to

creative productivity are specific to a given domain or versatile across domains. Root-Bernstein (this volume) also tackles the issue of whether creative individuals tend to show versatility or be confined to a highly circumscribed area of human endeavor.

The problem. Domain is a rather vague term, used in different ways depending on the context in which it is used. For the purpose of this discussion, we can roughly identify four kinds of domains: (a) evolution- or biology-based domains (Geary, 2005), which mainly concern competencies and skills that have evolutionary significance (e.g., providing survival and reproductive advantages) and are traceable to their evolutionary origins; (b) cognitive domains (Hirschfeld & Gelman, 1994), which concern inherent principles in information processing and specialized mechanisms for dealing with particular types of information; (c) ecologically and culturally defined domains (e.g., music, religion, mathematics); here a domain refers to an extant body of knowledge and practices, mediated by a particular symbol system, in any culturally sanctioned endeavor, with its characteristic social organization (i.e., field; Csikszentmihalyi, 1996); and (d) academic domains, which are more formally organized as disciplines of study. Gardner's (1983) theory of multiple intelligences is mainly concerned with the cognitive domains. It also implicates the biological substrates of mind, the basic architecture of the human brain/mind. Therefore, it is clearly more than a refutation of Spearman's "*g*," for it brought to the forefront a deeper issue of whether the human brain is an all-purpose information-processing device or instead consists of several highly specialized modules dedicated to processing specific types of information.

Fodor's notion of modularity clearly had an impact on Gardner's theorizing. However, Fodor (1983) reserved a place for "central processes," namely, those controlled, consciously accessible cognitive processes, such as strategy use, metacognitive control, particularly the formation of beliefs, all important for knowledge construction. Although domain-specific perceptions and intuitions (Fodor's *input systems*) may play a role in learning a new task, general cognitive abilities may also significantly contribute to the ease of learning (Gagné, 2004; Robinson et al., 2000). To use Newell and Simon's (1972) term, the use of *weak methods* (i.e., general heuristics) is likely when the learner is inexperienced with the task involved and strong methods (i.e., domain-specific cognitive models and devices) are not available. This is why Sternberg (1985) attempted to separate what one knows (i.e., acquired knowledge) and how one deals with novelty (i.e., fluid intelligence). This tension reveals the aptitude–achievement and being–doing–becoming tensions at another level: while what is achieved is always specific to a cognitive or culturally defined domain, how it is achieved may not. For example, in Sternberg's triarchic theory of intelligence, although experiential learning involves domain-specific experience (experiential subtheory), cognitive processes, particularly metacomponents, which are brought to bear upon this experience, are largely domain-general (componential subtheory). By the same token, expertise researchers generally view high-level domain expertise as valid evidence of exceptional competence. However, they tend to see the process of acquiring expertise and expert performance as involving identifiable domain-general or generalizable mechanisms, such as deliberate practice and metacognitive control (e.g., Ericsson, 1996, 2006).

At the cognitive level, the tension reflects the content–process conundrum that has not been resolved in psychology to date; that is, to what extent processing is separate from content representation. It affects how we understand gifted cognition. For example, there have been research efforts to pin down metacognition as a key difference between the gifted and "non-gifted." However, Ceci (2003) shows that metacognition is constrained by domain knowledge, thus not a domain-free cognitive process. For another, reasoning abilities are often seen as a marker of intellectual giftedness, yet Lohman (2006) pointed out that the process of reasoning is always sensitive to content and thus "pure" reasoning abilities are hard to find in reality (let alone measure).

Two types of domain-general cognitive theories or hypotheses have been advanced to explain gifted cognition as indicating an advanced or precocious cognitive development: One is the *cognitive efficiency hypothesis* (reaction time, processing speed, working memory capacity; see Geake, this volume); the other is the *cognitive sophistication hypothesis* (strategy use, metacognition, cognitive flexibility, managing cognitive complexity and novelty, etc.; see Davidson, this volume). However, research does not provide definitive support for such claims. Individuals with high IQs showed prolonged thickening of the cortices compared to their average counterparts (Shaw

et al., 2006), suggesting a non-specific cognitive advantage and advanced cognitive development in general (Robinson et al., 2000). However, Jackson and Butterfield (1986) concluded, based on their review, that "there is a great variability in the extent to which gifted children demonstrate precocity in Piagetian reasoning" (p. 160). The putative metacognitive advantage of gifted students also turned out to be more circumscribed than initially thought (Alexander, Carr, & Schwanenflugel, 1995; Steiner & Carr, 2003; Shore, 2000, this volume).

Alternatively, we might take a learning approach. Where giftedness is concerned, the issue of domain-specificity-generality really is about the differential acquisition of domain competence, rather than mature domain performance. Shiffrin's (1996) criteria for determining "natural talent," in terms of the *rate of learning* and *asymptotic performance* (i.e., when performance starts to reach a plateau despite continued efforts for improvement), are also relevant here. There is some evidence pointing to giftedness as a domain-general advantage in learning. For example, individuals with high IQs learn more quickly with less structured instructional conditions (Snow, 1994). Young children with high IQs learn Piagetian conservation tasks with fewer trials (Case, 1992), and they need fewer hints to solve the Tower of Hanoi problem (Kanevsky, 1990). The ease of learning for these individuals is even evident at the brain level in terms of the reduced glucose metabolic rate in the brain (Haier, 2001; Haier & Jung, 2008). Using a "test of limits" approach, a method for obtaining asymptotic performance, Baltes (1998) and his colleagues were able to identify increased rather than decreased individual differences.

Studying extreme cases of exceptionality also sheds light on the importance of domain-general abilities. For example, L. Miller (2005) found that, although some idiot savants show an amazing ease of learning, their work often falls short of conceptual coherence, suggesting that both dedicated mechanisms and general analytic and conceptual abilities are important for high-level competence in arts or other domains. The differences between child prodigies and idiot savants provide yet another important clue to the domain-specific versus domain-general debate, suggesting that both domain-specific and domain-general resources are required to achieve true excellence (Feldman, 2003). However, idiot savants' levels of intelligence often fall into the category of mental retardation. We do not know whether for a given domain there is a threshold at which a domain-general advantage will reach the point of diminishing returns. Indeed, some researchers (e.g., Hunt, 1999) believe in the existence of such a threshold. There is also research showing that the general cognitive advantage within a domain gradually disappears as one gains domain-specific competence (Ackerman, 1988, 1999).

In the gifted literature, the term "domain" often refers to culturally defined domains rather than cognitive domains. Therefore, what kind of cognitive (or affective) demands such a domain imposes on the person is rather an ecological question; namely what it takes to meet the challenges presented in a given task environment. Thus, domain specificity in this context is concerned with whether a person is uniquely fit to do well in one domain but not in others. In this sense, the distinction Simonton (1999) made between simple and complex domains seems important. Most domains of cultural importance are complex; therefore development of expertise in these domains likely involves both domain-specific and domain-general resources (in a biological or cognitive sense). Domain-specific advantages range from dedicated mechanisms such as modular devices (e.g., absolute pitch), physiological and structural–functional adaptations as a result of special training, to possible innate intuitions and encapsulated knowledge, the ease of learning with a particular symbol system. Domain-general advantages range from cognitive flexibility, metacognitive control, and reasoning of the inductive, deductive, and abductive nature, etc.

Solutions. Psychometric approaches (Carroll, 1993; Messick, 1992) offer a hierarchical structural solution, which includes not only different contents and media (quantitative, verbal, spatial), but also crystallized and fluid abilities. The psychometric approaches mainly provide prediction models that seemed to have work well in predicting differential pathways, depending on different constellations of strengths and weaknesses in prospective longitudinal studies (see Lubinski & Benbow 2000). However, psychometric theories are descriptive theories. It cannot resolve ambiguities such as whether there is indeed a general ("g") factor or "g" is just a statistical artifact and "positive manifold" (Thomson, 1916; see also Horn, 1986).

Different from psychometric approaches, which rely on representative tasks to derive ability structures,

bioecological approaches take a more theoretical approach. They posit that domain-specific and domain-general competencies have evolutionary origins, mediated through epigenetic development and environmental experiences (Feist, 2004; Feldman, 2003; Geary, 2005; Papierno et al., 2005). In general, bioecological approaches differentiate three main domains: physical, biological, and social (see Geary, 2005, for a taxonomy). The brain contains both dedicated mechanisms while maintaining neural plasticity in making adaptive changes through development. Thus, "innate talent, when it exists for a particular domain, comprises a rare combination of genes that come together to bring about the necessary penchants to self-select the appropriate environmental cue that will actualize that potential via proximal processes" (Papierno et al., 2005, p. 323). To the extent that a domain is cognitively complex, multiple genetic traits have to be simultaneously present to give rise to the manifestation of a talent; moreover, timing of the epigenetic development of all relevant components is also critical (Simonton, 2005). In general, bioecological models stress the importance of various kinds of niche potential and person–environment (domain) fit for talent development, which include both cognitive and affective considerations. For example, in Subotnik and Jarvin's (2005) rendition of music talent development, while development of "musicality" may involve special sensitivities and inclinations, "charisma" is a quality that is not specific to music. Personality characteristics, such as introversion, are also implicated as important for developing musical talent (Kemp, 1996).

Finally, one can also take a cognitive developmental approach. It entails restoring the core meaning of intelligence as the ability to problem solve and make adaptive changes (learning), while taking into account inherent development-related cognitive and neural possibilities and constraints. It assumes that initial gross wiring of the brain is not completely differentiated until through significant interaction with a structured environment (Karmiloff-Smith, 2004). Thus, an alleged innate talent is actually not innately specified but bootstrapped by specific structured environmental experience. A culturally defined talent (say, musicality) may require integration of several such functional units (e.g., for melody, rhythm, and harmony, respectively). Based on Karmiloff-Smith's (1992) notion that children often go beyond behavioral mastery to seek a conceptual handle on the newly acquired skill, we can extrapolate that talent development initially takes the form of perceptual and intuitive mastery (turning domain-relevant processes to domain-specific products, such as modular functional units), and gradually achieve conceptual understanding and analytic mastery through conscious, effortful problem solving and knowledge construction. To use Kagan's (2002) words, it is a process of turning the schematic to the semantic to achieve a conceptual grip. This conjecture is consistent with empirical findings (e.g., Bamberger, 1986), and potentially explains why musically gifted adolescents experience difficulties in switching from a more intuitive mode of music processing, presumably relying on dedicated modules in the brain, to an analytic one, which requires more conceptual analysis of musical elements. This cognitive development approach is also consistent with the notion that most talent development is non-universal (Feldman, 2003), thus entail environmental provisions and support, as well as personal resources, domain-specific and domain-general (see Dai & Renzulli, 2008, for a detailed exposition). From the cognitive development point of view, domain-specificity-generality issue cannot be resolved unless one takes a developmental approach, wherein domain-relevant resources are flexibly mobilized and co-opted in adaptation and self-organization in response to the demands of a domain at a specific stage of talent development. Based on this view, giftedness cannot be completely domain-specific, nor can it be domain-general.

Quantitative Versus Qualitative Differences

The tension between quantitative and qualitative differences focuses on the following question: in what sense and to what extent does gifted development constitute an *exceptional* condition, a condition that is beyond normality and warrants special attention and interventions. From a person-centered perspective on giftedness (i.e., the gifted child), does excellence or potential for excellence reflect some structural and functional organization of the mind that is different in kind rather than in degree? From a domain-centered perspective on giftedness (i.e., talent development), does the development of exceptional competence inherently in-

volve qualitatively different (and sometimes unique) pathways and trajectories, or is it just a little sooner, a little faster? The question is also related to domain specificity issue. If gifted potential is highly domain specific, then the gifted person is likely to show unique organization of cognitive and affective functioning, and unique developmental trajectories and pathways, qualitatively different from normal people.

Evidence of the tension. An increasing discontent expressed in the field is that categorical assumptions are made about what "gifted" means on the basis of a rather arbitrary cutoffs set on some continuous variables of aptitude or achievement (e.g., Borland, 2003, 2005; Keating, in press; Ziegler, 2005; see also Hertzog, this volume). Although not everyone agrees on the categorical interpretation (e.g., Gagné, 2004; Gallagher, 2000; Robinson, 2005), many scholars still feel compelled to label different levels of giftedness (e.g., moderately gifted, profoundly gifted, extremely gifted), similar to the practice of labeling different levels of mental retardation (AAMR, 1992), denoting qualitative differences within the gifted, as well as between the gifted and the "non-gifted" (Gagné, 2005a; Winner, 2000). Others prefer more inclusive cutoffs, implicitly assuming an above-average threshold in ability requirements for a variety of human endeavor (e.g., Renzulli, 1986); beyond this threshold, further finer-grained differentiation may not be justified or may have limited practical utility. Furthermore, many theorists assume unique developmental experience as quintessential to being gifted. For example, the Columbus Group sees developmental asynchrony as an inevitable result of being gifted (see Morelock, 1996); Dabrowski viewed gifted development as involving *positive disintegration* (see Piechowski, 1991); Robinson et al. (2000) see the gifted as going through more cognitive stages than their age peers. However, when various cognitive and affective characteristics of the "gifted" and "non-gifted" are compared, the picture is far from clear-cut. When differences were found (e.g., Dai et al., 1998; Jackson & Butterfield, 1986; Robinson & Clinkenbeard, 1998; Steiner & Carr, 2003), they are better characterized as a matter of degree rather than kind. Nevertheless, child prodigies (Feldman, 1986) evidence early emergence of talents that seem to be qualitatively different from normative developmental trajectories. Children with extremely high IQ seem to have unique academic and social experiences and social adjustment problems (Gross, 1993; Hollingworth, 1942; von Károlyi & Winner, 2005). The similar tension exists in the creativity research. Clinical and personality psychologists tend to see creative processes as involving unique intrapersonal dynamics, involving primary and secondary processes (e.g., Martindale, 1999; Rothenberg, 1979), thus differing from normal conditions. In contrast, cognitive psychologists tend to see creativity as a result of developing a solid knowledge base (Weisberg, 1999, 2006) and using general problem solving (Klahr & Simon, 1999), which are not qualitatively different from those that produce general intellectual performance and products. In other words, the processes leading to creative productivity may be quite mundane upon scrutiny.

