Article

Galton, Terman, Cox: The Distinctive Volume II in *Genetic Studies of Genius*

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Abstract

With just one exception, all of the volumes in Terman's Genetic Studies of Genius report the results of a longitudinal study of more than a thousand intellectually gifted children. That single exception is Volume II, Cox's single-authored *The Early Mental Traits of Three Hundred Geniuses*, which instead was a retrospective study of 301 eminent creators and leaders, using historiometric methods to estimate their IQs (as well as to assess a subset of 100 on 67 character traits). This article discusses how this volume actually fits with the other four volumes in the set. After giving the historical background, discussion turns to the emergence of Cox's doctoral dissertation. Then comes a narrative of the aftermath, including subsequent contributions by Cox, Terman, and numerous other researchers extending into the 21st century. The article closes by treating the ways that the intellectually gifted and the historic geniuses are not comparable, thus indicating the need for more recent replications and extensions of her work.

Keywords

archival, biographical, historical analysis, early childhood, gifted, intelligence

Strictly speaking, Lewis M. Terman's (1925-1959) monumental and highly influential *Genetic Studies of Genius* consists of five volumes. Although Holahan and Sears (1995) is sometimes identified as a sixth volume, by then the longitudinal enquiry had acquired a largely gerontological emphasis (Duggan & Friedman, 2014; cf. Oden, 1968). Yet, in some respects, the complete set might be better said to consist of four volumes rather than five. After all, the second volume might not seem to fit with the first and last three. It could have just as easily been published separately without any apparent interruption in the empirical presentation. Here are five reasons:

First, the second volume is sole authored by Catharine Cox (1926), even if it is based on her 1925 doctoral dissertation under Terman's supervision. In stark contrast, all of the other volumes feature Terman as either the single author (Terman, 1925 "and others"), as the first author of two (Terman & Oden, 1947, 1959), or as the third author of three (Burks et al., 1930). Those authorship contrasts are reflected in the volume titles as well. Despite using "genius" in the overall series title, all of the volumes but one use the word "gifted" instead. The lone exception is Cox's *The Early Mental Traits of Three Hundred Geniuses*.

Second, the latter volume concentrates on 301 of the most famous creators and leaders in modern Western civilization (Cox, 1926). Her research subjects most often have recognizable names like Galileo, Descartes, Cervantes, Rembrandt, Beethoven, Lincoln, Napoleon, Cromwell, and Luther—the complete list of impressive big names provided on multiple occasions throughout the volume. In comparison, all of the remaining volumes start with the sample of intellectually gifted children that Terman (1925) had studied in the first volume. The samples might alter somewhat due to attrition or other factors (including some late additions), yet the fact remains the same "Termites" were studied in repeated waves from the early 1920s to the late 1950s. And his subjects' anonymity was preserved unless self-revealed.

Third, as the previous contrast implies, the second volume did *not* present a longitudinal study of a given set of research subjects. Instead, Cox's (1926) inquiry was manifestly retrospective. It had to be, because each and every genius in her sample was already deceased, and often by one or more centuries. This would be expected given that their mean year of birth was 1705 (Simonton, 1976). Although successive waves of longitudinal assessment were rendered absolutely impossible, attrition was impossible as well because a common source of attrition, death, was already neutralized. As seen later, this actually introduces a special advantage not seen in the mainstream longitudinal investigation.

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Fourth, although all five volumes focus on high-IQ individuals, Cox (1926) could not posthumously administer standardized IQ tests to her 301 deceased geniuses. So instead she relied on historiometric assessment drawn from a large inventory of methods for applying objective quantitative techniques to biographical and historical data (Woods, 1909, 1911; see also Simonton, 1990). The other volumes, in contrast, applied psychometric assessments to living research subjects. The same discrepancy appears in the evaluation of personality characteristics.

Fifth and last, Volume II is by far the thickest of the five, a genuine tome. In particular, including the indices, Cox (1926) weighs in at 842 pages, which is almost 200 pages longer than the next largest, namely Volume I, which has 648 pages (Terman, 1925), and more than 300 pages longer than the third largest, Volume III, which has 524 pages (Burks et al., 1930). When all five volumes are combined, Volume II accounts for 30% of the total pages rather than the 20% had the page allotments been equal. Hence, however, discrepant Cox's contribution may be relative to the other volumes, the decision to include it in the planned series could not have been taken lightly. Its addition in 1926 more than doubled the size of the set published thus far. In this sense, it upstaged Terman's first volume.

