FROM GIFTEDNESS TO EMINENCE: DEVELOPMENTAL LANDMARKS ACROSS THE LIFESPAN

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This chapter begins with a provocative enigma: On one hand, the absolute number of gifted and talented people in the world must be extremely large; they may even be considered "a dime a dozen." For example, suppose that anyone in the top 10% of some ability distribution could be considered gifted or talented. That implies that for every million people, there are at least 100,000 who qualify. Therefore, every metropolitan area could contain enough gifted and talented citizens to populate a large town. This number may actually be an underestimate because this example assumes that there is only one cross-sectional distribution from which the gifted and talented are taken. Yet, that is very unlikely the case. In line with Gardner's (1983) theory of multiple intelligences, the top 10% in mathematical ability need not be the same people as the top 10% in sports, art, or music. Accordingly, a city of a million would contain far more than 100,000 gifted and talented denizens. To be sure, some might argue that the 10% criterion is set too low and a top 1% threshold should be applied instead. Terman's (1925) classic longitudinal study defined intellectual giftedness in terms of the top 1% of the school population in performance on an IQ test. Even when the bar is dramatically raised, the absolute number remains large: 10,000 gifted and talented people per million—and probably far more than this estimate if various abilities are largely uncorrelated.

On the other hand, the absolute count of adults who have attained eminence in any given domain of achievement is appreciably smaller than the top 10% or top 1% of a population. When Zuckerman (1977) wanted to interview United States scientists who had received the Nobel Prize, only 56 laureates were then living in the country (out of which she was able to recruit 41). That figure is much, much smaller than even the number of scientific geniuses that would be expected to live in any major metropolitan area. Therefore, it seems that the probability of potential giftedness or talent developing to actual eminent achievement, or genius, is extremely small. Galton (1869) estimated that geniuses, as judged by eminence, number only around 250 per million adults, or about .025%—a very tiny proportion. Something seems to be happening between childhood and adulthood so that only a restricted elite progresses toward eminence. Many may enter the hopper at the beginning, but only a very small number emerge at the end.

The purpose of this chapter is to examine this selection process by adopting a lifespan developmental perspective. The chapter begins with parental genetics and family environment, and then turns to education and training followed by a treatment of career trajectories and terminations, including death. To keep the discussion focused, the emphasis will be on creative talent. Even so, most of the developmental principles remain applicable to other forms of talent and giftedness, including exceptional achievement in music, sports, and games. Only simple talents, such as a gift for wiggling one's ears, would likely fall outside the scope of these principles.

CONCEPTION

The very first developmental landmark must entail the very moment of conception—when egg and

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sperm merge to produce a zygote. Indeed, Galton (1869) initially proposed that genius was born, not made. That was why his book was titled *Hereditary Genius*. More specifically, he strongly believed that achieved eminence in any domain involving either creativity or leadership mandates that an individual's "natural ability" resides at the uppermost right tail of the normal distribution. The term *natural*, of course, meant *genetic*, however Galton's concept of genetic inheritance was statistical rather than Mendelian. Many of Galton's successors, such as Terman (1925), operated under the same belief, substituting IQ for natural ability. A high IQ was taken as an equivalent to genius and hence, inevitable eminence (see also Cox, 1926; Walberg, Rasher, & Hase, 1978). Indeed, some dictionaries (e.g., *American Heritage Dictionary*) define a *genius* as someone having an IQ of 140 or greater, so the issue would seem settled.

If Galton's (1869) position were true, this chapter could go directly to the conclusion. After all, general intelligence as assessed by IQ tests boasts a high heritability (Bouchard & McGue, 1981), with a correspondingly high degree of stability across the lifespan (e.g., Simonton, 1976). Anyone identified with a high IQ in childhood would exhibit a high IQ in adulthood, and intellectual giftedness would translate immediately into adulthood genius. For example, the kids who made it into Terman's (1925) initial sample were shown to still have IQs in the upper 1% almost 2 decades later (Terman & Oden, 1947). Regression to the mean was minimal. Hence, if the top 1% defines genius, then the 11-year old geniuses remained geniuses at age 29.