The problem. Description of human characteristics as constituting various continua is a hallmark of population thinking underlying psychometric theory and measurement (Lohman, 2001). According to this view, people differ along certain dimensions in degree rather than in kind. However, it is also true that quantitative differences, when cumulated to reach a critical point, can lead to qualitative changes and new properties. A person with an IQ of 130 may not differ much in substance from a person with an IQ of 120, but has a distinct edge compared to a person with an IQ of 100. Because we never know for sure where these critical points may lie, decisions about cutoffs would be a matter of how to reduce errors and increase the certainty of a "hit," or deciding on the trade-off between using relatively liberal criteria (i.e., tolerating more Type I errors [false positives] while preventing Type II errors [false negatives]), versus using relatively stringent criteria (minimizing Type I errors [false positives] while permitting more Type II errors [false negatives]). However, the qualitative–quantitative tension reveals more than such pragmatics. The categorical approach to determining the gifted and the non-gifted treats the gifted as a homogeneous group, and there is abundant evidence that it is not. Those who emphasize inherent qualitative differences in gifted development (the Columbus Group or Dabrowski) tend to prescribe normative models of giftedness with strict defining attributes, while the concept of giftedness may be fundamentally prototypical, even exemplary; that is, one cannot infer universally valid attributes based on some particular cases, since trajectories leading to the same level of excellence and eminence (e.g., winning Nobel Prizes) can be quite different for different individ-

uals (Shavinina, 2004). Given the diversity of gifted phenomena, treating giftedness loosely as a form of developmental diversity (Keating, in press) may be a better strategy to include a variety of developmental patterns underlying gifted manifestations, some normal and others unique.

While it is debatable as to whether psychometrically defined giftedness constitutes a qualitative difference, setting those so identified apart from the rest of the population (Borland, 2005), qualitative individual differences in mental development due to both genetic and environmental influences have not been appreciated in the developmental literature (McCall, 1981). Effects of genetic and environmental interactions are likely multiplicative rather than additive (Ceci, 1996; Papierno et al., 2005), contributing to the likelihood of discontinuity in intra-individual development and inter-individual differences. There is evidence of a widened range of academic achievement, spanning several grade levels, at any grade at the onset of about the third grade (see Gagné, 2005b). Research also shows that selection criterion based on 1 in 10,000 versus 1 in 100 grounded on the out-of-level SAT test scores dramatically increased the odds in long-term prediction that one would obtain doctoral degrees and secure prestigious faculty positions (Lubinski, Webbs, Morelock, & Benbow, 2004). This evidence seems to support the "extremely gifted" classification. Practically, we can operationalize qualitative differences by resorting to the Vygostk's notion of *zone of proximal development* (ZPD). To the extent that two persons' ZPDs do not overlap, it constitutes two qualitatively different developmental conditions; thus a seventh or eighth grade student scoring 600 on SAT-M is clearly having a completely different ZPD than most of his or her age peers as far as mathematical (and possibly general intellectual) development is concerned, thus calling for curricular and instructional differentiation. On the other hand, this qualitative difference in ability and knowledge may or may not have spilt-over effects on other aspects of development (e.g., affect and motivation; see Morelock, 2000, for a Vygotskian analysis of cases of exceptionally high-IQ children).

Solutions. There are several possible ways of resolving the qualitative–quantitative tension. First, although some scholars postulate unique structural and functional organization of the brain as responsible for gifted manifestations (e.g., O'Boyle, 2008; O'Boyle, Benbow, & Alexander, 1995), a more functional approach seems to be a safer starting point; it postulates that quantitative differences in functioning in adaptive self-regulation and self-organization (psychometrically or otherwise measured) can lead to qualitative differences in developmental outcomes, such as organized complexity of one's action repertoire (Ziegler, 2005). For example, according to the cognitive evolution model of development (Siegler, 1996), children's strategy use in problem solving shows a developmental pattern of variation, selection, and optimization. As a result, more effective strategies are retained over time. By the same token, we might characterize advanced development as a case of quantitative individual differences in functioning (e.g., variability in strategy selection) leading to qualitatively different outcomes in development, as evidenced by widened developmental differences in achievement (Gagné, 2005), or distinct precocity in the case of child prodigies (Feldman, 1986). This approach allows for integration of differential and developmental approaches by specifying when and how individuals start to diverge (i.e., the onset of qualitatively different pathways and trajectories) in development (cf. McCall, 1981). The functional approach can also incorporate different kinds of "doing" as indicative of unique potential. Ericsson has, in effect, specified a qualitative difference when he distinguishes between ordinary mastery efforts and deliberate practice (Ericsson et al., 2005, in press). The condition of satisfaction for the former is "good enough" and the criterion for the latter is attaining whatever is humanly possible. Thus, different trajectories of the development of expertise depend on differing functional modes or styles (i.e., qualitative differences in *doing*), rather than differing capacities (i.e., qualitative differences in *being*).

A second approach to resolve the tension is to take a more eclectic view of biologically based individual differences as consisting of both differences within the normal range (quantitative, continuous) and abnormality (qualitative, discontinuous). In the former case, gifted individuals differ from others only in degree; they might show advanced development in some areas but otherwise function normally like others. In the latter case, gifted individuals differ from others in kind; that is, their functioning has measurable differences in neuro-cognitive organization, such as preference for specific lateralization (O'Boyle, 2008), or various forms of "a pathology of superiority" (Gershwind & Galaburda, 1987, p. 65) that create "twice exceptional" conditions (Lupart & Toy, this volume). Their

phenotypical development may indeed have biological substrates and "organic" causes. The distinction between normality and abnormality partly helps resolve the tension between the "being" and "doing" of gifted potential. While unique structural features of the brain constrain functioning and development (e.g., dyslexics or savant talent; see L. Miller, 2005), unique functional experience can also shape structural and functional organization of the brain (Schlaug, 2001). Both can produce qualitative differences in functional organization of the mind/brain.

A third approach is to invoke the distinction between universal and unique human development (Feldman, 1994). Any individual's development can be characterized as constituting a continuum from the most universal (like everyone else, continuous) to the most unique or idiosyncratic (unlike everyone else, discontinuous) (Feldman, 2003; Lohman & Rocklin, 1995). From this perspective, each individual is like all others (e.g., development of reasoning skills), some others (e.g., development of musical competence), and no others (e.g., development of unique personal knowledge and mental models of the world). Thus, the psychometric measures capture some universal dimensions along which individuals differ to some degree, but are blind to the unique side of human functioning and development. In a sense, psychometric continuity breaks down at a point where non-universal development begins. One can further argue that the more extreme individuals show deviation from the norm, the more unique their functioning and development tend to be, for cognitive or social–emotional reasons. It is their idiosyncratic functioning that provides opportunity for unique development patterns, whether it is early emergence of talent, as in the case of child prodigies in arts, sciences, and games (Feldman, 1986), or development of unique visions of the world, as in the case of Einstein, Dostoevsky, or van Gogh. (The distinction between universal and unique development will be further discussed in the section on "Nomothetic Versus Ideographic.")

Expertise Versus Creativity

Mature "gifted" accomplishments belong to two broad categories: expertise and creativity. To use Gardner's (1997) words, people in the "expertise" category are *masters* who have perfected their respective trades to an extremely high level (Ericsson, 2006), and people in the creativity category are *makers*, who have significantly transformed an intellectual or practical domain or artistic ways of expression, and moved a field forward, or even created a new field (Sternberg, 1999b). The conceptual tension of expertise versus creativity exists between those whose research focuses on expertise and those whose research focuses on creativity, and sometimes between gifted practitioners who espouse differing educational agendas, one aiming at developing high-level expertise and talent and the other at creative productivity.

Evidence of the tension. In a chapter of a volume on expertise (Ericsson, 1996) Simonton (1996) felt compelled to coin the term "creative expertise" (p. 227). What he actually delineates is a vision of development of creative productivity that is drastically different from Ericsson's carefully charted pathways to expertise based on controlled experiments and systematic observations. From Simonton's point of view, charting the ontogeny of creative productivity entails a different set of parameters than what expertise researchers have prescribed; yet for many cognitive psychologists, Ericsson included, trajectories leading to creativity is not that different from those leading to domain expertise (see Ericsson, 2006; Weisberg, 1999, 2006). There is also a feeling in the community of gifted education that goals of talent development should go beyond mere expertise to reach creative productivity (Renzulli, 2005; Subotnik & Jarvin, 2005).

The problem. Weisberg (2006) pointed out two competing propositions regarding the relations between expertise and creativity: (a) expertise facilitates creativity and (b) expertise impedes creativity. It is argued that expertise is necessary for creative productivity because a well-organized, in-depth knowledge base makes it possible to detect discrepancies and problems in the domain and identify new pathways to solving the problems. This *facilitation hypothesis* is supported by many real-life cases in arts and sciences and controlled research, discussed by Weisberg (1999, 2006) and Ericsson (2006). As a counter-argument, expertise impedes creativity because too much encapsulated knowledge renders an expert entrenched in established points of view and unable to "think outside the box." Experimental research demonstrating the difficulty of breaking a mental set (e.g., Luchins & Luchins, 1970) supports this *impediment hypothesis*. In real life, Max

Planck's reluctance to go in the direction that Einstein went, or Einstein's rejection of premises underlying quantum mechanics, is a case in point (see A. Miller, 1996). Indeed, it is not unusual that scientists "become increasingly ensnared by the ideas that they themselves created" (Simonton, 2002, p. 272). Too much of expertise becomes a handicap when rules of a game change, figuratively as well as literally (Frensch & Sternberg, 1989).

It should be pointed out, incidentally, that the expertise research tends to focus on domains involving the mastery of performance that requires one to execute a set of skills and routines within a specific time frame, such as instrument playing, figure skating, or the game of chess or go. One may argue that being capable of playing and interpreting a musical masterpiece near perfection is a completely different matter than being able to create a masterpiece, just as being able to execute a difficult routine beautifully does not means being able to choreograph such a routine. For the latter, deliberate practice may not be enough. Although one may agree that expertise is a necessary condition for creative productivity (this is even the case for Mozart; see Lehmann & Ericsson, 1998), a theory that provides a compelling account of exceptional mastery of skilled performance may not be adequate as an account of creative productivity. Biographic analysis shows that personalities and life trajectories of masters and makers seem distinctly different from each other (Gardner, 1997). While masters tended to exclusively focus on one domain, creators tended to hop around different domains, enhancing cognitive flexibility and forging borrowing and cross-fertilization (Simonton, 1997; Root-Bernstein, this volume).

In the community of gifted education, there is a widely held belief that students identified as gifted academic learners are not necessarily the most promising ones in terms of creative productivity. It is this misgiving that seems to have motivated a distinction between a mastery type of giftedness (or schoolhouse giftedness) and a creative type of giftedness (e.g., Callahan & Miller, 2005; Renzulli, 1986; Tannenbaum, 1997). Indeed, retrospective accounts of schooling experience by those eminent creative scientists and writers suggest that schooling in general is not a particularly pleasant and productive experience for many of them (Subotnik & Olszewski-Kubilius, 1998). In general, these creative individuals tended to structure their own lives and actively seek developmental opportunities instead of being structured by others, as is evident in Mark Twain's remark: "I have never let my schooling interfere with my education." The most successful individuals in adulthood that Terman identified in his longitudinal study (Terman & Oden, 1959) also shared similar characteristics, the ones that might not be congenial to typical school structures in terms of curriculum and instruction as well as social organization.

Solutions. A possible solution to this tension is to take a more domain-specific view on this issue; here domain refers to any well-defined human activity or endeavor, culturally sanctioned or not, that has adaptive significance and functional value. Tannenbaum's (1997) taxonomy is useful for this purpose. It (1) distinguishes producers from performers, (2) further breaks them down to different categories of productions and performance based on domains, and (3) differentiates two criteria: proficiency and creativity. In addition, there are differences between domains that are more formally organized as a field, with well-defined rules, boundaries, players, and gatekeepers, and domains whose social organization is relatively loose, and standards for excellence less well defined. For more formal disciplines and domains (e.g., classic music, academic disciplines, or medicine), substantial expertise (i.e., mastery of a canonical set of knowledge and skills) may be necessary before one can become creative. For other domains such as creative writing, business, or pop music, where technical mastery may not be as rigorous as formal disciplines, creativity may not require extensive development of expertise. Sometimes a lack of technical proficiency can be a good thing for innovation, as in the case of van Gogh's painting, partly thanks to his lack of formal training in realist painting techniques. It is also worth noting that efficient mastery in terms of quickly achieving knowledge encapsulation and skill automaticity may be of differential importance at different stages of talent development (Subotnik & Jarvin, 2005). In favor of the facilitation hypothesis, intense efforts of mastery can lead to transformation, in a sense that a striving for high-level expertise pushes one toward "the edge of chaos," detecting gaps and discrepancies in the existing system, which calls for creative solutions (Dai & Renzulli, 2008; Runco, 1994).