All that said, below I will discuss how Cox's (1926) investigation really does fit in with Terman's main research program regarding IQ. It even adds something that would be sorely missed otherwise. I start by providing the more general historical background, and then turn to Cox's specific work. From there I deal with the aftermath, including a treatment of how her work does not always comply very well with Terman's original expectations.

Historical Context

Terman's scientific hero was Francis Galton, who pioneered many aspects of what were to become core features of the psychology of intelligence (Simonton, 2017b). For example, Galton (1869) was the first to argue that individual differences in intelligence (or what he called "natural ability") were normally distributed—the now well-known "bell curve." Galton (1883) later attempted to assess these differences using his "anthropometry," which consisted of roughly three dozen quantitative measures of height, weight, physical strength, reaction time, visual and auditory acuity, and other rather basic human characteristics and capacities. Unfortunately, it became apparent by the beginning of the 20th century that these measures did not seem particularly relevant to the assessment of intelligence (Wissler, 1901). Yet those empirical disconfirmations did not stop Terman (1925) from subjecting a subsample of his intellectually gifted children to 37 anthropometrical measures!

Assessing the Intelligence Quotient

A more promising measurement alternative emerged out of the work that Binet and Simon (1905) had been conducting in France. Although their original emphasis was a practical one—identifying school children who could not keep up with the established curriculum—their concept of "mental age" proved more productive than Galton's anthropometric definition of natural ability. Somewhat later Stern (1914) introduced a new statistic: By dividing a child's mental age by their chronological age and then multiplying by 100, one would obtain their Intelligence Quotient or "I.Q."

It was this IQ definition that was integrated into Terman's (1916) Stanford–Binet Intelligence Scale. Even though the definition was restricted to children, it had one surprising asset: Those children did not have to actually take the test to obtain an estimated score! If some youth had a sufficiently detailed chronology of their intellectual development, sufficient to calculate their mental age at a given chronological age, then an overall IQ could be roughly estimated on that basis alone. Only 1 year after he published the new IQ test, Terman (1917) himself demonstrated this possibility using the early life of Galton, who had been a conspicuous child prodigy (Simonton, 2017b). Based on Galton's highly precocious intellectual development, Terman estimated an IQ score close to 200. On average, Galton's mental age was about double his chronological age. Interestingly, the source for Terman's raw data was the first volume of a biography by Karl Pearson (1914), another Galton admirer, who had earlier devised the product-moment coefficient that has proven so important in both psychometric and historiometric research (symbolized by r in line with Galton's concept of regression). Because Galton had died in 1911, he never learned about his stellar IQ score, nor even about Terman's improvements in intelligence testing.

Studying the Intellectually Gifted

After the brief venture into the historiometric assessment of IQ, Terman immediately returned to psychometric assessment, revising the Stanford–Binet scale and broadening its application. By the early 1920s, he obtained sufficient grant funds to initiate his ambitious longitudinal study. Terman aspired to show not only that boys and girls with genius-level IQs—defined as 140 or the top 1%—were healthy and well-adjusted but also would grow up to become highly successful adults. Yet given that the average age of his gifted children was around 11 years old, it would take some time before the last conjecture could be empirically confirmed. Indeed, Terman would not live to see the publication of Volume V, in which the Termites had reached the age at which their accomplishments could be reasonably assessed (Terman & Oden, 1959).

At this juncture, Terman's (1917) historiometric IQ estimate for Galton returns to provide a temporal shortcut. Because the achievements of historic geniuses are now established, a researcher can work backward to determine whether such figures would have gotten a sufficiently high IQ score had they been able to take the Stanford–Binet when they were alive. The central hypothesis of the longitudinal

study is simply reversed in a retrospective study. However, to make a convincing case, a large number of historic creators and leaders had to be sampled and their IQs estimated using a more objective and quantitative procedure than Terman had executed in his 1917 study, which was really nothing more than a "proof of concept" demonstration. Does it sound like an ideal project for a very bright and hard-working graduate student?

Cox's Doctoral Dissertation

Before describing the resulting dissertation, I first need to provide a little background information about the graduate student who carried out the research. Her biography gives context for what was by no means a typical doctoral thesis.

Biographical Background

Unlike her mentor Terman, Catharine Cox is seldom deemed famous enough to earn an entry in most biographical dictionaries devoted to major figures in the history of psychology (e.g., Sheehy et al., 1997; Stewart, 2008). Even so, quite a lot is still known about her life and career (Rogers, 1999). For much of this information, we are largely indebted to one of the Termites who eventually grew up to become a psychology professor and departmental chair at Stanford, namely, Robert R. Sears. Sears even took over Terman's longitudinal study in the 1970s, making him both researcher and participant in the same investigation. As if that were not improbable enough, Sears was actually joined by Lee Cronbach, a fellow Termite and colleague in Stanford's education department.