But this Galtonian position is not true. Although general intelligence is no doubt positively correlated with achieved eminence in most domains of achievement, the correlation is never strong enough to render it the exclusive determinant (Cox, 1926; Simonton, 1976; Simonton & Song, 2009; Walberg et al., 1978). A coefficient around .25 is a good ball-park estimate (Simonton, 2009a). Indeed, sometimes intelligence may even exhibit a curvilinear (nonmonotonic) function with achieved eminence such that too much intelligence can be a bad thing (Simonton, 1985). This outcome is especially likely in areas of leadership. Nevertheless, even when the relation is positive monotonic, considerable variance is left over, meaning that other factors must be involved. Besides other intelligences not highly correlated with general intelligences, these additional determinants can include individual differences in various dispositional characteristics, such as personality, interests, and values (Feist, 1998; Feist & Barron, 2003). For instance, openness to experience, one of the Big Five personality traits (McCrae & Greenberg, 2014), is highly predictive of creativity and leadership (Carson, Peterson, & Higgins, 2005; Rubenzer, Faschingbauer, & Ones, 2000; Simonton, 2006; cf. Cassandro & Simonton, 2010).

In lieu of a single genetic component, there is a whole array of separate genetic components. In short, most talents are multidimensional (Simonton, 2008b). To be talented, a person must inherit a wide assortment cognitive abilities and dispositional traits tailored to a specific domain of achievement (Simonton, 2014). Complicating matters, the contribution of these various individual–difference variables to the overall talent may undergo multiplicative, rather than additive, integration (Simonton, 1999). Multiplicative combination has been called *emergenesis* (Lykken, McGue, Tellegen, & Bouchard, 1992). In this case, talent becomes rarer than would be expected if the genetic components were combined in an additive fashion (Simonton, 1999). For instance, if the different genetic contributions are normally distributed in the population, their additive integration will also be normally distributed. Yet, if multiplicative integration applies, then the resulting talent distribution will be highly skewed, with a long upper tail. The most talented people in a group will prove far less common. After all, if inheritance is emergenic, then a deficiency in any single genetic component will undermine the multiplicative product. Even infinity, when multiplied by zero, becomes zero.

One final complication is also worth mentioning: A talent does not manifest itself at birth but rather unfolds over time, often not fully appearing until late adolescence or even early adulthood (Simonton, 2005). The genetic contribution to intelligence increases over the lifespan (Bouchard, 1995). Although this unfolding has been termed *epigenetic* *growth*, it should not be confused with the more basic genetic process of epigenetics (Simonton, 1999). When this developmental phenomenon is coupled with emergenesis, the emergence of talent may not kick until relatively late. If a talent requires multiple components, and if some of those components require some time before they become manifested in a child or adolescent, then occasionally the talent may bloom late. Consistent with this possibility, child prodigies will sometimes change their domain of excellence over the course of their development (Feldman, 1986). It can also work in the opposite direction, traits emerge that weaken or destroy the talent. The most dramatic example is mental illness leading to suicide.

All told, genetic considerations alone would predict that talent should be less frequent than suggested by a simple model of inheritance (see also Johnson & Bouchard, 2014).

BIRTH

The discussion of epigenetic growth has moved past the second developmental landmark: birth. The moment a person is born, the environment (nurture) begins to play a role alongside genetic endowment (nature).[1] Indeed, Galton (1874) himself introduced the nature–nurture issue in response to criticisms of his original genetic determinism (especially de Candolle, 1873). He even identified an environmental factor that is quite obviously environmental rather than genetic: birth order. He provided the original scientific evidence that first-children (especially sons) are overrepresented among eminent scientists (see also Clark & Rice, 1982; Eiduson, 1962; Roe, 1953; Simonton, 2008a; Terry, 1989; cf. Feist, 1993). Nonetheless, the actual relation between birth order and talent development is far more complex than simple primogeniture would imply. Subsequent research specifies circumstances where later-born children have advantages (e.g., Stewart, 1977; Sulloway, 2014; Walberg, Rasher, & Parkerson, 1979). A child's ordinal position initiates a family dynamic that often deflects that individual along a particular developmental path (Sulloway, 2010). Moreover, this family dynamic is moderated by a host of other variables, including gender, ethnicity, and socioeconomic class (Sulloway, 2014). For instance, the relation between birth order and scientific achievement is intensified for talented women (Simonton, 2008a).

