GENIUS, EXCEPTIONAL INTELLIGENCE AND ITS MEASUREMENT:

A SERIES

Vernon M Neppe MD, PhD

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Vernon M Neppe [ab]

A personal perspective to the approach to exceptional intelligence.

There is now a literature with thousands of papers on Human Intelligence.[c] Yet some topics, such as creativity and genius have attracted far fewer peer reviewed publications, and far more layperson speculations—like anyone scoring at Mensa level [d] being a genius! This is grossly inaccurate.

Although over decades of study, I have become familiar with much of the intelligence literature in the area, and my database is well over 4000 plus references—books and articles— I do not want to overwhelm the reader with citations. Instead, I will restrict the references to essentials, not so much to justify some of the points I make, but to focus on an essential core illustrating the precedent for some of the ideas, because ironically, almost every point on Intelligence Research still has some level of dispute.

I am fortunate to have learnt from several individuals whom I have worked with and whose ideas have been very useful in forming my own. Amongst the members of the Exceptional IQ groups, I am especially appreciative to Bob Williams, who is encyclopedic in his ideas on the area. I also very much appreciate Dr. Greg Grove and Stevan Damjanovic [1; 2] who were important contributors on our SCHIQ research and who have suggested important ideas. I am pleased to recognize the participants in a detailed ISPE The1000.Ning.com Intelligence discussion over several months which helped consolidate many of my ideas.

I have also recently benefited a great deal from an excellent discussion by Kevin Langdon with the doyen of Intelligence research, the late Dr. Arthur Jensen [3]. I particularly recommend this wonderful interview, not the least bit because several of the points I have made prior to encountering this interview correspond significantly with the views expressed by Dr. Jensen during this interview.

I am also grateful to the many of you who have developed your own high-level psychometric tests of varying strengths and values. Those actions, in themselves, have contributed to a broader debate of trying to solve the seemingly insoluble question of how to characterize exceptional

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[b] We thank the Pacific Neuropsychiatric Institute © for permission to publish.
[c] This refers to mental / cognitive abilities in the human. This differs for example from military or animal intelligence.
[d] Mensa membership is based on the individual's IQ score being above the 1 in 50 level of the population. This is equivalent to the top 2% of the population or an IQ of 131 applying the commonly used standard deviation (SD) in IQ research of 15.

intelligence. In that regard, besides the SCHIQ [1; 2], I also had the unique opportunity to professionally consult on the latest WAIS IQ test. However, with means of 100, the WAIS only has limited applications to exceptional intelligence.
I mention these points because this gives the reader a perspective of how I've developed my opinions based on some personal data [e].

In this paper, I focus specifically on exceptional intelligence and how it differs from genius. I express the distillation of my thoughts in six related sections: First, I portray my thoughts on several IQ concepts emphasizing exceptional intelligence (EIQ) and exceptional creative achievement (ECA). I then differentiate prodigies and suggest a comprehensible perspective of the concept of "genius". Most exciting may be describing a new way to evaluate exceptional intelligence, namely the development of a historical based intelligence test (the SCHIQ) [1; 2]. This plus the earlier background allows me to amplify the "c" (creativity) factor and several other new "factors" that may be pertinent to the concept of genius.

In these brief sections, I amplify 6 linked concepts. Each one builds on the previous sections, and I list these here, with only minimal amplification.
1. Exceptional intelligence: The limitations in the concept of IQ, describing some basic principles, likely well-known to many of you.
2. The old factors, g and s: Spearman's "g" is for "general factor" in intelligence; his "s" is for "specific factor" in intelligence. In the consequent mnemonic I am suggesting "GENIUSES", it is the G and first S. This includes information likely known to students of human intelligence.
3. The concept of genius, exceptional creative achievement and prodigies: a new perspective.
4. Development of a entirely new historical based intelligence evaluation (the SCHIQ [1; 2]):
5. The property of creativity. The "c" factor of creativity: In the GENIUSES mnemonic I suggest, the "c" changes to the U for unique, as in "unique creativity".
6. The new factors besides creativity:
"z" factor for zeal: the z is not in GENIUSES so changed to the E; the energy, the second E in the GENIUSES mnemonic;
"a" factor for achievement: the S for "skills manifesting as cultural achievement" reflects the second S in the consequent GENIUSES mnemonic I suggest;
"e" factor reflecting ego-strength: as in the first E ego-strength in that GENIUSES mnemonic;
" i" factor as in intuition /inspiration: as in the first I intuition in that GENIUSES mnemonic;
"n" factor reflecting nervous system integration: as in the first N intuition in that GENIUSES mnemonic.
Those familiar with specific sections like #1 and #2 may want to skip those sections.

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Exceptional intelligence: The limitations (Section 1).

Vernon M Neppe [fg]

Perspective: The conundrum of exceptional intelligence.