In any event, shortly after Cox's death in 1984, Sears (1986) published a fairly detailed and appreciative obituary that was based on some direct knowledge. In the early 1930s, Sears and his future wife, Pauline Sears (née Snedden), were both at Yale University when Cox (by then Cox Miles) was working there, and Pauline actually served as the latter's research assistant. Compounding the connections even further, Pauline later joined Robert at Stanford to work on the Terman longitudinal study as well, focusing on the gifted women. In addition, a more extensive and up-to-date biography has been published by Robinson and Simonton (2014), who took advantage of both archival sources and direct e-mail communications with her son-in-law on behalf of her daughter.

Finally, Cox or Cox Miles has webpages specifically devoted to her at Psychology's Feminist Voices (http://www.feministvoices.com/catharine-cox-miles) by Laura Ball), Human Intelligence (https://www.intelltheory.com/cox.shtml by the current author), Wikipedia (https://en.wikipedia.org/wiki/Catharine_Cox_Miles by anonymous editors), and Quakers In the World (http://www.quakersintheworld.org/quakers-in-action/371/Catharine-Cox-Miles, anonymous). In any case, the following biographical sketch is most dependent on Sears (1986), the primary source for the other narratives as well.

When Catharine Cox entered Stanford's graduate program in 1920, she was what might be called today a "re-entry student." Born in 1890, she was now 30 years old. Moreover, she had already received her Stanford BA and MA in German language and literature in 1911 and 1913, respectively. After spending a year in Germany at the universities of Jena and Berlin, she returned to California for an appointment at the College of the Pacific (at that time in San Jose, but now the University of the Pacific in Stockton). There she taught German and physical education for 5 years, advancing from instructor to full professor. As a Quaker, she joined the American Friends Service Committee in 1919, distributing food to relieve the starvation that plagued Berlin at the close of the First World War. Working much with children, she became increasingly interested in psychology, and had decided to return to Stanford to study under Terman, obtaining a teaching position in the German department to meet her financial needs. Cox was not the typical entering grad student by any means.

Although Cox was attracted to Terman's burgeoning work on intellectually gifted children, the project was not yet at a stage that she could carve out a doctoral thesis. That led to the suggested retrospective inquiry as an alternative.

Resulting Thesis

The information in this section is based on the present author's direct reading of Cox (1926) over the past 40-plus years, starting with his first secondary analysis of her published data (Simonton, 1976) and then turning to her unpublished data (Simonton, 2010; Simonton & Song, 2009). Needless to say, this author still owns a well-worn copy of Volume II that he purchased directly from Stanford University Press in the early 1970s (viz. its 1969 fourth printing). That detailed reading leads to the following description.

Sampling and Raw Data Compilation. Cox's (1926) investigation began by selecting a sample of 301 creators and leaders whose achieved eminence had been earlier measured by James McKeen Cattell (1903), who had studied under Galton (and thus had been a strong advocate of anthropometry). Eminence was assessed by the amount of space devoted to the target persons in American, British, German, and French standard reference works, Cattell having thereby obtained a ranked list of the 1,000 most eminent (see also Whipple, 2004). Starting with the top half figures on this list, Cox imposed further selection criteria, such as birth between 1450 and 1850, exclusively (to obtain adequate and complete information), achieved rather than inherited distinction (ruling out royalty like Louis XIV "the great" of France), and detailed biographical information about early childhood and adolescence (thus deleting William Shakespeare). To be more precise, Cox actually generated two distinct samples: Group A, the main collection of 282 creators and leaders, and Group B, 19 somewhat less eminent figures who were used

to initially calibrate the independent raters' IQ estimates. Such was the methodical care with which she carried out this project.

Cox (1926) then compiled systematic chronologies of intellectual development based on more than 3,000 biographical sources published in multiple languages (Sears, 1986). Abstracts of these data are provided in Part II (Cox, 1926, Chap. 14 to 24, pp. 223-741), and a full case study of the German philosopher Friedrich Schelling is presented in Appendix I (Cox, 1926, pp. 745-759). The latter is representative of the raw data stored in typescript for all her cases in Stanford's Terman Archives (see https://oac.cdlib.org/findaid/ark:/13030/kt3p303833/entire_text/Boxes23-24).