Of course, a child's family provides a wealth of experiences besides those directly contingent on ordinal position (see Chapter 30, this handbook). In Terman's (1925) longitudinal study of the intellectually gifted, great emphasis was placed on the homes providing stable, supportive, and stimulating environments for cognitive and emotional growth (see also Duggan & Friedman, 2014). These circumstances provide a striking contrast with what is found in the lives of the highly eminent, especially in creative domains like the arts (Simonton, 2009b). Instead, the home environments are more likely to be characterized by "diversifying experiences that help weaken the constraints imposed by conventional socialization" (Simonton, 2000b, p. 153). These experiences may include childhood or adolescent trauma, physical or cognitive disabilities, familial conflicts, economic ups and downs, parental ethnic or religious heterogeneity, geographic mobility, cultural marginality, multicultural exposure, and even political turmoil (e.g., Damian & Simonton, 2014, 2015). Such events not only influence the direction that talent development may take, but also the magnitude of achievement that is the end result of that development (Simonton, 2009b).

I hasten to point out that these family background variables interact with the genetic inheritance in complex ways to produce an adult who may or may not have realized early promise. A very delicate balance is required, with the absolute necessity of finding the "sweet spot" between too much and too little of a good (or bad) thing. This subtle complexity is revealed in the following quote:

[1]Many researchers argue that the impact of nurture operates prior to birth, especially the influence of the prenatal environment. A well-known example concerns the hypothesized influence of fetal testosterone on the development of certain talents (McManus & Bryden, 1991). Given that this chapter concentrates on eminent creators, we must admit the impossibility of directly studying such prebirth effects. We know absolutely nothing about the prenatal environment of any creative genius.

> In quiet, uneventful lives the changes internal and external are so small that there is little or no strain in the process of fusion and accommodation; in other lives there is a great strain, but there is also great fusing and accommodating power; in others great strain with little accommodating power. A life will be successful or not accordingly as the power of accommodation is equal to or unequal to the strain of the fusing and adjusting internal and external changes. (Butler, 1903/1998, p. 288)

Identifying the right match between nature and nurture is no easy task. Many potential geniuses will fall by the wayside, either never encountering a sufficient challenge or else finding themselves challenged too much. At the extremes, the developmental "rejects" may represent either mediocrity or psychopathology rather than the optimal middle of fully developed talent (Damian & Simonton, 2015).

EDUCATION

The next developmental landmark overlaps the preceding one: About a half decade after birth a child will enter school, for the first time exposing young talent to significant environmental influences outside the home, which include peers and teachers. The impact of formal instruction on talent development can be assessed by several different criteria. How well does the child, adolescent, or young adult do in school and college? Are they great scholars, mediocre, or worse? How far do they advance through the educational system? Do they become high school dropouts or do they obtain higher professional or graduate degrees? How quickly do they accelerate through the various grades and institutions?

Within the developmental concept of diversifying experiences, some events and circumstances can have contrary implications for future artists and scientists. Artists are more likely to encounter severe and frequent diversifying experiences than scientists. A parallel pattern holds for education: The development of artistic talent is far less contingent on scholastic success than the development of scientific talent (Simonton, 2009b; see also Schaefer & Anastasi, 1968). In addition, artistic development is less contingent on attaining high levels of formal education, if any at all (Raskin, 1936; Simonton, 1986). Top-level novelists and poets seldom obtain PhDs in creative writing before launching their careers. In a sense, artistic creators can skip this particular landmark on the way to creative genius. Scientific creators seldom have that luxury, a higher degree more often providing a necessary certification before entering the profession (Roe, 1953; Simonton, 1992a; Wispé & Ritter, 1964; Zuckerman, 1977). Despite once claiming "I shall not become a PhD . . . the whole comedy has become a bore to me" (Hoffmann, 1972, p. 55), even Albert Einstein obtained a doctoral degree.

Mark Twain once said "I have never let my schooling interfere with my education" (Harnsberger, 1972, p. 553). This quote implies that one other developmental landmark may stand between home and career.

