INTRODUCTION

Rationale, Goals, and Overview of the Book

> A devil, a born devil, on whose nature, nurture can never stick.
> William Shakespeare, *The Tempest*

The past 500 years or so of human accomplishments, let alone the more recent breakthroughs in science and technology in our creative economy, have been unparalleled in human history, surpassing all prior human accomplishments combined, at least from an economic and technological point of view. Without the Renaissance, the Scientific Revolution, and the Industrial Revolution, and without Galileo, Da Vinci, Newton, Walt, and Einstein, there would be no modern civilization as we know it today. Without Locke and Montesquieu, we would not have modern political systems. Without Kant and Wittgenstein, or Freud and Piaget, our self-understandings would be much limited. Without Mozart and Chopin, or Monet and Picasso, an essential piece of our aesthetic sense and sensibility would be missing. Who were those history-making geniuses and how did they become the people we know them to have been? Questions about genius have been the preoccupation of Dean Keith Simonton, a renowned psychologist who has spent his entire career deciphering these secrets (Simonton, 2021).

However, Jared Diamond, a biologist known worldwide for his book *Guns, Germs, and Steel*, is not convinced that a "great man theory" can carry any weight in explaining structural changes on a large timescale of history; for him, historical changes are more likely due to the necessity of surviving–thriving pressure in a larger social-historical context, and thus cannot be explained by the extraordinary achievements of a few great men and women. How about the numerous instances of less stellar but nonetheless impressive human achievements in a wide range of academic, artistic, professional, technical, athletic, and entrepreneurial endeavors? Such talents have become so abundant in our contemporary society that

Richard Florida (2002), an economist interested in urban creative productivity, has characterized it as the emergence of a new *creative class*. Are they also a "select few," destined to rise to the elite positions in society, or is it their choices and hard work, as well as social and cultural support and their many privileges, that allow them go so far?

How about those who are identified as "gifted and talented" in their school years? Do they warrant the labels granted to them during their childhood or adolescence? Can we identify the gifted and talented at a young age at all for educational and talent development purposes? All these questions depend on our understanding of the nature and nurture of talent, or whether talent development is contingent on a preexisting condition called giftedness or "natural talent." Alternatively, is it mainly by deep engagement and extended deliberate practice, with pedagogical and technical support, that we develop our talent to full fruition?

Human excellence is commonly viewed as any outstanding achievement that is culturally celebrated and promoted, though what kinds of achievement are celebrated can vary from culture to culture. Talent development is the means to the end of human excellence either by collective cultural standards or by individual personal standards (e.g., "surpassing oneself," regardless of comparative standings). In this context, *human excellence represents a cultural value shared by a group of individuals, often associated with a personal vision of creating and maintaining a productive, fulfilling life, rather than merely the finite goal of social or material success*. However, it still begs the question of whether some individuals are more talented and should have privileged access to opportunities for talent development, and whether there is a wide variety of talent trajectories and pathways for equal access and self-selection, some of which better suit one's niche potential and valence than others. A social policy question like this also depends on a good (often nuanced, rather than black-and-white) understanding of the nature–nurture issue.

A Glimpse at History regarding the Nature–Nurture Question

A deeply entrenched view of natural endowment as the ultimate explanation of human accomplishments started with Francis Galton (1869) and continued into the twentieth century, fueled by social Darwinism, from the *cognitive elite* argument made in the book *The bell curve* (Hernnstein & Murray, 1994) to behavioral and molecular genetics research that attempts to track down the genetic roots of intelligence and talent, levels of education, and social success (Belsky et al., 2016). The reification of talent as an

innate entity or capacity is criticized by popular media (Coyle, 2004) as well as scholars (Howe et al., 1998), yet what is offered as an alternative account, be it *deliberate practice* (Ericsson, 2006) or *social inequality* (Berliner & Biddle, 1995), does not address the issue of *self-selection effects* (Sternberg, 1996) in the form of selective affinity and selective participation in the midst of many choices and offerings (Dai & Renzulli, 2008). Theorizing the development of talent and expertise as starting with environmental experiences and proximal mediating processes, from Simon (1969) to Ericsson (2006), is not without criticism. Critiques of the expertise performance perspective (Ericsson et al., 2007; Weisberg, 2006) have looked at the contributions of a range of individual differences and contextual factors beyond merely "deliberate practice" (Ullén et al., 2016; Hambrick et al., 2018), pointing to a more complex picture of talent development wherein the role of "nature" cannot be ignored.