Multiple IQ Estimates. The IQ raters all had sufficient expertise in what to look for with respect to estimating each individual's mental age in a manner consistent with the Stanford–Binet test items. In point of fact, the three raters who calculated the composite estimates were none other than Cox herself, her mentor Terman, and Dr. Maud Merrill, who collaborated with Terman in successive revisions of the intelligence scale (having earned her own PhD under Terman in 1923 and becoming a Stanford assistant professor shortly after). Because Cox accordingly had multiple raters, she could publish reliability coefficients for each of the 301 geniuses, acknowledging that they did not all possess equally good data. These reliability coefficients were then used to calculate corrected IQ estimates in addition to the raw estimates. As a final manifestation of her methodological meticulousness, Cox actually had the raters calculate two distinct estimates, one using data to age 16, and the other the data from 17 to 26 years. Accordingly, she offered four IQ estimates altogether! The four estimates correlate so highly that they can be reasonably said to measure the same underlying construct (rs = .70 to .86 for Group A; Simonton & Song, 2009).

IQ-Eminence Correlations. To test Terman's main conjecture, Cox calculated the Pearson product-moment coefficient between Cattell's (1903) ranked eminence and the uncorrected IQ estimate for 17 to 26 years (using Group A). She thus obtained a statistically significant correlation of .25. Nonetheless, to be on the safe side, Cox also calculated the partial correlation: Adjusting for data reliability, the result was the still statistically significant value of .16. Although both significant, the effect sizes are perhaps not overly impressive. Even so, they both fall in the same ballpark for comparable psychometric research (cf. Simonton, 2009).

Furthermore, any interpretation of these findings must recognize that Cox's geniuses tended to have extremely high estimated IQs. Across all 301, the average uncorrected IQ for the earlier period (to age 16) was 153 (SD = 15; Simonton, 1976). Certainly, the vast majority would have qualified for inclusion in Terman's (1925) sample of intellectually gifted children.

Character Trait Ratings. Cox's (1926) historiometric study included many more statistical analyses of her IQ estimates, including comparisons across domains of achievement (e.g., military leaders score the lowest). But even more impressive was her decision to assess her geniuses on 67 "character" traits using a then standard inventory. For this purpose, she defined a truncated sample of 100 with the most reliable data (Group C from Group A; see p. 38), and then had two independent raters (herself and a certain Mary Meyrick, a former principal of a college preparatory school) evaluate that sample. Sadly, her analyses of the resulting data fall far short of the possibilities, especially in comparison with what she executed for the IQ data. For instance, she failed to present correlations between any of the character traits and either the IQ estimates or the achieved eminence measure. It seems almost as if her mentor told her that she had done more than enough for a PhD. Perhaps Terman did not even believe that her treatment of personality had any real relevance (Simonton, 2010). It is curious, for instance, that while all of her raw data concerning IQ have been stored in the Terman archives at Stanford University, all of the data regarding the 67 character traits have apparently vanished (Simonton & Song, 2009).

Here is my hypothesis why. At the time that Cox was working on her thesis, Terman was still heavily influenced by Galton's position that natural ability, or intelligence, conquers all. A strong intellect would be inevitably associated with sundry adaptive outcomes, even including positive personality traits and physical health. Yet Cox had shown that a high IQ did not suffice for attaining distinction. As she put it, "youths who achieve eminence are characterized not only by high intellectual traits, but also by persistence of motive and effort, confidence in their abilities, and great strength or force of character" (Cox, 1926, p. 218). She even suggested that stellar character traits could compensate for a less stellar intelligence: "high but not the highest intelligence, combined with the greatest degree of persistence, will achieve greater eminence than the highest degree of intelligence with somewhat less persistence" (Cox, 1926, p. 187). Thus, IQ's causal primacy had been pushed aside. Only two decades later, after Terman discovered that his own gifted children could exhibit dramatically contrary life outcomes even with virtually identical IQs would he realize that his initial emphasis on a strong IQ-eminence correlation was misplaced: "At any rate, we have seen that intellect and achievement are far from perfectly correlated" (Terman & Oden, 1947, p. 352). By then it was perhaps too late to rectify the archival omissions.

Second Volume's Aftermath

Empirical research on the 301 geniuses did not cease in 1926. Because all creators and leaders had been identified in the volume, they could be studied by those investigators who sought to add new variables or conduct alternative analyses. This reuse was sometimes facilitated by the fact that Cox had

included abstracts of the raw biographical data that provided the basis for her IQ estimates. Below I provide an overview of the most significant investigations based either on the full 301 or some subset of those geniuses. The overview begins with Cox herself, then turns to Terman, and ends with everybody else not surnamed Cox or Terman.