To avoid misleading bifurcation of expertise and creativity, a more refined distinction between adaptive expertise and routine expertise serves a good purpose. (Hatano & Inagaki, 1986). Schwartz, Bransford, &

Sears (in press) proposed two dimensions: efficiency and innovation. When one strikes a balance between efficiency (achieving mastery and automaticity) and innovation (making transformations and generalizations), one is more likely to become an adaptive expert. When one exclusively focuses on efficiency, one tends to become a routine expert. When one attempts to be innovative without achieving efficiency, one is likely to remain a confused novice. Thus, adaptive expertise entails a balancing act. Sometimes one has to give up well-mastered skills to try new ways of doing things, or take a metacognitive distance from one's entrenched beliefs to facilitate alternative ways of thinking about an object or phenomenon. Metacognitive control seems to be needed for both expertise and creativity (Weisberg, 2006).

In light of the above discussion, the goals of developing expertise and creativity have slightly different, but complementary pedagogical ramifications. Development of expertise typically goes through steady professional routes of sustained or extended mastery, while development of creative productivity involves more individuality (such as self-direction, risk-taking, and a sense of destiny). In many domains, they complement each other. Pertaining to gifted education, historical debates on enrichment and acceleration, two main delivery systems for gifted education, also reveal different emphases, mastery of increasingly challenging materials (acceleration) or gaining the breadth and depth of educational experience to sharpen the mind (enrichment). In an ideal learning condition, the two should intermingle to achieve content–process integration in the development of talent and creative potential (Coleman & Cross, 2005).

Nomothetic Versus Idiographic Approaches

Nomothetic and idiographic approaches represent two different ways of "carving the nature at its joints." Nomothetic approaches make general assumptions of how the world functions and derive deductive consequences of "natural laws" or universal principles for a given population, whereas idiographic approaches use an inductive approach, identifying unique patterns and regularities based on intimate observation of a set of particulars (Allport, 1937). Applying to the issue of giftedness, people with a nomothetic perspective make universal assumptions about what giftedness is and what attributes define giftedness. In comparison, people with an idiographic perspective see giftedness as involving unique individual functioning and development (e.g., child prodigies; Feldman, 1986; musical talent development; Subotnik & Jarvin, 2005), thus not easily fitting into any general differential or developmental theories. In other words, the concept of giftedness from an idiographic point of view is prototypical and exemplary, with limited generality.

Evidence of the tension. A most telling historical anecdote is that, when Spearman (1904) declared that, once and for all, general intelligence had been "objectively determined and measured" (p. 201), Binet was not convinced; he argued that two persons who obtained the same test score on some psychometric tests might nevertheless possess different skill sets, which turns out to be the case at the high end of the spectrum almost by statistical necessity. These two early pioneers of intelligence theory illustrate two very different ways or styles of looking at the world. Spearman was a mathematician who value universality, simplicity, and precision, and preferred numbers to immediate phenomenology, with a default assumption characteristic of his time: intelligence works like a "mental faculty," a position largely discredited by modern cognitive psychology. In contrast, Binet was a clinician who was intrigued by nuances and "idiographic complexity" of the individual intellectual functioning (Brody, 2000, p. 19). Similar differences can also be found in the creativity research. Simonton (1997), for example, developed a predictive and explanatory model of creative productivity in which only a small number of parameters are postulated, and all the theoretical predictions expressed mathematically. In contrast, Gardner (1993, 1997) took a much more intimate look at lives of those who have made landmark-creative contributions, with painstaking efforts to develop a sympathetic understanding of the workings of their minds. Indeed, just like Binet did not like what Spearman had to say, idiographic researchers typically do not like lots of generalizations made by nomothetic researchers (e.g., see Gruber, 1986 on psychometrically defined giftedness). Among the gifted researchers, consider the contrast between Gagné (1985, 2004) and Feldman (1986, 2003). The differing epistemic stances yield different visions of the nature and nurture of giftedness.

The problem. Simplification by integration and simplification by isolation are two different ways of understanding the complex world (Iran-Nejad, McKeachie, & Berliner, 1990). Making nomothetic or universal assumptions about psychological processes and individual differences in intelligence and personality is the mainstay of psychology since its inception as a science. In early years, it is conducted in the name of psychophysics. In differential psychology, the task is to identify variables that operate within a population. As Novick (1982) stated, "our success as scientists can be measured by our skill in identifying variables that can be used to define relevant, exchangeable subpopulations" (p. 6). Various ability and personality variables are thus derived through measurement techniques, and considered valid across a population. However, these psychological constructs are fictions we create to describe and organize a set of observations in terms of how these variables may influence individual functioning; a person does not act as a list of variables (Snow, 1995). These fictions start to lose their power when they fail to capture the nuances and complexities of individuality or specific lines of individual development (see also Cross, 2003 for a critique of nomothetic assumptions underlying the empirical-analytic mode of inquiry). For good assessment of gifted or exceptional potential, at least three criteria need to be satisfied: sensitivity, specificity, and normative value (Beutler & Rosner, 1995). Psychometric measurement is excellent at providing *normative value* through its well-calibrated norms and nomothetic span, adequate in *specificity* through good construct representation (though constructs like "intelligence" or "creativity" are often criticized as too broad and abstract to be psychologically meaningful and amenable to measurement), but poor at *sensitivity*, namely, capturing the uniqueness of the individual being assessed. For example, the individuality of the person who carried out all the actions over time leading to gifted performance and productivity can be lost in the snapshot measurement of theoretically deduced variables. A nomothetic approach to giftedness (e.g., defining giftedness psychometrically) is a double-edged sword. On the one hand, one can argue that extreme conditions of individual functioning should be captured by a psychometric measure if the instrument involved allows for fine-grained differentiation at the high end (i.e., no apparent ceiling effect). On the other hand, one can argue that the highly gifted may evade standard psychometric measurement altogether, because of their idiosyncrasies in structural and functional organization of their minds and their idiosyncratic handling of specific test situations. This is where the idiographic approach comes to claim its own legitimacy as an alternative or complementary approach.

Different from the variable-centered, nomothetic approach, an idiographic approach assumes the unity of the person as a whole. Aristotle identified three meanings of unity: (a) continuity by nature, (b) wholeness or indivisibility of form, and (c) wholeness or indivisibility of motion (see Silverstein, 1988). Unity so defined is the basic criterion for a thing to have a substance. Intelligence as measured IQs is arguably not a substance, as it does not meet the criterion of unity (cf. Gould, 1981). An enactive, functioning person does. Consciousness does. The idiographic approach differs from the nomothetic approach in another significant manner. The nomothetic approach takes on an objectivist, mechanical epistemic stance, treating individual functioning as an object, following universal laws; thus the subjective life of an individual can be treated as insignificant and epiphenomenal. In contrast, the idiographic approach always entails an intimate look into the mental life of the person involved (e.g., using a phenomenological approach; Cross, 2003). Thus many researchers proposed constructs, such as *organization of intentions* (Gruber, 1986), *subjective mental space* (Shavinina & Kholodnaja, 1996), or *subjective action space* (Ziegler, 2005), as one of the key ingredients of a model of how gifted performance comes about. The difference raises the issue of whether intuition, personal judgment, and other subjective aspects of life should be taken into account in scientific understanding of phenomena as complex as intelligence, expertise, and creativity. Psychologists differ in this regard (Kimble, 1984).

Solutions. The variable-centered, nomothetic approach is still the psychology's mainstream. On the other hand, the person-centered, idiographic approach, using constructs such as *individualized life tasks* (Cantor, 1990, p. 740), *personal strivings* (Emmons, 1986), has gained momentum. We all try to cut the nature at its joints. The issue is how to make the cuts that retain the complexity and sufficient details yet still show intelligible structure and regularities, the ways that "each

person is like all other people, some other people, and no other people" (Lohman & Rocklin, 1995, p. 470). As mentioned earlier, the field of gifted research started with nomothetic assumptions about human traits, such as intelligence (Terman, 1925), but increasingly recognized the importance of starting with particulars, the immediate phenomenology of gifted and talented behaviors (e.g., Witty, 1958). Indeed, Terman himself conducted many case studies in later years of his longitudinal study, producing insights that otherwise could not be obtained (see Terman & Oden, 1959).

The nomothetic versus idiographic dimension can be better seen as a continuum rather than a dichotomy. There are middle grounds between universals and particulars. Between using a variable-centered approach to identify "exchangeable subpopulations" (gifted, average, mentally retarded, etc.) and a person-centered approach to identify unique individuality, Muthén and Muthén (2000) offers a technical compromise. They recommend using a "latent class" statistical technique to identify relatively homogeneous subgroups in terms of different profiles and developmental patterns. However, Silverstein (1988) argued that to truly resolve the nomothetic–idiographic tension, functional developmental history (FDH) should be used as a unit of analysis. In the same vein, Haensly, Reynolds, and Nash (1986) called for attention to "the dynamic nature of the human response to a specific and variety of settings" (p. 130). They proposed a unit of analysis that consists of four Cs:

> "A meaningful definition of giftedness should take into account what and how abilities have productively come together (coalescence); the type of setting that elicits expression of those abilities (context), the opposing forces that generate a divergence of expression (conflict); and the quality, intensity, and duration of that expression (commitment)" (p. 132).

Snow (1995) echoed this sentiment: "it may be that the best way to understand both individual differences and individuality is in the context of development, whereas developmental pathways both general and unique may best be interpreted in the context of differential distributions" (p. xiv). The use of FDH as a unit of analysis instead of using variable-centered approaches seems to be a promising direction (see Dai & Renzulli, 2008, for an attempt to implement this approach).

Reductionism Versus Emergentism

If the nomothetic–idiographic tension concerns whether one starts with universals or particulars, and how uniqueness can be preserved in search of generality, the reductionism–emergentism tension concerns what levels of analysis and explanation is appropriate given a behavioral and psychological phenomenon. Psychology as a science started out with a strong reductionist orientation (e.g., psychophysics), treating mental events as epiphenomenal of neural-physiological processes. In general, reductionism in psychology is a tendency to trace all complex behaviors and high-level psychological phenomena (including early manifestations of gifts and talents or outstanding eminent achievement) backward to simpler, lower-level components that constitute higher-level phenomena. In its most radical form, psychological processes and events can be causally reduced to neural-physiological events and biochemistry, which can, in turn, be reduced to physics (or from cellular to molecular). A less dramatic example of the reductionist approach is to parse variations in intelligence and personality variables into proportions explained by genetics and environment, respectively (or using more refined schemes): complex phenomena can be taken apart to show its simpler components, and explained by these simpler components in an additive or multiplicative fashion (see Scarr, 1997).

Emergentism as a philosophic orientation is relatively new in psychology (Sawyer, 2002). It attempts to keep track of the emergence of complex behaviors in a forward manner, at various levels of organized complexity. For example, evolution can be understood as a self-assembly and self-organization of complexity: living beings have, over millions of years of evolution, surpassed critical thresholds of nervous systems, consciousness, language, and shared technology, which enable *Homo Sapiens* to achieve a maximal fit through learning and development in an unprecedented manner. Each threshold represents a new level of organized complexity that is indebted to, but cannot be reduced, to lower-level components (e.g., the linguistic, symbolic capability as an emergent property of human functioning entails directedness of consciousness but cannot be simply explained by consciousness). Emergentism would explain individual differences in complex human behaviors, including intellectual performance and manifestations of talents and creative productivity, as a matter of real-time developmental

emergence, a dynamic form of organized complexity (Dai, 2005; Sawyer, 2002). Indeed, the essence of development from an organismic point of view is the emergence of new properties with increasing organized complexity (Overtone, 1984).

Evidence of the tension. While Jensen (2001) and other differential psychologists were seeking the biological underpinnings of intelligence by obtaining physiological measures such as neural conduction velocity (see also Geake, this volume; Vandervert & Liu, this volume), Gruber (1986) dismissed such a "being" account and characterized Darwin, Piaget, and other epoch-making creative lives as self-construction (i.e., doing/becoming) of the extraordinary. In a sense they were trying to answer the same question of how human exceptional competence and creative productivity comes about, but they were going in such diametrically different directions. As another example, after the three-ring conception of giftedness, Renzulli (2002) still found something wanting and went ahead to propose a set of personal constructs, such as optimism, courage, sensitivity to human conditions, sense of destiny, as necessary motivational forces that drive actions leading to major creative contributions to the society and humankind. Behind the being–doing/becoming debate also lies an epistemological tension, differences in what Dennett (1987) called *epistemic stance*, or what Kimble (1984) identified as two cultures in psychology: scientism and humanism.

The problem. As one recalls, psychology as a young discipline used to emulate physics (some may argue that it still does!). Newtonian physics, with its first principles, has attested to the magical power of reductionism. As a matter of fact, it was so powerful that brilliant physicists such as Planck and Einstein all aspired to unify physical sciences under an even more basic, foundational theory. Planck, for example, warned that "physical research cannot rest so long as mechanics and electrodynamics have not been welded together with thermodynamics and heat radiation" (in Holton, 1981, p. 18). Despite the unsuccessful attempt in Einstein's later life with his unified field theory, reductionism has proved highly effective when used in physics, but less so in biology, and increasingly controversial in psychology (see Koch & Leary, 1992). It has to do with our basic assumption and understanding of human nature as mechanistic, organismic, or contextual (Overtone, 1984).