There are epistemological barriers to reconciliation and integration between the pro-nature and pro-nurture camps in research (see Ericsson et al., 2007; Gagné, 2009). To support the pro-nature, "heritability" argument, behavioral genetics researchers have attempted to partition or decompose the variations of human achievement into environmental and genetic factors in a reductive manner, oversimplifying (or, some may argue, distorting) the functional role of heredity and the environment as additive, obscuring the complex nature–nurture interaction. Molecular genetics research now uses the "polygenic score" or index, presumably a better way of estimating the heritability (Harden, 2021).

However, such an atheoretical search for a very remote cause (i.e., genes) is not very promising. As Anastasi (1958) argued a long time ago, rather than seeking to discover how much of the variance is attributable to heredity and how much to environment, "a more fruitful approach is to be found in the question of 'How?'" (1958, p. 197). Horowitz (2000) argued forcefully that such *variance partitioning* does not produce any insight as to how nature and nurture work together as part of a developmental system, with its emergent properties and higher levels of developmental organization.

At the deep level of this nature–nurture schism is the *Cartesian split*, a reductive effort to break things down to more basic units – body and mind, subjective and objective, and internal and external (Overton, 2014) – which is prone to favor component-dominant models, and even the nature–nurture dichotomous thinking (Dai, 2012), forgetting that the nature of developmental systems is fundamentally relational and interactive (Overton, 2014; Hilpert & Marchand, 2018). Unless we foreground

what happens to the developing person, and the what, how, when, and where of developmental processes and changes (i.e., seeking developmental specificity; see Dai, 2023), we will continue to make the same mistake as the blind men in the famous allegory describing the appearance of an elephant based on the parts of it they have touched. It is my contention that only by delineating a theory of talent development analogous to Darwin's "one long argument" about the evolution of species can we truly settle the nature–nurture debate once and for all.

Three Phases of Theoretical Development Regarding Nature and Nurture

Dewey and Bentley (1949) delineated the progressive development of a theory regarding nature and nurture. In the first phase of *self-action*, components (nature or nurture) are considered as behaving under their own power. Thus, genetically based characteristics and various environmental forces exert their respective agency and have their own additive contributions. The issue becomes that of which is more dominant and important. In the second phase of *nature–nurture interaction*, components are regarded as causally acting upon each other, leading to (a) *reciprocal effects*, whereby they are mutually reinforcing, and (b) *interaction effects*, whereby the combination of unique endogenous and exogenous elements produce a combustion effect, as it were, that neither alone would produce. Finally, in the third phase of *transactional processes*, components are seen as parts of a relational developmental system. In this sense, the *being* (e.g., genetic effects and traits) depends on nurturing conditions epigenetically and can manifest itself only through *doing*.

To use the metaphor of *Neurath's boat* (Neurath, 1983), early talent development models identified many well-defined pieces that make the boat (talent). However, these pieces have yet to be assembled and put to functional use to make a boat as a floating device on the sea (making talent components situated and functional). Although some models of talent development (e.g., Gagné, 1985, 2005) propose components (e.g., intrapersonal and environmental catalysts) to make the boat functional and enable it to float, it took another generation of scholars to point out the flaws of component models and theories (see Ziegler & Phillipson, 2012 for a critique). A systems view of how a boat (talent) functions is needed to explicate the nature of the dynamic interaction of components vis-à-vis task demands and social conditions. Over time, biological, psychological, and sociocultural aspects of talent development, like different structural

components of the Neurath's boat of talent, can be gradually integrated into a developmental systems theory of how humans develop their talent and achieve their ambitions. This is what this book attempts to accomplish.