TRAINING

The preceding section concentrated on formal education, like the kind offered in K–12 schools, colleges, and universities. Yet, that is not the only developmental route pursued to adulthood achievement. After all, the main goal is to acquire the necessary domain-specific expertise (Ericsson, 2014; Simonton, 2014). Sometimes that expertise acquisition is best pursued taking formal courses in the discipline, but very often such training has to be acquired outside regular coursework (see Chapter 15, this handbook). Indeed, highly creative adults often exhibited interests and hobbies in childhood and adolescence that anticipate their later careers, such as mechanical toys for physicists or insect collections for biologists (Roe, 1953; Segal, Busse, & Mansfield, 1980). Especially commonplace in many creative domains is an early and deep engagement in omnivorous reading (Roe, 1953; Simonton, 1984b; see also Terman, 1925). Often these hobbies and interests will instill a "crystallizing experience" in which a future high achiever discovers the domain in which they wish to devote the rest of their life (Walters & Gardner, 1986).

Such self-education may suffice for some domains of achievement. For instance, poets normally do not obtain any specialized training other than their own private reading of poetry (Simonton, 1986). Yet, in many other domains the requisite expertise is not acquired without the direct involvement of older, already established experts, whether teachers, mentors, or role models (Bloom, 1985; Simonton, 1984a, 1992a, 1992b). Stated in an inverse fashion, future achievers tend to have been students, disciples, or admirers of past achievers. This developmental landmark usually occurs in late adolescence or early adulthood. For scientists, the mentoring will most often take place in graduate school (Boring & Boring, 1948; Simonton, 1992a; Zuckerman, 1977). It is no accident that a large proportion of Nobel laureates in the sciences studied under previous laureates in the same scientific domain (Zuckerman, 1977).

Regardless of the details, much debate has recently centered on how long a person must engage in "deliberate practice" before the necessary domain-specific expertise is acquired (Detterman, 2014; Simonton, 2000a). This period is often expressed by the 10-year rule, or sometimes 10,000 hours of deliberate practice and study (cf. Ericsson, 2014). It has now become clear that this "rule" is a very rough approximation that, at best, represents a statistical average, with considerable dispersion around the mean (Simonton, 2014). Besides the substantial individual differences in the onset of domain-specific training (which can vary by a decade or more), it is essential to consider two intimately related phenomena.

The first phenomenon concerns *better faster effects* in which a young talent acquires the requisite expertise in much less than a decade, sometimes in only a few years of so-called deliberate practice (Simonton, 2014, 2016). Child prodigies provide extreme examples, as they will exhibit adult-level performance when younger than 10 years old. Although not all child prodigies grow up to become adult geniuses (Winner, 2014), a small proportion do manage to make the difficult transition, such as Blaise Pascal, Wolfgang Amadeus Mozart, and John Stewart Mill (three notables in Cox's, 1926, study of 301 geniuses) and Terence Tao, recipient of a MacArthur "Genius" Fellowship and a Fields Medal (Kell & Lubinski, 2014). For certain domains, such as classical music and mathematics, accelerated expertise acquisition is highly predictive of later adult success (Kell & Lubinski, 2014; Simonton, 2016; see also Cox, 1926).

The second phenomenon concerns *more bang for the buck effects* in which a young talent achieves more eminence than might be predicted on the basis of the amount of actual time devoted to so-called deliberate practice (Simonton, 2014). Even if two persons spent exactly 10 years in training, one may prove far more creative than the other. Indeed, this effect follows as a necessary consequence of the extremely skewed distribution of creative productivity (approximately described by the inverse power distribution known as the Lotka Law; Simonton, 2010). Given that the modal level of lifetime output is just a single work and that the most prolific creators tend to produce more than 100 times that amount, the variance in productivity is well out of proportion to the variance in deliberate practice. Geniuses could not possibly have devoted more than a century to domain-specific training—and most often took much less than that time.

Like many eminent achievers, Thomas Edison illustrates both effects simultaneously (Simonton, 2015). Not only did he become a highly successful inventor after only about a half-dozen years of off-hours self-training while working full-time as a telegrapher, but his eventual impact on world technology was well out of proportion to the duration and intensity of that domain-specific training. Indeed, until early in the 21st century Edison held the record for the most patents approved by the United States Patent Office—fully 1,095! Given that the typical inventor can claim only one patent, Edison was a thousand times more productive than the norm.