The mechanistic vision of human development is that of refinement of machinery. Just like a mechanical gadget, it can be taken apart to show how each component works, all following physical laws. For such a system, addition, subtraction, and rearrangement of components are sufficient to make it work, but no qualitative change can occur in and of itself. In short, a mechanistic model of human development is a reductionist model. In contrast, an organismic vision of human development is modeled after living things such as plants and animals. Living beings are progressively undergoing transformation or qualitative, discontinuous changes. Human beings are even more so; they actively participate in their own development through self-selection and self-initiated actions. Organismic models are non-reductionist and emergentist. A contextual vision of human development incorporates organismic principles but sees human functioning and development as fundamentally embedded in the person–environment dynamic interactions and functional relationships. Thus, contextual models of human development are not only emergentist but also interactionistic. In the context of these three different ontological views of human development, it is easy to see why emergentists tend to take an idiographic approach and reductionists tend to take a nomothetic approach.

Based on this scheme, at least four levels of analysis or explanation can be identified: the neural-biological level, the behavioral–functional level, the intentional level, and the activity or social-contextual level (Dai, 2005). Consider the lowest level of emergence in terms of neural wiring and circuit building through learning and maturation to form functional units in the brain. Reductionists parse variations in intellectual performance into genetic and environmental factors as proportional contributions to certain phenotypic development. Emergentism argues that neural wiring is not dictated by genes but highly sensitive to experience, better characterized as a probabilistic epigenesis rather than a deterministic one (Gottlieb, 1998). It has to do with neural plasticity in meeting developmental challenges (see Kalbfleisch, this volume), including talent development; for instance, structural and functional adaptations occur in the brain as a result of training in music (Schlaug, 2001) and other domains (Ericsson et al., in press). Experience and learning change brain physiology and anatomy during child and adolescent development (Nelson, 2000), even in adulthood

(Greenough, 1976). Thus, assumptions about fixed capacities do not hold even at the neural level!

Built on the neural-biological structures and functions is the next level of organized complexity, the growth of competence in cognitive and cultural domains, namely, talents and skills. Reductionists tend to assume that talent is innate, or treat it as an accidental by-product of some abnormal development, a "pathology of superiority." However, none of the talents in culturally defined domains comes as "packaged" or "pre-programmed." Rather, emergentists view talent as a result of developmental interactions at several levels (neural, cognitive–affective, social). The emergence of a talent can be characterized as a developmental continuity (quantitative changes) reaching a tipping point to produce a discontinuous outcome (a new level of organized complexity in one's action repertoire, to use the Actiotope Model; Ziegler, 2005). Domain competence is thus dynamic, in that a talent is a continually changing functional state, continuous increments building up to the next level of organized complexity.

Still another higher level of organized complexity has to do with the human ability to mentally represent one's own past, present, and future, and initiate actions and effect changes in himself or herself. Cognitive psychologists with a reductionist bias typically place their levels of analysis at "subpersonal" levels, that is, mental operations at subconscious level. Dennett (1987) saw them as subpersonal designs, assuming that some mental structures and operations opaque to consciousness carry out all the tasks, and the role of consciousness and intentionality, together with their social-cultural referents and meanings, is epiphenomenal and trivial for that matter. However, this reductionistic view of human functioning has been increasingly contended not only by philosophers (e.g., Searle, 1990, 2002), but also by neurologists and physical scientists (see Cornwell, 1995). For example, Edelman (1995), a neuroscientist, the 1972 Nobel Prize winner for Physiology and Medicine, argued that a unique characteristic of human beings is their ability to model the past and the future. He particularly stressed the role of emergence of selfhood, a construct used by Gruber (1986, 1998) to explain the genesis of many eminent creative contributions:

> "By selfhood, I mean not just the individuality that emerges from genetics or immunology, but the personal individuality that emerges from developmental and social interactions" (Edelman, 1995, p.201)

This selfhood, with its remembered past and envisioned future, sets humans apart from "non-intentional objects" (Edelman, 1995, p. 205). In keeping with this understanding of personal agency, a variety of self-related concepts are gaining legitimacy in the scientific discourse on human functioning and development, such as self-efficacy (Bandura, 1997) and possible selves (Markus & Nurius, 1986). These constructs are increasingly used in the gifted research.

At the highest organized complexity is the activity or social-contextual level, which sees all the other three levels of analysis as nested in this functional context. If intentionality is a centerpiece of human functioning, then human functioning must also be social, as intentionality has a distinct social component. Mainstream psychology often reveals mechanistic or organismic biases in explaining gifted and talented behavior, because etiologies of human behavior are typically seen as residing within the person in question. This individualistic bias is reflected not only in theories that consider gifted and talented as by and large genetically based, but also in theories that emphasize personal efforts as the main cause. Rarely do people see gifted and talented behaviors as *enabled*, not merely facilitated, by technology and culture, or as distributed between the person and an interacting environment (including other people), until very recently (e.g., Barab & Plucker, 2002; Moran & John-Steiner, 2003; Sawyer, 2003; Ericsson, 2006). Thus, the emergency of excellence at the social-contextual level is attributed to the synergistic power, as a result of reciprocation of domain and social affordances and individual and collective abilities (effectivities) over time.

Solutions. As the persistent reductionistic search for the Holy Grail of giftedness for the last century has seemed to meet with serious difficulties, emergentism, with its organismic and contextualist outlook, offers a viable alternative. It provides a new way of understanding excellence as a result of developmental diversity. Many of its features are worth consideration in understanding gifted and talent behaviors, for example, its non-deterministic, probabilistic view of human development, its emphasis on neural plasticity and cognitive adaptivity, its emphasis on equipotentiality and equifinality (i.e., different strengths and different developmental pathways lead to the same level of excellence, as evidenced in Gottfried et al., 2005; Shavinina, 2004; see also Kalbfleisch, this volume; Papierno et al., 2005). To be sure, emergentism has its own chal-

lenges, such as how to integrate findings that sit at different levels of analysis (with different grain sizes and structures, different laws and principles), and how to provide bridging principles between different levels of analysis that render emergentist accounts coherent and truly integrated, like a piece of seamless fabric rather than a patched quilt (see Searle, 2004, for a philosophic discussion of different levels of analysis).

Excellence Versus Equity

Conceptually, promoting and rewarding excellence does not necessarily impede social equity in terms of equal access to opportunities and resources for achieving excellence. However, in a democracy, especially in a society that has a history of racism, sexism, or other forms of social injustice, there are always concerns as to whether only some individuals or groups have privileged access to resources for achieving excellence and cultural distinction, while others are marginalized or even disfranchised.

Evidence of the tension. Gifted education bears the brunt of charges of elitism within the educational community and without. The charges include creating a ruling social elite (Margolin, 1994, 1996), destroying the communal unity of school (Sapon-Shevin, 1994, 1996), unfairly creating a social divide between the elect (i.e., the gifted) and the damned (the regular or non-gifted; Berliner & Biddle, 1995), to name a few. The anti-elitist sentiment is understandable if one realizes that in the US educational system, minority students (barring Asians) are overrepresented in special education and underrepresented in gifted education (Donovan & Cross, 2002). There is a suspicion that the system has an inherent bias against minority students in the selection system. Conversely, detracking (dismantling ability grouping) and the purposeful heterogeneous grouping increasingly popular in the United States has also raised concerns that gifted students are likely exploited in the name of cooperative learning (see Colangelo & Davis, 1997). As an early signal of the tension, Renzulli and Reis (1991) pointed out a "quiet crisis" (p. 26) that directly threatens the defensibility and viability of gifted education: the neglect of the issue of equity and underrepresented populations in gifted education. In 1996, an entire issue of the *Journal for the Education of the Gifted* was devoted to forging a constructive dialogue between gifted educators and critics of the gifted education movement. Most striking is Borland's (2003) recent advocacy for "gifted education without gifted children" (p. 105), a far cry from his early position (e.g., Borland, 1989). Borland's conclusion is that gifted education as currently practiced, for all its good intention, further perpetuates social injustice: privileging the already privileged. Scholars in gifted education are wrestling with the issue of whether gifted education should serve unique needs of relatively few or develop talents for all (e.g., see Gallagher, 2000; Treffinger & Feldhusen, 1996; Morelock, 1996).

The problem. The issue concerns whether the selection system for gifted education necessarily means unjustified exclusion of certain groups and individuals. The defense of gifted programs is often built on the assumptions of special needs of some top students that set them apart from their peers. The alleged "special needs" are often so vaguely defined that use of "special needs" as a rationale for gifted education is increasingly facing criticism (Borland, 2003; Grant, 2002) for ethical and pragmatic reasons. Another major argument used to defend gifted education is that cultivating giftedness as the most precious natural resources benefits both individuals who demonstrate this quality and the society at large (Renzulli & Reis, 1991). As the categorical approach to identifying "gifted children" using strict cutoffs appears untenable in light of new understandings of the diversity of gifted manifestations, should we still retain an identification system but use more inclusive criteria (Renzulli & Reis, 1997) or should we adopt a more radical "gifted education without gifted children" approach that Borland (2003) advocates? Epistemologically, the issue hinges on our understanding of the issues discussed above: the being versus doing/becoming of giftedness, the issue of qualitative versus qualitative differences, and domain specificity versus domain generality, and ultimately, what gifted education is for.

In a larger scheme of things, the tension reflects an egalitarian sentiment against elitism, a charge to which gifted education is vulnerable. Modern society is a mixture of meritocracy and democracy. This marriage is not always an amicable one. On the one hand, individual excellence is encouraged, recognized, and rewarded in a market economy where efficiency and productivity rule. Democracy also implies that individual differences and individuality should be respected,

and demonstrated high potential be given opportunity to develop. On the other hand, "survival of the fittest," "the winner takes all" (Ambrose, 2000), and above all, an image of an IQ elite ruling the less intelligent masses in an IQ-stratified society, reminiscent of Plato's philosopher-kings, is scary to many, particularly when this elitist vision was promoted by Terman, Goddard, and other Darwinians a hundred years ago in the United States, and still find sympathizers today (e.g., Herrnstein & Murray, 1994). This is probably why many people today seem comfortable with athletic elites, business elites, artistic elites, or even technology elites, but uneasy about an intellectual elite.

However, as Hofstadter (1963) argued, "The intellectual class, whether or not it enjoys many the privileges of an elite, is of necessity an elite in its manner of thinking and functioning" (p. 407). One may even argue that a true democracy entails such a high intellectual quality (Dewey, 1916). McWhorter (2003), for example, pointed out an alarming decline in the quality of political discourse in the United States; the language many politicians (arguably an elite group) prefer to use seems increasingly less formal compared to their counterparts in the 1800s and 1900s, relying more on sound bites that have an emotional appeal to their audiences or constituencies but not much of intellectual substance. This declined quality of thinking not only has direct political consequences (e.g., war and peace), but also affects the quality of a democracy.

Advocacy for the gifted runs counter to democracy in another way. Culturally speaking, democracy and commercialism are not particularly congenial to refined minds and senses. Indeed, people like William James (or Henry James for that matter) would likely feel out of place if they were still alive today. Tocqueville (1835) foretold the decline of senses and sensibilities in the modern era, and expressed his mixed feelings about the then emergent democracy in his *Democracy in America*. By the same token, Tannenbaum (1998) warned that the sound and fury of the popular culture could numb sensitivities and dumb down sensibilities, threatening the very existence of the gifted on this planet! It raises the issue of whether it is an important role of gifted education to preserve an "elite" quality in an increasingly materialist, post-modern world. In historical hindsight, Sputnik-mobilized energy and enthusiasm for educational excellence in science and mathematics is a mixed blessing, because what historically motivated the gifted movement were political and economic exigencies (e.g., the United States is losing its competitive edge! To Soviet Union in 1950s, to Japan in 1980s, and now to China!). Giftedness as a precious natural resource should be cultivated and put to good use for the sake of national interest, and no one would question the value of doing so (see Carroll, Crowe, Earle, Orland, Moon, Ross, & Subotnik, this volume). However, it can be argued that well-cultivated, refined minds and senses, as reflected in their intellectual and artistic products and expressions, have their own intrinsic value, and should be preserved with equal urgency.

Solutions. Early Darwinians such as Galton and Terman interpreted Darwin's "survival of the fittest" as a uni-dimensional hierarchy, which is, in hindsight, a misconception. As in a natural world, there are many ways that the organism–environment fit can be achieved. In other words, Darwinian niche potential can be pluralistic, rather than hierarchical. Moreover, it is the variation or diversity, socially and biologically, that produces excellence, not the mere inheritance of family genes. Indeed, as Simonton (2005) pointed out, genius or extreme forms of giftedness is more likely a genetic accident than an inherited family trait. Thus, the myth of a natural-born elite group passing their "gifted genes" onto their offspring, perpetuated by Galton (1869), should be debunked. One might even venture a hypothesis that the statistical concept of regression to the mean also applies in this context. As to how a society should view and treat those who demonstrate different levels of excellence or promise, Sternberg (1996) proposed a Jeffersonian ideal that people are equal in terms of political and social rights, and thus should have equal opportunity to realize their potential, but the extent to which they utilize and benefit from these opportunities may not be equal. People should be rewarded for what they accomplish, given equal opportunity, not for what they might have or could have accomplished. In other words, everyone should be given equal opportunities, but one should not expect equal outcomes, nor should one reward everyone equally if the outcomes are different. A corollary of this argument is that actual achievement should be used as a basis for reward, not putative potential.