Volcano versus River: Essentialist versus Developmentalist Models of Talent Development

More than ten years ago, in my book *The nature and nurture of giftedness* (Dai, 2010), I identified two dominant ways in which scholars and researchers conceptualized human potential for great achievements. One is the essentialist construal of human potential, viewing human potential as having a strong genetic basis, working like an innate capacity, either domain-specific or domain-general. The other is the developmentalist construal, viewing human potential not as a fixed capacity but as dynamically interacting with opportunities and challenges, affordances and constraints; how far one can go is not a function of one's capacity, but related to supporting tools, resources, and social support. More recently, I used the metaphors of volcano and river to illustrate these two competing models (Dai, 2021). The volcano metaphor implies a core capacity of human potential, *erupting*, as it were, under internal and external pressures (Gagne's "intrapersonal and environmental catalysts"). The river metaphor, in contrast, is seamless, a process of a stream contextually taking shape and becoming a river (with larger capacity) and eventually reaching its destination. The river metaphor fits better than that of the volcano with the contextual, dynamic, and emergent nature of human potential (Dai & Renzulli, 2008). It reveals the principle of *emergence* and developmental self-organization, which is probabilistic and indeterminate but principled (Kelso, 2000; Lewis, 2000).

Metaphors are always flawed; human living systems are not made of water molecules but have their own agency and design. Thus, a relational human developmental system is an agent-based dynamic system. *Evolving individuality*, from biology to culture, vastly neglected as a source of human potential, looms larger in my thinking, and eventually becomes a main theoretical argument presented in this book. This way, characteristic and maximal adaptation to the affordances and constraints of tasks and social environments is treated not merely as a technical issue of overcoming cognitive constraints or developing proficiency (Ericsson & Lehmann, 1996), but as building personal connections with the world that have developmental consequences.

The tension I have identified all along between the essentialist and developmentalist construal of human potential also reflects my qualms about the notion of a society stratified by intelligence quota (IQ) (see *The bell curve* by Herrnstein & Murray, 1994), based on a monolithic view of human potential. It contributes to my growing conviction that the essentialist idea of high potential, especially as a fixed capacity, is problematic and ill-informed (see the discussion of the *reaction range* versus the norms-of-reaction version of genetic effects in the ensuing chapters). I was convinced that *high human potential is pluralistic rather than monolithic, dynamic rather than static* (a fixed capacity, like the hardware of a computer), and *epigenetically shaped rather than preordained*. This is not to deny the existence of geniuses. Rather, it is my argument that even geniuses like Einstein or Mozart needed talent development opportunities and extended deep engagement with physics or music to build up their respective "programs"; in short, their accomplishments cannot be reduced to the superiority of their neural substrates (e.g., the brain structure) and genetic makeup.

My growing conviction was, of course, crystalized in the wake of the highly influential work of Csikszentmihalyi, Ericsson, Gagné, Gardner, Simonton, and Sternberg, among others. I was also a diligent follower of Abe Tannenbaum's thoughts in the field of gifted and talented studies. His psychosocial theory of talent (Tannenbaum, 1983, 1986; see Kanevsky, 2020) lays a solid foundation for much of what I have been working on for the past two decades. In the meantime, I have been working with Joe Renzulli, my mentor, colleague, and friend, for many years; his wisdom has had an enduring impact on me personally as well as intellectually. What I am reporting in this book, the evolving complexity theory (ECT) of talent development, is the result of more than a decade of searching for (and researching) a broader psychosocial basis of human potential, an effort to resolve and go beyond the nature–nurture conundrum and to embrace a more pluralistic, contextual, and dynamic vision of cultivating human potential and developmental possibilities for the sake of human excellence (see Dai, 2012, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022).

To use the metaphor of Neurath's boat for theory-building, we have to work at the cutting edge of our knowledge to reconstruct a functional boat of talent development theory, albeit with many unknowns ahead of us. To use Neurath's words, "we are like sailors who have to rebuild their ship on the open sea, without ever being able to dismantle it in dry-dock and reconstruct it from its best components" (Neurath, 1983, p. 92). At a systemic level, our knowledge-building will inevitably become

constructivist rather than *positivist* in the sense that a theory is a conceptual edifice created by humans (like the design of a boat) to better understand a class of phenomena, which can never be made in a piecemeal, mechanical fashion by the compiling hundreds and thousands of linear, one-to-one empirical links of isolated "variables" built with the assumption of "all other things being equal" (*ceteris paribus*), which would at best gives us a fragmented description of a myriad of components of a boat (or a human functioning system), and at worst distort what a functional boat (or human functioning system) looks like.