Under the auspices of Exceptional Intelligence, there are those who will point to those with IQ scores above the 1 in 1000 level of rarity. This is a reasonable approach because measuring scores above that level are fraught with difficulty. Some would be even more stringent requiring those with intelligence levels at the statistical 1 in 3000 level or above. However, such measurements have significant confounding factors. Importantly, whatever the level of Exceptional Intelligence applied, this is very different from the label of "genius" although in my opinion, the genius needs to exhibit exceptional intelligence based on convergent thinking as one necessary requirement. This means scoring at the Exceptional Intelligence range on regular high-level battery type IQ tests.

Already, you may be saying but what about the obvious exceptions, Nobel Laureates Richard Feynman, the "people's scientist" (with an anecdotal 125 of IQ), Drs. William Shockley, inventor of the transistor, and Dr. Luis Alvarez, inventor of the liquid hydrogen bubble chamber, who narrowly missed the Terman qualifying scores of 140 IQ (SD 16, so sigma[h] of 2.5)? [4-8] The essence here may not be *"What is the IQ score, but what did the subjects score on the proper measures of intelligence applying the construct of creative skilled performance?"* Moreover, the questions here arise about the limits of the testing that may have been done, the compromises of their "convergent" IQ scores (one on one answers) with any divergent thinking (creative awarenesses), and the fact that genius is very different from winning a (not peace) Nobel Prize.

IQs in the Exceptional Intelligence range are very difficult to measure for many reasons:

1. Because divergent skills in intelligence become increasingly relevant: Effectively, often there are many ways to solve the same problem and there may be several solutions. Consequently, a single correct answer to even a high level intelligence battery might reflect the limitation of the test author or of the test itself, but it might not measure the appropriate validity construct of Exceptional Intelligence [1; 9-11]. The highly intelligent creative individual may score less as a consequence. [12-16]
2. Numerous different tests have been developed. These focus either on several general aspects of intelligence or specific components.
    a. Some tests have problems of limits, for example, the IQ tests that are developed for the population (mean 100 score) exhibit increasing variance as the scores go beyond 2 standard deviations (IQ >130 or above the 96.7%-ile) and even more beyond 3SD (IQ>145; 1 in >741). This means that the scores are increasingly flawed and

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[h] Sigma refers to the number of standard deviations above (+) or below (-) the mean IQ (of 100).

unreliable.

b. Some focus on specific qualities. For example, so-called *"culture free"* tests [17] may limit intelligence qualities that should be tested for. Moreover, some high-level batteries may concentrate on *specific* qualities like problem solving: Whereas this may correlate strongly with what we call the g-factor (or "general" factor) in intelligence [i], a single specific skill, like problem solving, still has its own limitations and does not correlate well with clusters [18 19; 20].

The problems of scoring exceptional intelligence

These relate, inter alia, to:

1. samples

- How does one find suitable subjects as they are rare?
- And, if so how does one know what their intelligence level is anyway to establish if they are within that sample?

2. construct validity

- What outside measure can one use to demonstrate the IQ?
- Who proves that they have those levels of intelligence?

3. validity and reliability of arbitrary test instruments:

- Let's say a subject scores 30 on a test that a developer has constructed so as to measure exceptional IQs. Let's say according to the score on that test, it may be converted to a score quantified at "3 sigma", which is equivalent to an IQ of 145 when applying a standard deviation (SD) of 15:
    - But who says this is so?
    - On what basis? Is the test constructor the one who decided?
    - And does that imply that because someone agrees with the test results, they are correct?
- On another level, what about scores on the "SAT" and related scholastic tests like the "ACT" or graduate level tests like the "MCATS" in the USA [21]?
    - These historically correlated reasonably with IQ scores at the usual range up to say 2 Standard Deviations.
    - But what about the "sky limit" scores? These are the maximum scores that the test can attain.
    - How much variance (variability in error) was being reflected at those extremes?
    - How much does the fashion of specialized training and course work preparation for the SAT (or the other tests) impact scores? Do these scores now reflect the SAT score, but little else? The same could be said for the ACT and the MCATS.
    - Eventually, these tests targeted to measure real life constructs move away from IQ in the context of a score that is supposedly unmodifiable.
- What about the individual who does not admit to doing particular IQ tests several times, learns answers that are correct, and scores higher each time?
    - We would know the test is invalid, but when it's not admitted to, that does not help

[i] g-factor in intelligence:

obtaining an honest measure of so-called IQ. This appears to be a potential problem in the high IQ societies.

3. *What about creativity—surely this also is highly relevant when examining individuals with exceptional intelligence?*
    - Yes, as indicated, creativity may cause respondents to answer incorrectly.
    - Similarly, sometimes the candidate may know too much to answer correctly, not because of creativity but because of greater expertise in the area, where the test constructor might not realize there are better answers.