In gifted education, one way of solving the excellence versus equity problem is to reintegrate gifted education into general education. It is now feasible be-

cause general education has increasingly emphasized high-level thinking and teaching for transfer and expertise (e.g., Bransford, Brown, & Cocking, 1999). While arguing that goals and guiding principles for gifted education and general education are fundamentally similar, Tomlinson (1996) posits nine dimensions on which educational and instructional differentiation may be made for gifted learners: (a) foundational to transformational, (b) concrete to abstract, (c) simple to complex, (d) few facets to multifacets, (e) smaller leap to greater leap, (f) more structured to more open, (g) clearly defined to fuzzy, (h) less independence to greater independence, and (i) slower to quicker. They can be seen as dimensions along which all students (including the gifted) can be properly positioned based on their zones of proximal development, on how much they will benefit from a given educational experience at a specific point in time. A continuum of educational provisions can be made, some suitable for many, and others only suitable to a relatively few (Renzulli & Reis, 1997; Stanley, 1997; Shore & Delcourt, 1996).

Conclusion

More than a century ago, Galton (1896) envisioned that we eventually pinpoint genius as a heritable, measurable mental faculty. Terman (1925) went further to study this putatively heritable trait with the then newly invented measurement technology. These pioneers of gifted psychology provide us with a legacy that needs to be taken seriously, and critically reviewed in light of all the scientific advances made over the past century. In this chapter, I suggest several tensions between the old and the new, between different ways of approaching the same issue, and explore how these tensions can be resolved or eased by efforts of synthesis. I attempt to show that meaningful exchanges can be made between those who hold diametrically different viewpoints, and that under the seemingly discrete approaches and perspectives, there is commensurability, continuity, and complementarity. Such exchanges would ensure that, even though we may not agree with each other, we at least understand each other's point of view.

Human understanding follows a learning curve. Ultimately, it self-corrects. Studies of giftedness are no exception. Galton was almost prophetic in his times, but naïve by today's standards of scientific knowledge. T. S. Elliot once commented that, with new insights into the human nature and conditions, the entire world order needs to be rearranged to reflect these new understandings. This said, the essential tensions surrounding the concept of giftedness will linger for several reasons. First, we are dealing with issues that are value laden, with ethic and political consequences. Indeed, many in the field can be better described as champions of certain justifiable causes rather than disinterested bystanders; scientists are social beings as well, and have their own political sympathies and commitments. Second, the epistemic complexity of the issues makes it inevitable that knowledge claims we have made or will make, however supported by evidence, are based on theoretical models rather than objective realities independent of the observer and/or the instrument that permits the observation); these knowledge claims or creative interpretations of data are constrained, but not automatically made self-evident, by empirical evidence. And finally, epistemic beliefs and ontological commitments of scholars and researchers, including principles guiding their research, are usually not subject to falsification (Lakatos, 1978). One can remain hopeful, however, that scholars and researchers in the field constructively capitalize on these tensions with both open-mindedness and critical thinking. To quote Toulmin (1972):

> "A man [or woman] demonstrates his [her] rationality, not by a commitment to fixed ideas, stereotyped procedures, or immutable concepts, but by the manner in which, and the occasions on which, he [she] changes those ideas, procedures, and concepts." (p. x).

References

AAMR (American Association on Mental Retardation) (1992). *Mental retardation: Definition, classification, and systems of support* (9th ed.). Washington, DC: Author.

Ackerman, P. L. (1988). Determinants of individual differences during skill acquisition: Cognitive abilities and information processing. *Journal of Experimental Psychology: General, 117*, 288–318.

Ackerman, P. L. (1999). Traits and knowledge as determinants of learning and individual differences: Putting it all together. In P. L. Ackerman, P. C. Kyllonen & R. D. Roberts (Eds.), *Learning and individual differences: Process, traits, and content determinants* (pp. 437–460). Washington, DC: American Psychological Association.

Alexander, J. M., Carr, M., & Schwanenflugel, P. J. (1995). Development of metacognition in gifted children: Directions for future research. *Developmental Review, 15*, 1–37.

Allport, G. W. (1937). *Patterns and growth in personality*. New York: Holt, Rinehart & Winston.

Ambrose, D. (2000). World-view entrapment: Moral-ethical implications for gifted education. *Journal for the Education of the Gifted, 23*, 159–186.

Ambrose, D. (2003). Barriers to aspiration development and self-fulfillment: Interdisciplinary insights for talent discovery. *Gifted Child Quarterly, 47*, 282–294.

Ambrose, D. (2005). Interdisciplinary expansion of conceptual foundations: Insights from beyond our field. *Roeper Review, 27*, 137–143.

Angoff, W. H. (1988). The nature-nurture debate, aptitudes, and group differences. *American Psychologist, 43*, 713–720.

Baltes, P. B. (1998). testing the limits of the ontogenetic sources of talent and excellence. *Behavioral and Brain Sciences, 21*, 407–408.

Bamberger, J. (1986). Cognitive issues in the development of musically gifted children. In R. J. Sternberg & J. E. Davidson (Eds.), *Conceptions of giftedness* (pp. 388–413). Cambridge. England: Cambridge University press.

Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York: W. H. Freeman.

Barab, S. A., & Plucker, J. A. (2002). smart people or smart context? Cognition, ability, and talent development in an age of situated approaches to knowing and learning. *Educational Psychologist, 37*, 165–182.

Berliner, D. C., & Biddle, R. J. (1995). *The manufactured crisis: Myths, fraud, and the attach on America's public schools*. Reading, MA: Addison-Wesley Publishing.

Beutler, L. E., & Rosner, R. (1995). Introduction to psychological assessment. In L. E. Beutler & R. Rosner (Eds.), *Integrative assessment of adult personality* (pp. 1–24). New York: The Guilford press.

Bidell, T. R., & Fischer, K. W. (1997). Between nature and nurture: The role human agency in the epigenesis of intelligence. In R. J. Sternberg & E. Grigorenko (Eds.), *Intelligence, heredity, and environment* (pp. 193–242). New York: Cambridge University press.

Block, N. J., & Dworkin, G. (1976). *The IQ controversy*. New York: Pantheon.

Bloom, B. S. (1985). *Developing talent in young people*. New York: Ballantine Books.

Bonsangue, M. V., & Drew, D. E. (1995). Increasing minority students' success in calculus. *New Directions for Teaching and Learning, 11*, 501–518.

Borland, J. H. (1989). *Planning and implementing programs for the gifted*. New York: Teachers College press.

Borland, J. H. (1997). The construct of giftedness. *Peabody Journal of Education, 72*(3 & 4), 6–20.

Borland, J. H. (2003). The death of giftedness. In J. H. Borland (Ed.), *Rethinking gifted education* (pp. 105–124). New York: Teachers College press.

Borland, J. H. (2005). Gifted education without gifted children: The case for no conception of giftedness. In R. J. Sternberg & J. E. Davidson (Eds.), *Conceptions of giftedness* (2 ed., pp. 1–19). Cambridge, England: Cambridge University press.

Bransford, J. D., Brown, A. L., & Cocking, R. R. (1999). *How people learn: Brain, mind, experience, and school*. Washington, DC: National Academy press.

Brody, N. (2000). History of theories and measurements of intelligence. In R. J. Sternberg (Ed.), *Handbook of intelligence* (pp. 16–33). Cambridge, UK: Cambridge University press.

Bronfenbrenner, U., & Ceci, S. J. (1994). Nature-nurture reconceptualized in developmental perspective: A bio-ecological model. *Psychological Review, 101*, 568–586.

Callahan, C. M., & Miller, E. M. (2005). A child-responsive model of giftedness. In R. J. Sternberg & J. E. Davidson (Eds.), *Conceptions of giftedness* (2 ed., pp. 38–51). Cambridge, England: Cambridge University press.

Cantor, N. (1990). From thought to behavior: "Having" and "doing" in the study of personality and cognition. *American Psychologist, 45*, 735–750.

Carey, S. (1999). Sources of conceptual change. In E. K. Scholnick, K. Nelson, S. Gelman, A. & P. H. Miller (Eds.), *Conceptual development: Piaget's legacy* (pp. 293–326). Mahwah, NJ: Lawrence Erlbaum.

Carroll, J. B. (1993). *Human cognitive abilities: A survey of factor-analytic studies*. Cambridge: Cambridge University press.

Carroll, T., Crowe, E., Earle, J., Orland, M., Moon, J., Ross, P., et al. (in press). Identifying and developing exceptional talent in science, technology, engineering, and mathematics (STEM): Developing a national strategic agenda. In L. Shavinina (Ed.), *Handbook on Giftedness*. New York: Springer Science.

Case, R. (1992). *The mind's staircase: Exploring the conceptual underpinnings of children's thought and knowledge*. Hillsdale, NJ: Lawrence Erlbaum.

Ceci, S. J. (1996). *On intelligence: A bio-ecological treatise on intellectual development* (2 ed.). Cambridge, MA: Harvard University press.

Ceci, S. J. (2003). Cast in six ponds and you'll reel in something: Looking back on 25 years of research. *American Psychologist, 58*, 855–864.

Ceci, S. J., & Liker, J. (1986). A day at the races: A study of IQ, expertise, and cognitive complexity. *Journal of Experimental Psychology: General, 115*, 255–266.

Ceci, S. J., & Williams, W. M. (1997). Schooling, intelligence, and income. *American Psychologist, 52*, 1051–1058.

Chi, M. T. H., Feltovich, P. J., & Glaser, R. (1981). Categorization and representation of physics problems by experts and novices. *Cognitive Science, 5*, 121–152.

Cleary, T. A., Humphreys, L. G., Kendrick, S. A., & Wesman, A. (1975). Educational uses of tests with disadvantaged students. *American Psychologist, 30*, 15–41.

Colangelom, N., & Davis, G. A. (Eds.) (1997). *Handbook of gifted education* (2 ed.). Boston, MA: Allyn & Bacon.

Coleman, L. J., & Cross, T. L. (2005). *Being gifted in school: An introduction to development, guidance, and teaching*. Waco, TX: Prufrock press.

Cornwell, J. E. (1995). *Nature's imagination: The frontiers of scientific vision*. Oxford, UK: Oxford University press.

Cronbach, L. J. (1957). The two discipline of scientific psychology. *American Psychologist, 12*, 671–684.

Cross, T. L. (2003). Rethinking gifted education: A phenomenological critique of the politics and assumptions of the empirical-analytic mode of inquiry. In J. H. Borland (Ed.), *Rethinking gifted education* (pp. 72–79). New York: Teachers College, Columbia University.

Csikszentmihalyi, M. (1996). *Creativity: Flow and the psychology of discovery and invention*. New York: HarperCollins.

Csikszentmihalyi, M., Rathunde, K., & Whalen, S. (1993). *Talented teenager*. New York: Cambridge University press.

Csikszentmihalyi, M., & Robinson, R. E. (1986). Culture, time, and the development of talent. In R. J. Sternberg & J. E. Davidson (Eds.), *Conceptions of giftedness* (pp. 264–284). Cambridge, UK: Cambridge University press.

Dai, D. Y. (2004). Why the transformation metaphor doesn't work well: A comment on Gagne's DMGT model. *High Ability Studies, 15*, 157–159.

Dai, D. Y. (2005). Reductionism versus emergentism: A framework for understanding conceptions of giftedness. *Roeper Review*, 144–151.

Dai, D. Y., & Coleman, L. J. (2005). Introduction to the special issue on nature, nurture, and development of exceptional competence. *Journal for the Education of the Gifted, 28*, 254–269.

Dai, D. Y., Moon, S. M., & Feldhusen, J. F. (1998). Achievement motivation and gifted students: A social cognitive perspective. *Educational Psychologist, 33*, 45–63.

Dai, D. Y., & Renzulli, R. S. (2008). Snowflakes, Living systems, and the mystery of giftedness. *Gifted Child Quarterly, 52,* 114–130.

Dai, D. Y., & Sternberg, R. J. (2004). Beyond cognitivism: Toward an integrated understanding of intellectual functioning and development. In D. Y. Dai & R. J. Sternberg (Eds.), *Motivation, emotion, and cognition: Integrative perspectives on intellectual functioning and development* (pp. 3–38). Mahwah, NJ: Lawrence Erlbaum.

DeHaan, R. G., & Havighurst, R. J. (1957). *Educating the gifted*. Chicago: University of Chicago press.

Delisle, J. (2003). To be or to do: Is a gifted child born or developed? *Roeper Review, 26*, 12–13.

Dennett, D. (1987). *The intentional stance*. Cambridge, MA: Bradford Books/MIT press.

Dewey, J. (1916). *Democracy and education*. New York: The Free press.

Donovan, M. S., & Cross, C. T. (Eds.) (2002). *Minority students in special and gifted education (Committee on Minority Representation in Special Education, Division of Behavioral and Social Sciences and Education, National Research Council)*. Washington, DC: National Academy press.

Dweck, C. S. (1999). *Self theories: Their role in motivation, personality, and development*. Philadelphia: Psychology press.

Edelman, G. M. (1995). Memory and the individual soul: Against silly reductionism. In J. Cornwell (Ed.), *Nature's imagination: The frontiers of scientific vision* (pp. 200–206). Oxford, England: Oxford University press.

Emmons, R. A. (1986). Personal strivings: An approach to personality and subjective well-being. *Journal of Personality and Social Psychology, 51*, 1058–1068.

Ericsson, K. A. (1996). The acquisition of expert performance: An introduction to some of the issues. In K. A. Ericsson (Ed.), *The road to excellence: The acquisition of expert performance in the arts and sciences, sports, and games* (pp. 1–50). Mahwah, NJ: Lawrence Erlbaum Associates.