These two effects imply that certain developmental variables, some genetic and others environmental, influence the rate at which domain-specific expertise is acquired and the effectiveness with which that expertise is converted into outright achievements. This implication has been formally expressed in terms of the recursive model shown in Figure 18.1. Although this model was specifically

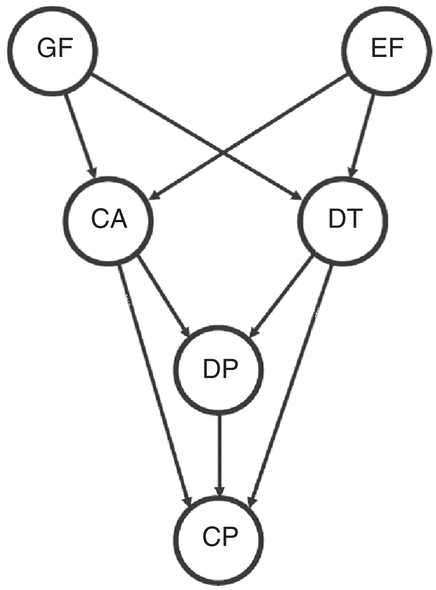

FIGURE 18.1. A simple recursive model specifying cross-sectional variation in creative performance (CP) as a direct function of corresponding individual differences in deliberate practice (DP), cognitive abilities (CA), and dispositional traits (DT; mediating variables), and as an indirect function of genetic and environmental factors (GF and EF). Each circle indicates sets of variables rather than single variables. The arrows connecting circles indicate multiple direct effects from variables in one set to variables in another set. The variables themselves may be either observed or latent (as normally holds for set GF except in rare cases where specific genes have been identified). From "Creative Performance, Expertise Acquisition, Individual Differences, and Developmental Antecedents: An Integrative Research Agenda," by D. K. Simonton, 2014, *Intelligence, 45,* p. 71. Copyright 2014 by Elsevier. Reprinted with permission.

designed to explain creative achievement, it can be readily modified into a more inclusive model by changing the ultimate endogenous variable from creative performance to some other criterion, such as athletic or musical performance.

In any case, the arrows going from cognitive abilities and dispositional traits to deliberate practice can produce the better-faster effects while those going from those same two variable sets to creative performance can generate the more bang for the buck effects. In the former case, a talent might have a natural genetic capacity for accelerated domain mastery, whereas in the latter case an achiever might have the imaginative powers to get more with less. As Edison described, "To invent, you need a good imagination and a pile of junk." Similarly, Einstein did not know a lot more physics than the typical physicist of his time, and probably knew somewhat less, but he was able to revolutionize physics with what he did know. It is telling that his breakthrough paper on special relativity did not even include any references.

CAREER

Whatever the developmental details, eventually an adult will have acquired sufficient domain-specific expertise to launch a career. This career takes the form of major achievements. In the case of creative domains, these achievements involve overt products, such as poems, plays, paintings, sculptures, scores, inventions, articles, books, designs, programs, or films. With an important exception, the output of these products is most often distributed over the course of the creator's lifespan. This longitudinal distribution then leads to an additional set of developmental landmarks, namely, the age at career onset, the age at career peak, and the age at career termination. Corresponding to each of these events are the ages at first major contribution, best contribution, and last major contribution (Raskin, 1936; see also Jones, Reedy, & Weinberg, 2014; Kozbelt, 2014; McKay & Kaufman, 2014). These landmarks also have important repercussions for understanding the conversion of childhood giftedness to adult eminence.

Age at Career Onset and First Major Contribution

Technically speaking, the career begins when the individual starts making contributions to a chosen domain, but what is meant by a "contribution"? A generous definition could be adopted that includes any creative product, regardless of impact. For example, if a scientist publishes in a peer-reviewed journal, that may count as the onset of a career. By definition, the paper's acceptance to a journal proves that the scientist has acquired the necessary domain-specific expertise. However, a very large proportion of published research is never cited by anybody, suggesting that lots of work is being ignored (Redner, 1998).