Catharine Cox Miles

Ironically, Cox did the least in building on her magnum opus. There were probably three nonexclusive reasons for this apparent neglect (cf. Robinson & Simonton, 2014; Sears, 1986). First, 1 year after her volume's publication, she married the Stanford psychologist Walter Miles, a widower with three teenage children. She thus had a very abrupt transition into full parenthood, plus giving birth to her own child shortly after (besides a second that was stillborn). A study of 80 eminent women psychologists found that only 53% had any children at all, and those who did so typically had just 1 or 2 ($M = 1.28$; Simonton, 2017a). Yet for a time, she was mother to four, a responsibility that she took very seriously, however demanding. Second, even when she engaged in research, she often collaborated in the research programs of others. The most notable example is her work with Terman regarding sex differences, efforts that were not always as productive as the time she put in because of disagreements with her former mentor about the very meaning of masculinity and femininity (not surprisingly, her conceptions were somewhat less gender stereotyped; Terman & Miles, 1936). Third, Cox went through the common postdoctoral phase of high geographical mobility. Before her marriage, she spent, 1925-1927, in Cincinnati working as the chief psychologist in three venues (mental health clinic, children's hospital, and veteran's diagnostic center). Back at Stanford from 1927-1932 to work with Terman, she then joined her husband for appointments at Yale—her position as a clinical professor who also started up a private practice. There they both stayed until retiring in 1953, after which they moved to Turkey where her husband taught for the next 3 years. They then retired in Connecticut, thousands of miles from her raw data, which ended up in Stanford's Terman archives.

Naturally, there may be a far simpler explanation: She just might have lost interest in her geniuses. After all, since her dissertation was signed off in 1925, she had become much more a clinical practitioner. But that account is plainly not the case. A decade after her Volume II was published she coauthored a study on a subset of 50 geniuses under the title: "Childhood Physical and Mental Health Records of Historical Geniuses" (Miles & Wolfe, 1936). Here, she showed that the mental and physical health of geniuses in their childhood could be assessed with the same reliability as her prior assessments of their IQ (as well "as teachers' ratings of behavior traits in school children," Miles & Wolfe, 1936, p. 390). Moreover, this publication was the tip of the iceberg. The Walter R. and Catharine Cox Miles Collection (Archives of the History of American Psychology at the University of Akron) contains reliably assessed physical and mental health scores for all 282 geniuses in Group A (Simonton & Song, 2009). The files are not very well catalogued or organized—more or less random scraps of paper thrown into a shoebox—so it was impossible to determine the exact date that these data were compiled. But the discovery does show that she continued some involvement with her distinctive research sample, and even managed to merge that involvement with her current clinical commitments.

Lewis Terman

Obviously, Terman was very favorably impressed with Cox's (1926) thesis. He would not have added it to his own solo Volume I otherwise. Nor would he have devoted so much of his own time estimating two IQ scores for each of 301 geniuses. Many years later, in 1940, Terman delivered a Presidential address on "Psychological Approaches to the Biography of Genius" at the Pacific Division of the American Association for the Advancement of Science, which was shortly afterward published in *Science*, then still under Cattell's editorship (Terman, 1940). Here Terman provided a concise and appreciative summary of her classic inquiry.

Of course, Terman's (1940) summary did not explicitly represent any original research exploiting Cox's (1926) data. Yet, it implicitly did so, for he also mentions that one of his former graduate students, Ralph K. White, had studied the versatility of her geniuses (White, 1931). In fact, this student used the actual unpublished data to gauge the degree of competence in 23 distinct domains of achievement using a scale that ranged from negative to positive (e.g., from hating math to making breakthrough contributions to mathematics). Like Cox, White used multiple raters so that he could calculate reliability coefficients. He obtained many intriguing results, such as indicating how achievement domains exhibited certain clusters and how geniuses in domains like music seemed to show the least versatility. Because Cox Miles had returned to Stanford during this period, he was able to consult with her about his study (explicitly saying that he was "extremely grateful" for her "criticism and suggestions" in Footnote 1; White, 1931, p. 460). White's contribution remains worth reading today as the topic's single best treatment, particularly given that the geniuses who received the highest versatility scores are illustrious polymaths who attained eminence in multiple domains. Examples from her sample include Leonardo da Vinci, Benjamin Franklin, and Johann von Goethe. But White's inquiry has one unexplained quirk: The number of geniuses studied is 300, not 301. Cox's (1926) title had rounded the number to "three hundred," so maybe that caused some confusion. Yet the sum of Group A and Group B is undoubtedly 301 (= 282 + 19; Simonton, 1976). It is surprising that nobody caught the discrepancy, or why the error was even made in the first place. Worse yet, because White categorized achievement domains differently than

Cox, the identity of the poor omitted genius cannot be easily deciphered. The luminary may have just fallen between the cracks.