Ericsson, K. A. (2006). The influence of experience and deliberate practice on the development of superior expert performance. In K. A. Ericsson, N. Charness, P. J. Feltovich & R. R. Hoffman (Eds.), *The cambridge handbook of expertise and expert performance* (pp. 683–703). New York: Cambridge University press.

Ericsson, K. A., Charness, N., Feltovich, P. J., & Hoffman, R. R. (2006). *The cambridge handbook of expertise and expert performance*. New York: Cambridge University press.

Ericsson, K. A., Nandagopal, K., & Roring, R. W. (2005). Giftedness viewed from the expert-performance perspective. *Journal for the Education of the Gifted, 28*, 287–311.

Ericsson, K. A., Nandagopal, K., & Roring, R. W. (2007). Giftedness and evidence for reproducibly superior performance: An account based on the expert-performance framework. *High Ability Studies, 18,* 3–55.

Feist, G. J. (2004). The evolved fluid specificity of human creative talent. In R. J. Sternberg, E. L. Grigorenko & J. L. Singer (Eds.), *Creativity: From potential to realization* (pp. 57–82). Washington, DC: American Psychological Association.

Feldhusen, J. F. (1992). *TIDE: Talent identification and development in education*. Sarasota, FL: Center for Creative Learning.

Feldhusen, J. F. (2003). Lewis M. Terman: A pioneer in the development of ability tests. In B. J. Zimmerman & D. H. Schunk (Eds.), *Educational psychology: A century of contributions* (pp. 155–169). Mahwah, NJ: Lawrence Erlbaum Associates.

Feldman, D. H. (1986). *Nature's gambit: Child prodigies and the development of human potential*. New York: Basic Books.

Feldman, D. H. (1992). Has there been a paradigm shift in gifted education: Some thoughts on a changing national scene. In N. Colangelo, S. G. Assouline & D. L. Ambrose (Eds.), *Talent development: Proceedings from 1991 Henry and Jocelyn Wallace National Research Symposium on Talent Development* (pp. 89–94). Uninville, NY: Trillium.

Feldman, D. H. (1994). *Beyond universals in cognitive development* (second ed.). Norwood, Nj: Ablex.

Feldman, D. H. (2003). A developmental, evolutionary perspective on giftedness. In J. H. Borland (Ed.), *Rethinking gifted education* (pp. 9–33). New York: Teachers College, Columbia University.

Fischer, K. W., & Yan, Z. (2002). Darwin's construction of the theory of evolution: Microdevelopment of explanations of variation and change in species. In N. Granott & J. Parziale (Eds.), *Microdevelopment: Trnasition processes in development and learning* (pp. 294–318). Cambridge, UK: Cambridge University press.

Fodor, J. A. (1983). *The modularity of mind*. Cambridge, MA: The MIT press.

Freeman, J. (2005). Permission to be gifted: How conceptions of giftedness can change lives. In R. J. Sternberg & J. E. Davidson (Eds.), *Conceptions of giftedness* (2 ed., pp. 80–97). Cambridge, England: Cambridge University press.

Frensch, P. A., & Sternberg, R. J. (1989). Expertise and intelligent thinking: When it is worse to know better? In R. J. Sternberg (Ed.), *Advances in the psychology of human intelligence* (Vol. 5, pp. 157–188). Hillsdale, NJ: Lawrence Erlbaum.

Gagné, F. (1985). Gifted and talent: Reexamining a reexamination of the definitions. *Gifted Child Quarterly, 29*, 103–112.

Gagné, F. (1999). My convictions about the nature of abilities, gifts, and talents. *Journal for the Education of the Gifted, 22*, 109–136.

Gagné, F. (2004). Transforming gifts into talents: The DMGT as a developmental model. *High Ability Studies, 15,* 119–147.

Gagné, F. (2005a). From gifts to talents: The DMGT as a developmental model. In R. J. Sternberg & J. E. Davidson (Eds.), *Conceptions of giftedness* (2 ed., pp. 98–119). Cambridge, England: Cambridge University press.

Gagné, F. (2005b). From noncompetence to exceptional talent: Exploring the range of academic achievement within and between grade levels. *Gifted Child Quarterly, 49*, 139–153.

Gallagher, J. J. (2000). Unthinkable thoughts: Education of gifted students. *Gifted Child Quarterly, 44*, 5–12.

Gallagher, J. J., & Courtright, R. D. (1986). The educational definition of giftedness and its policy implications. In R. J. Sternberg & J. E. Davidson (Eds.), *Conceptions of giftedness* (pp. 93–111). Cambridge, England: Cambridge University press.

Galton, F. (1869). *Hereditary genius: An inquiry into its laws and consequences*. London: Macmillan.

Gardner, H. (1983). *Frames of mind*. New York: Basic Books.

Gardner, H. (1993). *Creating minds*. New York: Basic Books.

Gardner, H. (1997). *Extraordinary minds: Portraits of 4 exceptional individuals and an examination of our extraordinariness*. New York: Basic Books.

Geake, J. (in press). Neuropsychological characteristics of academic and creative giftedness. In L. Shavinina (Ed.), *Handbook on Giftedness*. New York: Springer Science.

Geary, D. C. (1995). Reflections of evolution and culture in children's cognition. *American Psychologist, 50*, 24–37.

Geary, D. C. (2005). *The origin of mind: Evolution of brain, cognition, and general intelligence*. Washington, DC: American Psychological Association.

Gershwind, N., & Galaburda, A. M. (1987). *Cerebral lateralization: Biological mechanism, associations, and pathology*. Cambridge, MA: The MIT press.

Getzels, J. W., & Jackson, P. W. (1962). *Creativity and intelligence: Explorations with gifted students*. New York: Wiley.

Gottfredson, L. S. (1997). Editorial: Mainstream science on intelligence: An editorial with 52 signatories, history, and bibliography. *Intelligence, 24*, 13–24.

Gottfried, A. E., & Gottfried, A. W. (2004). Toward the development of a conceptualization of gifted motivation. *Gifted Child Quarterly, 48*, 121–132.

Gottfried, A. W., Gottfried, A. E., Cook, C. R., & Morris, P. E. (2005). Educational characteristics of adolescents with gifted academic intrinsic motivation: A longitudinal investigation from school entry through early adulthood. *Gifted Child Quarterly, 49*, 172–186.

Gottlieb, G. (1998). Normally occuring environmental and behavioral influences on gene activity: From central dogma to probabilistic epigenesis. *Psychological Review, 105*, 792–802.

Gould, S. J. (1981). *The mismeasure of man*. New York: W. W. Norton and Company.

Graham, S. (in press). Underrepresentation of minority students in gifted education. In R. F. Subotnik & D. Matthews (Eds.), *Lifespan perspectives on giftedness*.

Grant, B. A. (2002). Justifying gifted education: A critique of needs claims and a proposal. *Journal for the Education of the Gifted, 25*, 359–374.

Greenough, W. T. (1976). Enduring brain effects of differential experience and training. In M. R. Rosenzweig & E. L. Bennett (Eds.), *Neural mechanisms of learning and memory* (pp. 255–278). Cambridge, MA: The MIT press.

Grinder, R. E. (1985). The gifted in out midst: By their divine deeds, neuroses, and mental test scores we have known them. In F. D. Horowitz & M. O'Brien (Eds.), *The gifted and talented: developmental perspectives* (pp. 5–35). Washington, DC: American Psychological Association.

Gross, M. U. M. (1993). *Exceptionally gifted children*. London: Routledge.

Gruber, H. E. (1981). *Darwin on man: A psychological study of scientific creativity* (Rev. ed.). Chicago: University of Chicago press.

Gruber, H. E. (1986). The self-construction of the extraordinary. In R. J. Sternberg & J. E. Davidson (Eds.), *Conceptions of giftedness* (pp. 247–263). Cambridge, England: Cambridge University press.

Gruber, H. E. (1998). The social construction of extraordinary selves: Collaboration among unique creative people. In R. C. Friedman & K. B. Rogers (Eds.), *Talent in context: Historical and social perspectives on giftedness* (pp. 127–147). Washington, DC: American Psychological Association.

Gustafsson, J.-E., & Undheim, J. O. (1996). Individual differences in cognitive functions. In D. C. Berliner & R. C. Calfee (Eds.), *Handbook of educational psychology* (pp. 186–242). New York: Simon & Schuster Macmillan.

Haensly, P., Reynolds, C. R., & Nash, W. R. (1986). Giftedness: coalescence, context, conflict, and commitment. In R. J. Sternberg & J. E. Davidson (Eds.), *Conceptions of giftedness* (pp. 128–148). New York: Cambridge University press.

Haier, R. J. (2001). PET studies of learning and individual differences. In J. L. McClelland & R. S. Siegler (Eds.), *Mechanisms of cognitive development: Behavioral and neural perspectives* (pp. 123–145). Mahwah, NY: Lawrence Erlbaum Associates.

Haier, R. J., & Jung, R. E. (2008). Brain imaging studies of intelligence and creativity: What is the picture for education? *Roeper Review, 30*, 171–180.

Hall, V. C. (2003). Educational Psychology From 1890 to 1920. In B. J. Zimmerman & D. H. Schunk (Eds.), *Educational psychology: A century of contributions* (pp. 3–39). Mahwah, NJ: Lawrence Erlbaum Associates.

Hatano, G., & Inagaki, K. (1986). Two courses of expertise. In H. Stevenson, H. Azuma & A. Hakuta (Eds.), *Child development and educaiton in Japan*. Washington, DC: Center for Applied Linguistics.

Heinzen, T. (in press). Ilk hunting: Demons, worms, geniuses, and the search for the elusive ego-twisted computer hacker talent. In L. Shavinina (Ed.), *Handbook on Giftedness*. New York: Springer Science.

Heller, K. A., Perleth, C., & Lim, T. K. (2005). The Munich Model of Giftedness designed to identify and promote gifted students. In R. J. Sternberg & J. E. Davidson (Eds.), *Conceptions of giftedness* (2 ed., pp. 147–170). Cambridge, England: Cambridge University press.

Herrnstein, R. J., & Murray, C. (1994). *The bell curve: Intelligence and class structure in American life*. New York: Free press.

Hertzog, N. (this volume). Arbitrariness of definitions of giftedness. In L. Shavinina (Ed.), *Handbook on giftedness*. New York: Springer Science.

Hirschfeld, L. A., & Gelman, S. A. (1994). Toward a topography of mind: An introduction to domain specificity. In L. A. Hirschfeld & S. A. Gelman (Eds.), *Mapping the mind:*

Domain specificity in cognition and culture (pp. 3–35). New York: Cambridge University press.

Hofstadter, R. (1963). *Anti-intellectualism in American life*. New York: Vintage Books (A Division of Random House).

Hollingworth, L. S. (1942). *Children above 180 IQ*. New York: World Book Company.

Holton, G. (1981). Thematic presuppositions and the direction of scientific advance. In A. F. Heath (Ed.), *Scientific explanation* (pp. 1–27). Oxford, England: Clarendon press.

Horn, J. (1986). Some thoughts about intelligence. In R. J. Sternberg & D. K. Detterman (Eds.), *What is intelligence? Contemporary viewpoints on its nature and definition* (pp. 91–96). Norwood, NJ: Ablex Publishing Corporation.

Howe, M. J. A. (1997). *IQ in question: The truth about intelligence*. London: SAGE Publications.

Howe, M. J. A., Davidson, J. W., & Sloboda, J. A. (1998). Innate talents: Reality or myth? *Behavioral and Brain Sciences, 21*, 399–442.

Hunt, E. (1999). Intelligence and human resources: Past, present, and future. In P. L. Ackerman, P. C. Kyllonen & R. D. Roberts (Eds.), *Learning and individual differences: Process, traits, and content determinants* (pp. 3–28). Washington, DC: American Psychological Association.

Hunt, E. (2006). Expertise, talent, and social encouragement. In K. A. Ericsson, N. Charness, P. J. Feltovich & R. R. Hoffman (Eds.), *The cambridge handbook of expertise and expert performance* (pp. 31–38). New York: Cambridge University press.

Iran-Nejad, A., McKeachie, W. J., & Berliner, D. C. (1990). The multisource nature of learning: An introduction. *Review of Educational Research, 60*, 509–515.

Jackson, N. E., & Butterfield, E. C. (1986). The self-construction of the extraordinary. In R. J. Sternberg & J. E. Davidson (Eds.), *Conceptions of giftedness* (pp. 151–181). Cambridge, England: Cambridge University press.

Jensen, A. R. (2001). Spearman's hypothesis. In J. M. Collis & S. Messick (Eds.), *Intelligence and personality: Bridging the gap between theory and measurement* (pp. 3–24). Mahwah, NJ: Lawrence Erlbaum.

Kagan, J. (2002). *Surprise, uncertainty, and mental structures*. Cambridge, MA: Harvard University press.

Kalbfleisch, M. L. (in press). The neural plasticity of giftedness. In L. Shavinina (Ed.), *Handbook on Giftedness*. New York: Springer Science.

Kanevsky, L. (1990). Pursuing qualitative differences in the flexible use of problem-solving strategy by young children. *Journal for the Education of the Gifted, 13*, 115–140.

Kanevsky, L. (2000). Dynamic assessment of gifted students. In K. A. Heller, F. J. Monk,. J. Sternberg & R. F. Subotnik (Eds.), *International handbook of giftedness and talent* (2nd ed., pp. XX). Amsterdam: Elsevier Science Ltd.