This reality might require a more restrictive definition of contribution: The product must actually make a recognized contribution, such as eventually receiving citations from fellow scientists, before the career is said to have begun. The more restrictive requirement tends to increase the expected age of career onset. For instance, a study of 120 eminent classical composers found that, on average, these creators had been composing for a dozen years before they finally created a work that won an enduring place in the performance repertoire (Simonton, 2016). To be sure, some of the earlier works might be considered juvenilia, lacking the necessary expertise to make a mark. Even so, the time lag underlines the necessity of focusing on the first genuine creative contribution rather than the first attempted contribution. With this proviso, the first genuine success in most creative domains tends to appear during the creator's late 20s or early 30s (Lehman, 1946; Raskin, 1936; Simonton, 1991a, 1991b; cf. Simonton, 2007a).

Age at this first career landmark is certainly not a universal constant. Instead, the specific longitudinal placement is dependent on other factors, three of which stand out above the rest (Simonton, 1988, 1997).

First, the expected age of first major contribution varies according to the domain of achievement. This variation is apparent in the lowest line plotted in Figure 18.2. The mean age for this landmark is given for nine domains of science and technology. Although the line tends to oscillate around an average of 30 years of age, mathematicians make their first major contribution about three years earlier, whereas the first major contribution in medicine appears about two years later, yielding a half-decade difference overall (Simonton, 1991a). Given that the average interval between the first and last major contribution is a little more than two decades, these interdisciplinary contrasts are by no means minor. They represent about a quarter of the typical career length.

Second, the expected age of first major contribution varies according to the total rate of creative productivity (Simonton, 1997). Because quality is a positive function of quantity, those who are the most prolific at the beginning of their careers will have higher odds of having an early success (Simonton, 2010). This consequence is illustrated in the upper two graphs in Figure 18.3. For the highly creative, the first major work will appear before age 30, whereas for the less creative, the first major work will not emerge until their mid-30s.

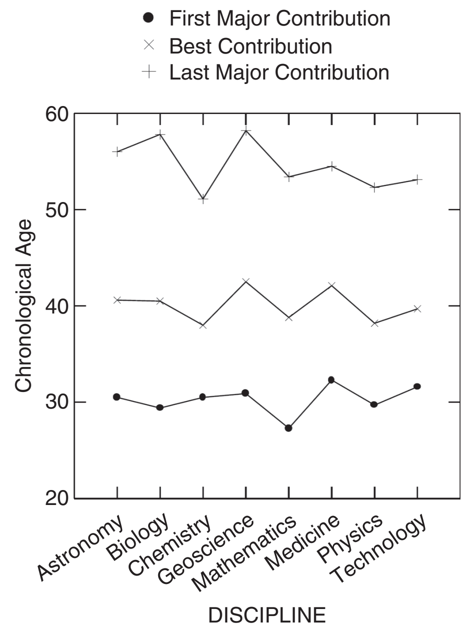

FIGURE 18.2. Mean chronological age of 2,026 highly eminent scientists and inventors for the three career landmarks for eight disciplines in science and technology. A contribution involved a discovery or invention that had a lasting impact on the history of the domain. From *Creativity in Science: Chance, Logic, Genius, and Zeitgeist* (p. 69), by D. K. Simonton, 2004, Cambridge, England: Cambridge University Press. Copyright 2004 by Cambridge University Press. Reprinted with permission.

Third, controlling for individual differences in creative productivity, the age of career onset is positively correlated with the age at first major contribution. This relation can be seen by comparing the upper two graphs in Figure 18.2 with the lower two graphs. Whereas the upper graphs represent *early bloomers* who initiated creative output at age 20, the lower graphs represent *late bloomers* who did not start until age 30. Clearly, the late start shifts the age at first major contribution by a decade regardless of whether the person rates high or low in creativity. Therefore, career trajectory is best described in terms of career age (Simonton, 1997).