At this point a reader might ask, why am I talking about this study here rather than in the next section? Wasn't White the sole author? The rationale comes from two footnotes on the first page of the article. One says "The study was initiated by Lewis M. Terman, and carried out under his direction" (White, 1931, p. 460) and the other "Recommended by Lewis M. Terman, accepted for publication by Carl Murchison . . . " (White, 1931, p. 460). White at the time was a young graduate student in his first or second year. He was thus open (or vulnerable) to suggestions (or impositions) that might lead to publications. Yet the article exhibits a certain tension because White ends it with what can be seen as an overly negative criticism of the methodology. Sometime soon after publication, in fact, White switched topics, doing his PhD applying factor analysis to a personality assessment issue (White, 1937), and then worked with the famed Kurt Lewin at the University of Iowa and thus coauthored a classic experiment on the relation between leadership styles and interpersonal aggression (Lewin et al., 1939). Eventually, White became an eminent pioneer in peace psychology. The peace psychology division (48) of the American Psychological Association even sponsors a lifetime achievement award named after him—of which he was the first recipient. White was not an incapable grad student, but just had interests that did not coincide with Terman's (see also Simonton, 2019b).

Beyond Cox and Terman

Below I provide brief summaries of several studies that were in various ways inspired by Cox's (1926) pioneering investigation.

White (1930): The Mad-Genius Hypothesis. The same Stanford graduate student who studied versatility also seems to have published an earlier research note based on Cox's (1926) character ratings that looks more independent of Terman's influence. Entitled "Note on the Psychopathology of Genius," the name Terman appears nowhere in the article, not even in a footnote. Moreover, the methodology is inferior to that in the 1931 article under Terman's direction, implying that it might have been unsupervised. Finally, but perhaps most importantly, it deals with a subject with which Terman had no sympathy, namely, the mad-genius controversy (Terman, 1940). Following Galton's views, Terman deemed geniuses the brightest and the best *Homo sapiens* had to offer. That's why he, too, believed in eugenics, even if not so blatantly as Galton or Pearson (Simonton, 2017b). Yet it is curious that Catharine Miles-Cox was collecting data on psychopathology about the same time that White grappled with this very subject. At least these two of Terman's graduate students seemed less willing to submit to the party line (cf. Simonton, 2010).

While White (1930) was engaged in the character traits, most other researchers were fascinated by the IQ estimates, just as Terman was. At times, these scores were used for somewhat narrow purposes, as the following two examples indicate.

McCurdy (1957): 20 High-IQ Geniuses. McCurdy simply used Cox's scores to obtain 20 subjects with the highest IQs for an inquiry into the "childhood patterns" behind exceptional intellectual development (e.g., birth order, parental support, and isolation from peers). Unlike Cox (1926), but more in line with Miles and Wolfe (1936), McCurdy's investigation was purely qualitative, with no quantified measures or analyses of any kind.

Simonton (1986, 2006): Presidential IQs. In contrast to McCurdy (1957), Simonton (1986) used the IQ scores that Cox (1926) had estimated for eight presidents of the United States (from Washington to Grant) to validate an Intellectual Brilliance measure that he had obtained using a totally different methodology (viz. independent judges assessed anonymous personality sketches using an adjective checklist). Because the alternative assessments were highly correlated ($r = .70$), Simonton (2006) later combined these two measures with a third concerning Openness to Experience (Rubenzer & Faschingbauer, 2004) and then implemented iterative missing-value methods to obtain estimates for all three assessments, effectively providing Cox-like IQ estimates for every president between Washington and George W. Bush, inclusively. In line with Terman's and Cox's expectations, these IQ scores correlated between .31 and .35 with expert assessments of executive performance (but see Simonton, 2018b). It comes as no surprise that these IQ scores have received much attention in the popular media and social networks (see, e.g., https://moneywise.com/a/smartest-and-least-brainy-presidents).

Other investigators have taken advantage of Cox's (1926) IQ data to replicate and extend her results. There are three main illustrations.