An Overview of What Is Coming Up in the Book

Chapter 1 provides an introduction to the evolving complexity theory (ECT) of talent development (TD), a new theory that adopts a relational developmental systems perspective on how talent is nurtured and human excellence is achieved. It charts various pathways to excellence by specifying *what* develops, *how* the process is regulated, *when* certain developmental events should take place, and *where* social-historical conditions can either constrain or empower TD. *Evolving complexity refers to the nature of TD as encompassing biological, experiential, cognitive, and sociocultural aspects of developmental self-organization, resulting in distinct individuality, of which specific talent achievement is a manifestation*. In this sense, ECT distinguishes itself from other TD models in its emphasis on the primacy of action/interaction, and the nature of TD as adaptation to task affordances and constraints. ECT adheres to three principles: probabilistic epigenesis (Gottlieb, 1998), proximal processes (Bronfenbrenner & Ceci, 1994), and self-organization of the system toward higher-order coherence (Lewis, 2000). ECT also views TD as the means to an end of creating a productive, fulfilling life, with many developmental niches and pathways to human excellence within and across domains.

Chapter 2 addresses the question of *what develops*; the main argument of ECT is that most talent domains as defined by culture are not genetically programmed or preordained; however, most human accomplishments or excellence as we know of are traceable to the ancient, even prehistoric roots when *Homo sapiens* were still living a hunting-and-gathering life. Therefore, any talent we are familiar with can be seen as a new machine made of "old parts" ever-present in prehistoric times and everyday life. The old parts refer to a set of bioecological effectivities that have a long history of serving the surviving–thriving function in human ecology. They are gradually harnessed and further refined through enculturation and

institutionalized education and training, and supported by cultural niche construction and infrastructure (e.g., guilds and professional communities). Here lies a critical distinction between *typical development* in an expectant cultural environment and *optimal development* in a highly enriched one (Fischer & Pipp, 1984), potentially resulting in Matthew effects and social disparities. Along the way, evidence of developmental diversity and divergent pathways suggests spontaneous self-organization of bioecological aptitudes and dispositions in adapting to affordances and challenges presented in a sociocultural environment, laying the foundation the growing person–object or person–world relationships.

Chapter 3 addresses the question of *how TD takes place*. The main argument is that two driving forces emerge as individuals move from early spontaneous actions and reactions to environmental opportunities and challenges to more purposive real and projected actions. One driving force emerging in a personal context of surviving–thriving adaptation is individual niche-picking, which influences the direction and strengths of personal strivings; the other driving force is *cultural selection* based on cultural norms and distinction, which determines what is culturally worth supporting given cultural priorities (e.g., sports versus academics). These two "invisible hands" jointly regulate one's *characteristic adaptation* (CA) in the exploratory stage of talent development, and *maximal adaptation* (MA) in the systematic developmental stage (Dai et al., 2015). Both CA and MA are seen by ECT as two self-organizing motivational forces for long-term development (Fischer & Connell, 2003). CA allows the person to explore their horizon of life possibilities and identify a pathway to success that is most rewarding as well as achievable, and MA allows the person to seek inner and outer resources to maximize their chance of success. Consequently, a developing person has to show patterns of CA and MA conducive to reaching the highest level of self-organization: *building a personal enterprise*.

Chapter 4 addresses the question of *when certain events of TD have to take place* for a viable line of the pursuit of excellence. ECT views the life cycle of a person as significantly constraining the timing of developmental events and processes for achieving any long-term goals. Where human excellence is concerned, social conventions and cultural provisions further constrain what should be done and *when* it must be done. In other words, *developmental corridors* can be opened and closed at specific developmental junctures that determine the best timing for engagement in specific endeavors that might have a better chance of success. Based on research evidence, ECT postulates two main concepts: (a) *developmental windows*,

which vary from domain to domain, closing certain developmental corridors and pathways (e.g., to become a musician) but opening others (e.g., to become a biologist) for the exploratory stage, and (b) *developmental progressions*, which stipulate a temporal sequence of milestone events and critical transitions that have to take place to sustain TD. Finally, distinct Matthew effects, the cumulative advantage prevalent in TD, are explained over this TD course in terms of accelerated development as well as individual strengths, social recognition, and privileged access to opportunities and resources.