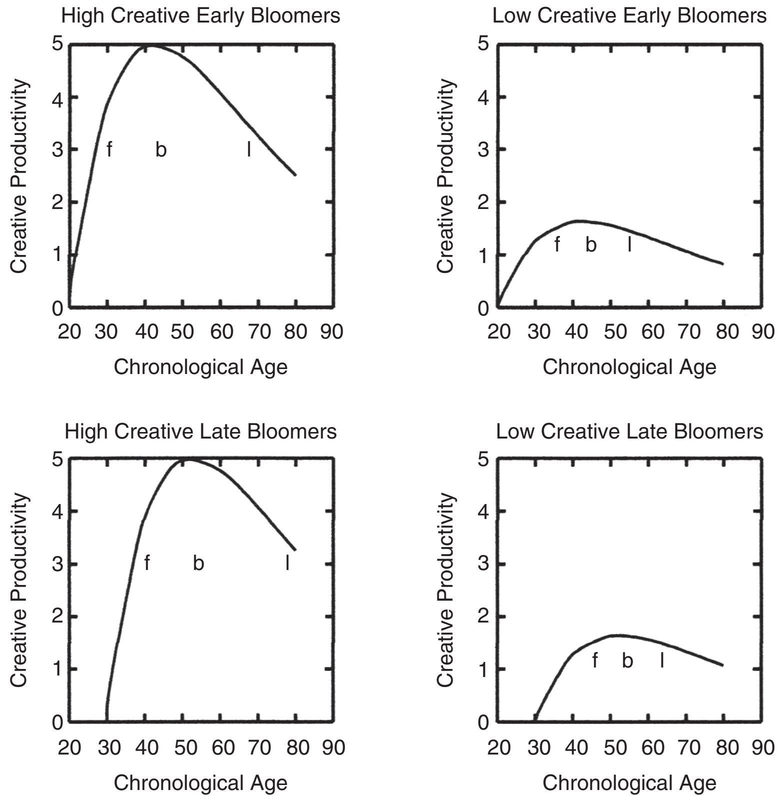

FIGURE 18.3. Fourfold typology of career trajectories and landmarks based on the distinctions between high and low creative and between early and late bloomers. f = first major contribution; b = best contribution; l = last major contribution. Reprinted from *Great Psychologists and Their Times: Scientific Insights Into Psychology's History* (p. 94), by D. K. Simonton, 2002, Washington, DC: American Psychological Association. Copyright 2002 by the American Psychological Association.

Significantly, these three factors operate independently of each other, producing a tremendous variety of predicted outcomes for specific adult achievers.

Age at Career Peak and Best Contribution

The middle line in Figure 18.2 also indicates that the expected age for the creator's best contribution also varies substantially in science and technology (Simonton, 1991a). Although the mean age hovers around 40 years old, the separate disciplinary peaks vary from around 38 years old for chemistry to around 43 years old for the earth sciences, yielding a difference of a half decade (Simonton, 1991a). Comparable contrasts have been identified in the arts as well. For example, poets tend to be younger than novelists when they produce their most outstanding work (Simonton, 2007b; see also Simonton, 1975). Again, the differential tends to be about a half decade. Despite these interdisciplinary contrasts, it remains true that the best contribution appears about mid-career, albeit slightly closer to the first major contribution.

This placement has an important rationale: It falls closest to the peak of creative productivity (Simonton, 1988). This correspondence is suggested in all four graphs shown in Figure 18.3. The best contribution tends to appear near the peak of creative output, or just a little after (because the age–productivity relation is not symmetrical). As noted before, quality tends to be a positive function of quantity, and creators tend to produce their single most important works when they have created the most works total. In the case of 120 eminent classical composers, for instance, the expected age at maximum compositional output was around 39 years old, whereas the expected age at the best composition was around 40 years old, just a year later (Simonton, 2016; cf. Simonton, 1991b).

In line with what was noted in the previous section, these expectations are contingent on the age at career onset (Simonton, 1997). Early bloomers will display proportionally earlier peaks and late bloomers will exhibit later peaks. Even so, as might be surmised from Figure 18.3, the peak's longitudinal location does not appear to be influenced by individual differences in total creative output. There is only one exception: the "one-hit wonders" that are sometimes found in classical music (Kozbelt, 2008). These are composers who contributed one and only one masterwork to the classical repertoire, so that their posthumous reputation depends on a single work notwithstanding a career of productivity. Nevertheless, these exceptions to the statistical rule tend to be unusual in another way, namely, that they are usually relatively brief compositions in simple musical forms that contain extremely attractive melodies (e.g., Pachelbel's *Canon in D*).