Simonton (1976): Multivariate Analysis of 301 Geniuses. Simonton conducted a study that combined both Group A and Group B, but also added new measures based on Cox's biographical abstracts: father's status, education, and versatility (defined more restrictively than White, 1931; cf. Cassandro & Simonton, 2010). Although Simonton also found a positive association between IQ and achieved eminence (using Cattell, 1903), the relationship diminished substantially when placed in a complex multivariate regression equation that included both interaction effects and curvilinear functions. The likely implication is that the effects of IQ on eminence are mediated by other variables, such as education and versatility.

Walberg et al. (1978): IQ and Eminence in 282 Geniuses. About the same time as the preceding inquiry, Walberg et al. (1978)

independently focused on the Group A, and then examined how IQ correlated with new achieved eminence assessments from sources published after Cattell (1903), including as late as 1974. They obtained an overall product-moment correlation of .33, which is somewhat higher than what Cox reported for her Group A, which may be partly attributable to the ratio rather than ordinal nature of the eminence measures. Ranked eminence throws a lot of meaningful variance away.

Simonton and Song (2009): Childhood Mental and Physical Health. Three decades after the preceding two studies, an investigation augmented Cox's (1926) eminence and intelligence scores with her unpublished data on childhood physical and mental health (Simonton & Song, 2009). The net conclusion was "that eminence is a positive function of IQ and that IQ is a positive function of mental health and a negative function of physical health" and that "levels of early physical and mental health vary across 10 specific domains of achievement" (Simonton & Song, 2009, p. 429). From Terman's perspective, the negative correlation between physical health and IQ should be a bit disconcerting. It appears to endorse the "nerd" stereotype that he was trying to overthrow from the very get-go (Terman, 1925). Yet these are Cox's own data!

Simonton (2008): Giftedness and Eminence in Eminent African Americans. Last, I should note a historiometric study that replicates Cox's (1926) main finding—the correlation between intelligence and eminence—but does so via totally different creators and leaders as well as distinct measures of both intelligence and eminence. In particular, Simonton first had eight independent raters assess the youthful giftedness of 291 eminent African Americans based on anonymous abstracts of intellectual development, obtaining a highly reliable composite measure ($\alpha = .84$). He also had a different set of raters assess the same subjects on two eminence measures (one based on Black reference works and the other on White sources; data from Simonton, 1998) and the Creative Achievement Scale (Gray, 1966; Ludwig, 1992b; $\alpha = .81$ for the six-item composite). Even after introducing statistical controls for gender, birth year, domain of achievement, and whether the subject was still living (which was the case for 24% at the time), giftedness significantly predicted all three criteria (βs = .20, .14, and .25, respectively). This result is useful because both Terman (1925) and Cox (1926) relied almost exclusively on majority-culture samples.

Discussion

There probably have not been that many empirical studies of intellectual giftedness published in the mid-1920s that have survived the test of time. Yet, Terman (1925) is obviously one, Hollingworth (1926) another, and Cox (1926) a solid third, and not necessarily in third place! Moreover, Cox's IQ estimates have established a secure spot in contemporary popular culture. If anyone googles the surname of a historic genius that happened to have entered her sample, and then adds "IQ," there's a very high probability that one of her estimates will pop up on the screen. Depending on the search wording, an entire list of scores might even appear. More important, we have just seen in this article that her contributions have continued to inspire research well into the 21st century. That influence is justified by the simple fact that most if not all of her research subjects represent incontestable exemplars of genius. They constitute what have been called "significant samples" (Simonton, 1999). These are persons about whom whole biographies are written and thus have interest beyond making up mere research samples.

That point deserves emphasis whenever discrepancies appear between the intellectually gifted and the outright genius. Both Terman and Cox had assumed that the retrospective inquiry was just a longitudinal inquiry run in reverse. Geniuses would have scored at gifted levels on the Stanford–Binet had we a time machine to transport ourselves back centuries. Yet for many reasons that temporal equivalence may not always work (Simonton, 2016). For example, children who are favored to take special IQ tests owing to teacher nominations are not equivalent to deceased adults who get selected for their pervasive and enduring contributions to human civilization. Psychometric and historiometric "tests" even differ. The Stanford–Binet assesses intellectual development of a highly generic sort—competencies that all school children are expected to acquire given sufficient time. In contrast, Cox's raters had no other choice but to gauge IQ according to more domain-specific intellectual growth. Mozart's IQ is based mostly on his musical development, Pascal's on his mathematical development. Had it been reversed, neither Mozart nor Pascal might have qualified as geniuses. In Mozart's case, for example, a contemporary scientific observer actually reported that for all of the prodigy's performance mastery, his nonmusical behaviors still reflected his chronological age (Barrington, 1770). At the keyboard little Mozart was superior to his own father, a professional musician, but when not showing off the 8-year-old would hop around the room on his hobby horse.