Chapter 5 looks at talent development and human excellence among broader social-historical conditions and changes. The flourishing of particular forms of excellence in a given historical period or culture is always distinct, due to both cultural values and priorities as well as societal changes in opportunity structure, leisure, and conditions of education. If human excellence reflects high-level self-organized individuality, then sociocultural contexts matter; *if sociocultural contexts provide a set of conditions and constraints, evolving individuality in such contexts can provide human agency in changing the world and history, not by traits and genes, albeit acknowledging their supporting role, but by cultural evolution that leverages characteristic and maximal adaptation*. However, sociocultural conditions (including available technology) also significantly constrain where individual strivings are heading as well as how far individuals can go, and the Needham Puzzle on the birth of modern science (why it occurred in the West, not China) is discussed in this light. The comparison of Da Vinci and Wang Yangming is made to demonstrate that any creative act is a *sociocultural act*, which can change history yet is constrained by one's times.

If Chapter 5 helps delineate how macro-level cultural evolution in human history explains micro-level changes in terms of individual developmental self-organization (i.e., evolving individuality), eventually leading to various forms, ways, and levels of human excellence, Chapter 6, based on bioecological effectivity, cultural complexity, and evolving individuality, develops a conceptual framework of levels of talent achievement that can explain a myriad of phenomena of talent achievement. Five levels are identified (modular talents, precocious masters, consummated masters, unrelenting innovators, and game-changers). Central to this framework is the distinction between *masters* and *makers*. *The master's job is to preserve and refine the inherited culture, and the maker's job is to produce variation and deviation that changes culture*. The two can create essential tensions between norms and freedom, between conservatism and progressivism. The chapter concludes the "one long argument" of ECT by summarizing:

(1) the evolving complexity of talent as developmental self-organization encompassing biological, experiential, cognitive-affective, and sociocultural levels of analysis (Chapter 1);
(2) the two "invisible hands" governing characteristic (direction) and maximal adaptation (persistence) (Chapters 2 and 3);
(3) the three critical transitions for sustaining one's long-term development (Chapter 4);
(4) the four levels of self-organization toward excellence and evolving individuality; and
(5) the five levels of talent achievement from masters to makers.

Chapters 1–6 are the main body of exposition of ECT. Chapter 7 uses a set of criteria developed by Ford's (1994) living systems approach and Sameroff's (2010) developmental science of the nature–nurture issue to evaluate ECT with respect to whether ECT satisfies these criteria for addressing various aspects of high-level functional and developmental underpinnings of excellence. Using these criteria, ECT can be viewed as a person-centered theory of talent development and human excellence that is quite versatile in its explanatory power vis-à-vis a wide range of talent achievement phenomena. In comparison with existing component and process models of TD, ECT goes beyond the nature–nurture dichotomy in addressing a deeper issue often neglected in the mainstream scientific discourse: the role of *evolving individuality through culture*. Looking into the future, the main challenge for ECT is how it can be aligned with developmental science, and how intertheoretical dialogues can be formed with other branches of research on developmental diversity (e.g., developmental psychopathology and developmental criminology) as branches of developmental sciences all concerned with understanding and improving human conditions (i.e., use-inspired; Stokes, 1997).

Chapter 8 is concerned with the practical use of ECT, especially on building an ECT-based assessment-guidance system. Four instruments are conceptualized and designed for the purpose: (a) *talent potential indicators*, which assesses aptitudes and dispositions relevant to bioecological effectivities; (b) *talent personal action space (PAS) indicators*, which assess CA; (c) *talent driver indicators*, which assesses four types of human motivations; and (d) *talent milestone indicators*, which assess achievement or psychosocial milestone events leading to human excellence. The first two instruments are mainly for talent identification, and thus are more useful in the exploratory stage of TD, and the last two instruments can be used across the board for assessing where the person stands with respect to the pursuit