Karmiloff-Smith, A. (1992). *Beyond modularity: A developmental perspective on cognitive science*. Cambridge, MA: MIT press.

Karmiloff-Smith, A. (2004). Bates' emergentist theory and its relevance to understanding genotype/phenotype relations. In M. Tomasello & D. I. Slobin (Eds.), *Beyond nature-nurture: Essays in honor of Elizabeth Bates* (pp. 219–236). Mahwah, NJ: Lawrence Erlbaum Associates.

Keating, D. P. (in press). Developmental Science and Giftedness: An Integrated Lifespan Model. In R. F. Subotnik & D. Matthews (Eds.), *Lifespan perspectives on giftedness*.

Kelley, T. L. (1927). *Interpretation of educational measurement*. New York: World Book.

Kemp, A. E. (1996). *The musical temperament*. Oxford, England: Oxford University press.

Kimble, G. A. (1984). Psychology's two cultures. *American Psychologist, 39*, 833–839.

Klahr, D., & Simon, H. A. (1999). Studies of scientific discovery: Complementary approaches and convergent findings. *Psychological Bulletin, 125*, 524–543.

Koch, S., & Leary, D. E. (Eds.) (1992). *A century of psychology as science*. Washington, DC: American Psychological Association.

Kuhn, T. S. (1962). *The structure of scientific revolution*. Chicago: University of Chicago press.

Kuhn, T. S. (1977). *The essential tension: Selected studies in scientic tradition and change*. Chicago: University of Chicago press.

Kunda, Z. (1990). The case for motivated reasoning. *Psychological Bulletin, 108*, 480–498.

Lakatos, I. (1978). *The methodology of scientific research programs*. Cambridge, England: Cambridge University press.

Langley, P., Simon, H. A., Bradshaw, G. L., & Zytkow, J. M. (1987). *Scientific discovery: Computational explorations of the creative process*. Cambridge, MA: MIT press.

Lehmann, A. C., & Ericsson, K. A. (1998). The historical development of domains of expertise: Performance standards and innovations in music. In A. Steptoe (Ed.), *Genius and mind* (pp. 67–94). Oxford, UK: Oxford University press.

Lippmann, W. (1976). The abuse of the tests. In N. J. Block & G. Dworkin (Eds.), *The IQ controversy* (pp. 18–20). New York: Pantheon.

Lohman, D. F. (2001). Issues in the definition and measurement of abilities. In J. M. Collis & S. Messick (Eds.), *Intelligence and personality: Bridging the gap between theory and measurement* (pp. 79–98). Mahwah, NJ: Lawrence Erlbaum.

Lohman, D. F. (2005). An aptitude perspective on talent identification: Implications for identification of academically gifted minority students. *Journal for the Education of the Gifted, 28*, 333–360.

Lohman, D. F. (2006). Beliefs about differences between ability and accomplishment: From folk theories to cognitive science. *Roeper Review, 29*, 32–40.

Lohman, D. F., & Korb, K. A. (2006). Gifted today but not tomorrow? Longitudinal changes in ability and achievement during elementary school. *Journal for the Education of the Gifted, 29*, 451–484.

Lohman, D. F., & Rocklin, T. (1995). Current and recurrent issues in the assessment of intelligence and personality. In D. H. Saklofske & M. Zeidner (Eds.), *International handbook of personality and intelligence* (pp. 447–474). New York: Plenum.

Lubinski, D. (2004). Introduction to the special section on cognitive abilities: 100 years after Spearman's (1904) "'General intelligence,' objectively determined and measured". *Journal of Personality and Social Psychology, 86*, 96–111.

Lubinski, D., & Benbow, C. P. (1992). Gender differences in abilities and preferences among the gifted. *Current Directions in Psychological Science, 1*, 61–66.

Lubinski, D., & Benbow, C. P. (2000). States of excellence. *American Pshchologist, 55*, 137–150.

Lubinski, D., & Benbow, C. P. (2006). Study of mathematically precious youth after 35 years. *Perspectives on Psychological Science, 1*, 316–345.

Lubinski, D., & Dawis, R. V. (1992). Aptitudes, skills, and proficiencies. In M. D. Dunnette & L. M. Hough (Eds.), *Handbook of Industrial/organizational psychology* (2 ed., Vol. 3, pp. 1–59). Palo Alto, CA: Consulting Psychologists press.

Lubinski, D., Webbs, R. M., Morelock, M. J., & Benbow, C. P. (2004). Top 1 in 10,000: A 10-year follow-up of the profoundly gifted. *Journal of Applied Psychology, 86*, 718–729.

Luchins, A. S., & Luchins, E. H. (1970). *Wertheimer's seminar revisited: Problem solving and thinking* (Vol. 1). Albany, NY: State University of New York press.

Lupart, J., & Toy, R. (in press). Twice-exceptional: Multiple pathways to success. In L. Shavinina (Ed.), *Handbook on Giftedness*. New York: Springer Science.

Margolin, L. (1994). *Goodness personified: The emergence of gifted children*. Hawthorne, NY: Aldine De Gruyer.

Margolin, L. (1996). A pedagogy of privilege. *Journal for the Education of the Gifted, 19*, 164–180.

Markus, H., & Nurius, P. (1986). Possible selves. *American Psychologist, 41*, 954–969.

Marland, S. P. (1972). *Education of the gifted and talented: Report to the Congress of the United States by the U.S. Commissioner of Education*. Washington, DC: Government Printing Office.

Martindale, C. (1999). Biological bases of creativity. In R. J. Sternberg (Ed.), *Handbook of creativity* (pp. 137–152). Cambridge, UK: Cambridge University press.

Matthews, D. J., & Foster, J. F. (2006). Mystery to mastery: Shifting paradigms in gifted education. *Roeper Review, 28*, 64–69.

Mayer, R. E. (2003). E. L. Thorndike's enduring contributions to educational psychology. In B. J. Zimmerman & D. H. Schunk (Eds.), *Educational psychology: A century of contributions* (pp. 113–154). Mahwah, NJ: Lawrence Erlbaum Associates.

Mayer, R. E. (2005). The scientific study of giftedness. In R. J. Sternberg & J. E. Davidson (Eds.), *Conceptions of giftedness* (2 ed., pp. 437–447). Cambridge, UK: Cambridge University press.

McCall, R. B. (1981). Nature-nurture and the two realms of development: A proposed integration with respect to mental development. *Child Development, 52*, 1–12.

McWhorter, J. (2003). *Doing our own thing: The degradation of language and music and why we should, like, care*. New York: Gotham Books.

Messick, S. (1992). Multiple intelligences or multilevel intelligence? Selective emphasis on distinctive properties of hierarchy: On Gardner's Frames of Mind and Sternberg's Beyond IQ in the context of theory and research on the structure of human abilities. *Psychological Inquiry, 3*, 365–384.

Miller, A. I. (1996). *Insights of genius: Imagery and creativity in science and art*. New York: Springer-Verlag.

Miller, L. K. (2005). What the savant syndrome can tell us about the nature and nurture of talent. *Journal for the Education of the Gifted, 28*, 361–373.

Mönks, F. J., & Mason, E. J. (1993). Developmental theories and giftedness. In K. A. Heller, F. J. Mönk & A. H. Passow (Eds.), *International handbook of research and development of giftedness and talent* (pp. 89–101). Oxford, England: Pergamon.

Moran, S., & John-Steiner, V. (2003). Creativity in the making: Vygotsky's contemporary contribution to the dialectic of development and creativity. In R. K. Sawyer, V. John-Steiner, S. Moran, R. J. Sternberg, D. H. Feldman, J. Nakamura & M. Csikszentmihayi (Eds.), *Creativity and development* (pp. 61–90). Oxford, England: Oxford University press.

Morelock, M. J. (1996). On the nature of giftedness and talent: Imposing order on chaos. *Roeper Review, 19*, 4–12.

Morelock, M. J. (2000). A sociohistorical perspective on exceptionally high-IQ children. In R. C. Friedman & B. M. Shore (Eds.), *Talents unfolding: Cognition and development* (pp. 55–75). Washington, DC: American Psychological Association.

Muthén, B., & Muthén, L. K. (2000). Integrating person-centered and variable-centered analyses: Growth mixture modeling with latent trajectory classes. *Alcoholism: Clinical & Experimental Research, 24*, 882–891.

Neisser, U., Boodoo, G., Bouchard, T. J., Boykin, A. W., Brody, N., Ceci, S. J., et al. (1996). Intelligence: Knowns and unknowns. *American Psychologist, 51*, 77–101.

Nelson, C. A. (2000). *From neurons to neighborhood*. Washington, DC: National Academic press.

Newell, A., & Simon, H. A. (1972). *Human problem solving*. Englewood Cliffs, NJ: Prentice-Hall.

Novick, M. R. (1982). Educational testing: Inferences in relevant subpopulations. *Educational Researcher, 11*, 4–10.

O'Boyle, M. W. (2008). Mathematically gifted children: Developmental brain characteristics and their prognosis for well-being. *Roeper Review, 30*, 181–186.

O'Boyle, M. W., Benbow, C. P., & Alexander, J. E. (1995). Sex differences, hemispheric laterality, and associated brain activity in the intellectual gifted. *Developmental Neuropsychology, 11*, 415–443.

Overtone, W. F. (1984). World views and their influence on psychological theory and research: Kuhn-Lakatos-Laudan. In H. W. Reese (Ed.), *Advances in child development and behavior* (Vol. 18, pp. 191–226). Orlando, FL: Academic press.

Papierno, P. B., Ceci, S. J., Makel, M. C., & Williams, W. W. (2005). The nature and nurture of talent: A bioecological perspective on the ontogeny of exceptional abilities. *Journal for the Education of the Gifted, 28*, 312–331.

Passow, A. H. (1981). The nature of giftedness and talent. *Gifted Child Quarterly, 25*, 5–10.

Perkins, D., & Ritchhart, R. (2004). When is good thinking. In D. Y. Dai & R. J. Sternberg (Eds.), *Motivation, emotion, and cognition: Integrative perspectives on intellectual functioning and development* (pp. 351–384). Mahwah, NJ: Lawrence Erlbaum.

Phillips, D., & Burbules, N. (2000). *Postpositivism and educational research*. Lanham, MD: Rowman & Littlefield.

Piaget, J. (1972). *Psychology and epistemology: Toward a theory of knowledge*. Harmondsworth, England: Penguin.

Piechowski, M. M. (1991). Emotional development and emotional giftedness. In N. Colangelo & G. A. Davis (Eds.), *Handbook of gifted education* (pp. 285–306). Boston: Allyn and Bacon.

Piirto, J. (1994). *Talented children and adults: Their development and education*. New York: Macmillan.

Renzulli, J. S. (1977). *The enrichment triad model: A guide for developing defensive programs for the gifted*

and talented. Mansfield Center, CT: Creative Learning press.

Renzulli, J. S. (1978). what makes giftedness? Re-examining a definition. *Phi Delta Kappan, 60*, 180–184, 261.

Renzulli, J. S. (1986). The three-ring conception of giftedness: A developmental model for creative productivity. In R. J. Sternberg & J. E. Davidson (Eds.), *Conceptions of giftedness* (pp. 53–92). Cambridge. England: Cambridge University press.

Renzulli, J. S. (1994). *Schools for talent development: A practical plan for tatal school improvement*. Mansfield Center, CT: Creative Learning press.

Renzulli, J. S. (1999). What is this thing called giftedness, and how do we develop it? A twenty-five year perspective. *Journal for the Education of the Gifted, 23*, 3–54.

Renzulli, J. S. (2002). Expanding the conception of giftedness to include co-cognitive traits and to promote social capital. *Phi Delta Kappan*(Sept.), 33–58.

Renzulli, J. S., & Reis, S. M. (1991). The reform movement and the quiet crisis in gifted education. *Gifted Child Quarterly, 35*, 26–35.

Renzulli, J. S., & Reis, S. M. (1997). *Schoolwide enrichment model: A how-to guide for educational excellence*. Mansfield Center, CT: Creative Learning press.

Robinson, A., & Clinkenbeard, P. R. (1998). Giftedness: An exceptionality examined. *Annual Review of Psychology, 49*, 117–139.

Robinson, N. M. (2005). In defense of a psychometric approach to the definition of academic giftedness: A conservative view from a die-hard liberal. In R. J. Sternberg & J. E. Davidson (Eds.), *Conceptions of giftedness* (2 ed., pp. 280–294). Cambridge, England: Cambridge University press.

Robinson, N. M., Zigler, E., & Gallagher, J. J. (2000). Two tails of the normal curve: Similarities and differences in the study of mental retardation and giftedness. *American Psychologist, 55*, 1413–1424.

Root-Bernstein, R. (in press). Multiple giftedness: The case of polymaths. In L. Shavinina (Ed.), *Handbook on Giftedness*. New York: Springer Science.

Rothenberg, A. (1979). *The emerging goddess*. Chicago: University of Chicago press.

Runco, M. A. (1994). Creativity and its discontents. In M. P. Shaw & M. A. Runco (Eds.), *Creativity and affect* (pp. 102–123). Norwood, NJ: Ablex Publishing Corporation.

Sawyer, R. K. (2002). Emergence in psychology: Lessons from the history of non-reductionist science. *Human Development, 45*, 2–28.

Sawyer, R. K. (2003). Emergence in creativity and development. In R. K. Sawyer, V. John-Steiner, S. Moran, R. J. Sternberg, D. H. Feldman, J. Nakamura & M. Csikszentmihayi (Eds.), *Creativity and development* (pp. 12–60). Oxford, UK: Oxford University press.