Another example concerns developmental backgrounds and experiences (Simonton, 2016). Most obviously, Terman's (1925) sample consisted almost entirely of a single cohort of boys and girls raised in the state of California. In contrast, Cox's (1926) sample included geniuses spread across four centuries and representing more than two dozen nationalities. Her sample was also more heterogeneous with respect to socioeconomic background as well. Where the Termites predominately came from middle- and upper-class families, with a third having fathers in professional occupations, her geniuses originated from families ranging from semiskilled and even unskilled to business and even nobility. But the most remarkable discrepancy did not become apparent until many years later. The post-Cox historiometric research on achieved eminence has revealed the developmental impact

of what have been called "diversifying experiences" (Damian & Simonton, 2014). These are events and conditions occurring in childhood and adolescence "that help weaken the constraints imposed by conventional socialization" (Simonton, 2000, p. 153). Such developmental influences encompass the death of one or both parents, intrafamilial conflict, economic instability, geographic mobility, multicultural backgrounds, and cognitive or physical disabilities (Damian & Simonton, 2015). Diversifying experiences appear to be especially critical in the emergence of geniuses in the arts (Damian & Simonton, 2014). Yet a striking feature of the Termites is how so many grew up in highly stable and conventional homes (Terman, 1925). Not surprisingly, very few Termites made a big name for themselves in artistic endeavors (Terman & Oden, 1959).

One final illustration regards the closely related mad-genius issue, a question that is far more intricate than most researchers realize (Simonton, 2019a). For instance, one historiometric study showed that the relation between achieved eminence and symptoms of psychopathology not only varies among domains but also can adopt either linear or curvilinear forms (Simonton, 2014). These niceties are less likely to be detected in longitudinal studies in which selection procedures at the front end combine with progressive attrition due to mental health issues. It is of interest that the unpublished data that Cox Miles collected for Miles and Wolfe (1936) indicated that the poets, novelists, and dramatists (i.e., Cox's, 1926 "Writers PND") were more prone to display inferior mental health even in childhood and adolescence (Simonton & Song, 2009). White (1930) also had pointed out the high rate of early "psychopathic traits" among the creators in this group. Although Volume V did report that some of the Termites at midlife had written plays, novels, and other fiction, these products may not have reached the level necessary to earn major awards (Terman & Oden, 1959). And the failure to list poetry among the accomplishments may be telling, because poets have consistently shown the highest risk of psychopathology—including suicide—among eminent creators (e.g., Ludwig, 1992a; McKay & Kaufman, 2014). Indeed, one eminent poet in the Cox's Group A, Thomas Chatterton, committed suicide at age 17. If he were a Termite, he would not have survived until Volume IV, when the average age was 29 (Terman & Oden, 1947). Hence, it is conceivable that this tendency might affect either initial selection or cumulative attrition in longitudinal inquiries.

Conclusion

Despite the striking contrasts between Terman's intellectually gifted children and Cox's eminent achievers, research following the publication of *Genetic Studies of Genius* has clearly favored the longitudinal approach over the retrospective approach (e.g., Subotnik & Arnold, 1994). A prime example is the Study of Mathematically Precocious Youth initiated in the early 1970s that has followed multiple cohorts into adulthood (Kell & Lubinski, 2014). Although such inquiries have greatly advanced our understanding over what was gleaned from the Termites, the alternative approach that Cox advocated has yet to realize its potential contributions. What is needed is a retrospective study that not only replicates Volume II but also extends it in multiple directions. In particular, it should be possible to (a) broaden the sample of geniuses to included more women, nationalities, subcultures, and domains of achievement (e.g., Damian & Simonton, 2015; Simonton, 2018a); (b) update the personality measures to incorporate the Big Five Factors as well as other potential individual-difference variables that have emerged in the past century (e.g., McCrae & Greenberg, 2014); (c) introduce a larger number of developmental variables, including those assessing diversifying experiences (Damian & Simonton, 2014; see also Walberg et al., 1979); and (d) institute more sophisticated multivariate analyses that integrate all of the new assessments in a manner worthy of 21st-century research (cf. Simonton & Song, 2009). If sufficiently well executed, such a post-Cox study could be worthy of placement as honorary Volume VI in *Genetic Studies of Genius*.

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