Age at Career Termination and Last Major Contribution

It would be reasonable to anticipate that the age at the last major contribution should also be influenced by the domain of creative achievement. This expectation is also confirmed in Figure 18.2, this time in the uppermost line. Once more the interdisciplinary contrasts are striking, seven years separating the expected ages for chemists and earth scientists (Simonton, 1991a). Yet, the other two factors influential with respect to the age at first major contribution also influence the age at last major contribution: creative productivity and age at career onset. The contribution of these two factors is evident in Figure 18.3. First, controlling for career onset, the highly creative have their last major work appear later in life. Second, controlling for creative productivity, early bloomers have their last major contribution appear at a younger age than do the late bloomers. The logical basis for this contrast should be obvious, too. The more prolific a creator is toward the tail end of career, the higher the likelihood that at least one more major work will appear. Although, the sad side of this tendency is that the last major contribution will likely be followed by other products that contribute absolute nothing to the creator's posthumous reputation. Even a genius as great as Albert Einstein closed out his career with a unified field theory that was an extreme embarrassment relative to his last major work on the general theory of relativity. His contemporaries believed that it was time totally wasted.

DEATH

Besides the factors just mentioned, there is another variable that is critically important—the creator's age at death, which represents the last developmental landmark. No matter what the domain of creative achievement, the age at career onset, or the level of creative productivity, death ends the story. This reality especially confronts extreme late bloomers who discover their special talents too late. The Austrian composer Anton Bruckner did not realize his special gift for composing structurally complex symphonies until his 40s. Besides not producing his first masterpieces until he was in his 50s, he left unfinished a phenomenal ninth symphony when he died in his early 70s. It is probably safe to conjecture that many late bloomers never get around to creating what would have been their last major contribution.

Although the age at death leaves a bigger impact on the age at career termination and last major work, it remains true that it also has an impact on the other career landmarks (see Simonton, 1975, 2007a). A tragic illustration is the so-called "Spanish Mozart" Juan Crisóstomo Arriaga, who died before his 20th birthday. Although he is still known today for the string quartets composed when he was 16 years old and a symphony composed a bit later, it would be absurd to suggest that he had come anywhere close to creating what would have been his best contribution, even less his last major contribution. If he had lived slightly longer, he might have created a string quartet or symphony that superseded his earlier compositions and become recognized for his actual first major contribution. It must be remembered that Mozart's own first masterpieces did not appear until after he was well into his 20s (Simonton, 2016).

Arriaga is not the sole example either. Thomas Chatterton committed suicide at age 17 after forging the neomedieval Rowley poems that later left a big impression on Romantic poets. Évariste Galois laid the groundwork for modern algebra days before dying in a duel at age 20. Like Arriaga, neither Chatterton nor Galois were close to attaining the second career landmark in their developmental trajectory. Nor can we ever know how many talents failed to manifest genius because their potential was nipped in the bud too early. Certainly, the number of late bloomers who never got the chance to acquire the necessary expertise is uncountable.

In fact, life expectancies across various domains of achievement tend to correspond with the expected ages for making major contributions. Poets tend to die younger than novelists, just as mathematicians are prone to die younger than earth scientists (McKay & Kaufman, 2014; Simonton, 1975, 1991a). Although the precise causes remain to be established (cf. McCann, 2001), one plausible explanation is that those who generate earlier career landmarks are able to die younger and still make a contribution to their domains. By the same token, late bloomers will necessarily have superior life expectancies than early bloomers. If Bruckner had died at the same age as Arriaga, his name would not have been mentioned anywhere in this chapter. Or to offer an even more extreme example, if Grandma Moses had died in her mid-70s, it is doubtful that she would have become a renowned folk artist.

So, we encounter one last reason why the manifestation of adult genius is so much scarcer than the talent potential that presumably precedes it. Not every gifted child will manage to negotiate all of the developmental landmarks between conception and termination.

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