Sapon-Shevin, M. (1994). *Playing favorittes: Gifted education and the disruption of community*. Albany, NY: State University of New York press.

Sapon-Shevin, M. (1996). Beyond gifted education: Building a shared agenda for school reform. *Journal for the Education of the Gifted, 19*, 194–214.

Scarr, S. (1997). Behavior-genetic and socialization theories of intelligence: Truce and reconcilation. In R. J. Sternberg & E. L. Grigorenko (Eds.), *Intelligence, heredity, and environment* (pp. 3–41). New York: Cambridge University press.

Schlaug, G. (2001). The brain of musicians: A model for functional and structural adaptation. In R. J. Zatorre & I. Peretz (Eds.), *The biological foundations of music (Annals of the New York Academy Sciences)* (Vol. 930, pp. 281–299). New York: New York Academy of Sciences.

Schneider, W. (2000). Giftedness, expertise, and (exceptional) performance: A developmental perspective. In K. A. Heller, F. J. Monk, R. J. Sternberg & R. F. Subotnik (Eds.), *International handbook of giftedness and talent* (2nd ed., pp. 165–177). Amsterdam: Elsevier Science Ltd.

Schoenfeld, A. H. (1992). Learning to think mathematically: Problem solving, metacognition, and sense-making in mathematics. In D. A. Grouws (Ed.), *Handbook of research on mathematics teaching and learning*. New York: Macmillam.

Schwartz, D. L., Bransford, J. D., & Sears, D. (in press). Efficiency and innovation in transfer. In J. Mestre (Ed.), *Transfer of learning: Research and perspectives*. Greenwich, CT: Information Age Publishing.

Searle, J. R. (1990). Is the brain's mind a computer program? *Scientific American, January*, 26–37.

Searle, J., R. (2002). *Consciousness and language*. Cambridge, UK: Cambridge University press.

Searle, J., R. (2004). *Mind: A brief introduction*. New York: Oxford University press.

Shavinina, L. (1999). The psychological essence of the child prodigy phenomenon: Sensitive periods and cognitive experience. *Gifted Child Quarterly, 43*, 25–38.

Shavinina, L. (2004). Explaining high abilities of Nobel laureates. *High Ability Studies, 15*, 243–254.

Shavinina, L. V., & Kholodnaja, M. A. (1996). The cognitive experience as a psychological basis of intellectual giftedness. *Journal for the Education of the Gifted, 20*, 3–25.

Shavinina, L. V., & Seeratan, K. L. (2004). Extracognitive phenomena in the intellectual functioning of gifted, creative, and talented individuals. In L. V. Shavinina & M. Ferrari (Eds.), *Beyond knowledge: Extracognitive aspects of developing high ability* (pp. 73–102). Mahwah, NJ: Lawrence Erlbaum.

Shiffrin, R. M. (1996). Laboratory experimentation on the genesis of expertise. In K. A. Ericsson (Ed.), (pp. 337–345). Mahwah, NJ: Lawrence Erlbaum Associates.

Shore, B. M. (2000). Metacognition and flexibility: Qualitative differences in how gifted children think. In R. C. Friedman & B. M. Shore (Eds.), *Talents unfolding: Cognition and development* (pp. 167–187). Washington, DC: American Psychological Association.

Shore, B. (this volume). Metacognition in gifted and talented individuals. In L. Shavinina (Ed.), *Handbook on Giftedness*. New York: Springer Science.

Shore, B. M., & Delcourt, M. A. B. (1996). Effective curricular and program practices in gifted education and the interface with general education. *Journal for the Education of the Gifted, 20*, 138–154.

Shaw, P., Greenstein, D., Lerch, J., Clasen, L., Lenroot, R., Gogtay, N., et al. (2006). Intellectual ability and cortical development in children and adolescents. *Nature, 440/30*, 676–679.

Siegler, R. S. (1996). *Emerging minds: The process of change in children's thinking*. New York: Oxford University press.

Siegler, R. S., & Kotovsky, K. (1986). Two levels of giftedness: Shall even the twain meet. In R. J. Sternberg & J. E. Davidson

(Eds.), *Conceptions of giftedness* (pp. 417–435). Cambridge, UK: Cambridge University press.

Silverstein, A. (1988). An Aristotelian resolution of the idiographic versus nomothetic tension. *American Psychologist, 43*, 425–430.

Simmonton, D. K. (1996). Creative expertise: A life-span developmental perspective. In K. A. Ericsson (Ed.), *The road to excellence* (pp. 227–253). Mahwah, NJ: Lawrence Erlbaum Associates.

Simonton, D. K. (1997). Creative productivity: A predictive and explanatory model of career trajectories and landmarks. *Psychological Review, 104*, 66–89.

Simonton, D. K. (1999). Talent and its development: An emergenic and epigenetic model. *Psychological Review, 3*, 435–457.

Simonton, D. S. (2002). *Great psychologists and their times: Scientific insights into psychology's history*. Washington, DC: American Psychological Association.

Simonton, D. K. (2003). Scientific creativity as constrained stochastic behavior: The integration of product, person, and process perspectives. *Psychological Bulletin, 129*, 475–494.

Simonton, D. K. (2005). Giftedness and genetics: The emergenic-epigenetic model and its implications. *Journal for the Education of the Gifted, 28*, 270–286.

Snow, C. P. (1967). *The two cultures and a second look*. London: Cambridge University press.

Snow, R. E. (1992). Aptitude theory: Yesterday, today, and tomorrow. *Educational Psychologist, 27*, 5–32.

Snow, R. E. (1994). Aptitude development and talent achievement. In N. Colangelo, S. C. Assouline & D. L. Ambroson (Eds.), *Talent development* (Vol. 2, pp. 101–120). Dayton, OH: Ohio Psychology press.

Snow, R. E. (1995). Foreword. In D. H. Saklofske & M. Zeidner (Eds.), *International handbook of personality and intelligence* (pp. xi-xv). New York: Plenum.

Soniak, L. A. (2006). Retrospective interviews in the study of expertise and expert performance. In K. A. Ericsson, N. Charness, P. J. Feltovich & R. R. Hoffman (Eds.), *The cambridge handbook of expertise and expert performance* (pp. 287–301). New York: Cambridge University press.

Spearman, C. (1904). "General intelligence," objectively determined and measured. *American Journal of Psychology, 15*, 201–292.

Stanley, J. C. (1996). In the beginning: The Study of Mathematically Precocious Youth. In C. P. Benbow & D. Lubinski (Eds.), *Intellectual talent* (pp. 225–235). Baltimore: The Johns Hopkins University press.

Stanley, J. (1997). Varieties of intellectual talent. *Journal of Creative Behavior, 31*, 93–119.

Stanovich, K. E. (1999). *Who is rational? Studies of individual differences in reasoning*. Mahwah, NJ: Lawrence Erlbaum.

Stanovich, K. E., & West, R. F. (1997). Reasoning independently of prior belief and individual differences in actively open-minded thinking. *Journal of Educational Psychology, 89*, 342–357.

Steiner, H. H., & Carr, M. (2003). Cognitive development in gifted children: Toward a more precise understanding of emergent differences in intelligence. *Educational Psychology Review, 15*, 215–246.

Sternberg, R. J. (1985). *Beyond IQ: A triarchic theory of human intelligence*. Cambridge, England: Cambridge University press.

Sternberg, R. J. (1995). *A thriarchic approach to giftedness* (Research Monograph 95126). Storrs, CT: The National Research Center on the Gifted and Talented.

Sternberg, R. J. (1996). *Successful intelligence*. New York: Simon & Schuster.

Sternberg, R. J. (1999a). Intelligence as developing expertise. *Contemporary Educational Psychology, 24*, 359–375.

Sternberg, R. J. (1999b). A propulsion model of types of creative contributions. *Review of General Psychology, 3*, 83–100.

Sternberg, R. J. (2000). The concept of intelligence. In R. J. Sternberg (Ed.), *Handbook of intelligence* (pp. 3–15). Cambridge, UK: Cambridge University press.

Sternberg, R. J. (2007). Cultural concepts of giftedness. *Roeper Review, 29*, 160–165.

Sternberg, R. J., & Davidson, J. E. (1986). Conceptions of giftedness: A map of the terrain. In R. J. Sternberg & J. E. Davidson (Eds.), *Conceptions of giftedness* (pp. 3–18). Cambridge, England: Cambridge University press.

Sternberg, R. J., Grigorenko, E. L., & Singer, J. L. (Eds.) (2004). *Creativity: From potential to realization*. Washington, DC: Amreican Psychological Association.

Subotnik, R. F. (2003). A developmental view of giftedness: From being to doing. *Roeper Review, 26*, 14–15.

Subotnik, R. F. (2006). Longitudinal studies: Answering our most important questions of prediction and effectiveness. *Journal for the Education of the Gifted, 29*, 379–383.

Subotnik, R. F., & Jarvin, L. (2005). Beyond expertise: Conceptions of giftedness as great performance. In R. J. Sternberg & J. E. Davidson (Eds.), *Conceptions of giftedness* (2 ed., pp. 343–357). Cambridge, England: Cambridge University press.

Subotnik, R. F., & Olszewski-Kubilius, P. (1998). Distinctions between children's and adults' experiences of giftedness. *Peabody Journal of Education*.

Tannenbaum, A. J. (1983). *Gifted children: Psychological and educational perspectives*. New York: Macmillan.

Tannenbaum, A. J. (1997). The meaning and making of giftedness. In N. Colangelo & G. A. Davis (Eds.), *Handbook of gifted education* (2 ed., pp. 27–42). Boston, MA.

Tannenbaum, A. J. (1998). Programs for the gifted: To be or not to be. *Journal for the Education of the Gifted, 22*, 3–36.

Terman, L. M. (1925). *Genetic studies of genius: Vol. 1, Mental and physical traits of a thousand gifted children*. Standford, CA: Stanford University press.

Terman, L. M., & Oden, M. H. (1959). *Genetic studies of genius: The gifted group at mid-life*. Stanford, CA: Stanford University press.

Thomson, G. H. (1916). A hierarchy without a general factor. *British Journal of Psychology, 8*, 271–281.

Tocqueville, A. (1835/2004). *Democracy in America*. Washintong, DC: Library of Congress.

Tomasello, M., & Slobin, D. I. (Eds.) (2004). *Beyond nature-nurture: Essays in honor of Elizabath Bates*. Mahwah, NJ: Lawrence Erlbaum Associates.

Tomlinson, C. A. (1996). Good teaching for one and all: Does gifted education have an instructional identity? *Journal for the Education of the Gifted, 20*, 155–174.

Toulmin, S. (1972). *Human understanding* (Vol. 1). Princeton, NJ: Princeton University press.

Treffinger, D. S., & Feldhusen, J. F. (1996). Talent recognition and development: Successor to gifted education. *Journal for the Education of the gifted, 19*, 181–193.

Turkheimer, E., Haley, A., Waldron, M., D'Onofrio, & Gottesman, I. I. (2003). Socioeconomic status modifies heritability of IQ in young children. *Psychological Science, 14*, 623–628.

Vandervert, L. R., & Liu, H. (in press). Neurological bases of individual differences in giftedness. In L. Shavinina (Ed.), *Handbook on Giftedness*. New York: Springer Science.Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Cambridge, MA: Harvard University press.

von Károlyi, C., & Winner, E. (2005). Extreme giftedness. In R. J. Sternberg & J. E. Davidson (Eds.), *Conceptions of giftedness* (2 ed., pp. 377–394). Cambridge, England: Cambridge University press.

Weisberg, R. W. (1999). Creativity and knowledge: A challenge to theories. In R. J. Sternberg (Ed.), *Handbook of creativity* (pp. 226–250). Cambridge, UK: Cambridge University press.

Weisberg, R. W. (2006). Modes of expertise in creative thinking: Evidence from case studies. In K. A. Ericsson, N. Charness, P. J. Feltovich & R. R. Hoffman (Eds.), *The Cambridge handbook of expertise and expert performance* (pp. 761–787). New York: Cambridge University press.

Wineburg, S. S. (1991). Historical problem solving: A study of the cognitive process used in the evaluation of documentary and pictorial evidence. *Journal of Educational Psychology, 83*, 73–87.

Winner, E. (1996). *Gifted children*. New York: Basic Books.

Winner, E. (1997). Exceptionally high intelligence and schooling. *American Pshchologist, 52*, 1070–1081.

Winner, E. (2000). The origins and ends of giftedness. *American Pshchologist, 55*, 159–169.

Witty, P. A. (1958). Who are the gifted? . In N. B. Henry (Ed.), *Education of the gifted. 57th Yearbook of the National Society for the Study of Education, Part 2*. Chicago: University of Chicago.

Ziegler, A. (2005). The Actiotope Model of giftedness. In R. J. Sternberg & J. E. Davidson (Eds.), *Conceptions of giftedness* (2 ed., pp. 411–436). Cambridge, England: Cambridge University press.

Ziegler, A., & Heller, K. A. (2000). Conceptions of giftedness from a meta-theoretical perspective. In K. A. Heller, F. J. Monk, R. J. Sternberg & R. F. Subotnik (Eds.), *International handbook of giftedness and talent* (2nd ed., pp. 3–21). Amsterdam: Elsevier Science Ltd.

Zuckerman, H. (1983). The scientific elite: Nobel laureates' mutual influences. In R. S. Albert (Ed.), *Genius and eminence: The social psychology of creativity and exceptional achievement* (pp. 241–252). Oxford, UK: Pergamon press.