We see that in chess certainly, for example, what I call examples of "correct incorrectnesses". That chess analogy I implied is useful to illustrate the multiple different levels. Sometimes, rarely, the "better move" is what turns out to be the inferior one, because that ostensibly "superior" move may be refuted by an even more superior one. So the irony is you could have won that same game by not being good enough to lose—not seeing the dramatic better move. And yet, that better player, at the same time may not be good enough to win because he cannot see the refutation to what he deemed the better move. There is a depth to chess and sometimes a player may choose what a grandmaster would play, but not for the same reason.

Careful interpretations:

Of course, obvious elements relate too to Standard Deviation (SDs) of the Test.
Many IQ tests are scored with SDs of 15. This means that 3 SDs from the mean of 100 would be 145 (1 in 741).
If SD is 16, that is 148 as in Stanford Binet test; if 24 as in some Cattell versions it could be 172.
In each instance the equivalence must be calculated. To say someone has an IQ of 148 is meaningless until the SD is applied. (SD=15, 1 in 1455 e.g. WAIS; SD = 16, 1 in 604 e.g. Stanford Binet; SD=24, 1 in 44 e.g. Cattell)
Rodrigo De la Jara's Table [22] of IQ Percentile and Rarity at http://www.iqcomparisonsite.com/IQtable.aspx portrays the statistical difference applying SD of 15 and 16. It becomes a source of easy comparison.

Scoring in children

Moreover, it's even more difficult to understand children's scores because some may be problematic based on ratio scale calculations and figures suggesting far more individuals with exceptional IQs than expected, particularly in the very exceptional ranges.
Vernon (also called Geoffrey Thomas) Sare in 1951 followed on (what is called) "lognormalized" data suggested by John Scoville and Robert Dick, suggesting that there is a far, far higher likelihood of children and possibly the consequent adults scoring very high IQs on ratio scoring. Much of the data arose from the Terman children, but the projections were such that clearly this involved extending the presupposed normal distribution curve. For example, a ratio IQ of 196 (SD 16 so 6 sigma) was 3500 times more common than it should have been. The problem is there was no-one in that data set approaching 196. On the other hand at an IQ of 141, just twice as many showed a deviation frequency of occurrence than the ratio IQ frequency. This data has not been taken seriously, to the extent that there is debate as to its veracity. [23].

By having a ratio scale, the phenomenon and its magnitude are clearly established by the raw measurements, whatever may be their cause [3]. The problem is that such a normal distribution does not occur and the curve in any event, like many psychological phenomena is assumed to be ratio (it does not have zero, but is "parametric" because it can be linked on a number line) when much of our data is ordinal (it is non-parametric; ordered in the series).

Distribution curves

The above data does introduce something very important and that is that is very unlikely that to the right of the normal Gaussian distribution curve that certainly seems valid up to 2SD above the normal, that IQs are normally distributed.

There is indeed data showing they might correspond with what Cyril Burt called a Pearson Type 4 correction [24] [3] and the distribution should be regarded as ratio at all but ordinal clusters. This has been supported by Hans Eysenck [25; 26] [j]

The Terman data does not take "late bloomers" into account concentrating on "early bloomers". [4-8]Jensen points out that the late bloomers may substitute for the earlier ones, producing a population distribution that may be similar in adults and children, although individually one on one their scores may not correspond. [3]

The Flynn effect

The so-called Flynn Effect is named after the New Zealand psychologist who described it James R Flynn and was initially described by Richard Herrnstein and Charles Murray [27]

The 'Flynn effect' is the name that has become attached to the exciting development, that the twentieth century saw massive IQ gains from one generation to another.

The whole controversy on the so-called Flynn effect: Effectively, people score higher IQs today in many countries and cultures [28-36]. The question is why, and the jury is still out on this as it can be answered both ways:

Is this because they are more intelligent? Proponents argue that education and exposure to new information increase their scores and they have better nutrition. Opponents argue the tests are developed such that they can score more on the same questions because of different exposure, or that culture free tests are fairer (sometimes called "culture fair"). The scores are elevated too when individuals "prepare" for their "IQ tests" or now such tests as the SAT or MCATS or equivalent. However, this is not all of the story.

Robert Williams point out that the Flynn Effect:

- exists between birth cohorts;
- is found within sibships;
- appears early in life (before school age);
- has presumably multiple causes;
- has gains that are mostly not meaningful;
- has serious methodological issues to be resolved and which may be a major cause of the

[j] P58 of "Genius"

gains;
- is not invariant over time.

The Flynn effect is very difficult to resolve. [37; 38]Essentially, we're living in a different world today to our world of several decades ago. This means comparisons are very difficult, indeed to make. Today, we will have new skills and have lost other skills. [28-36]

The best single study of was done in Denmark with military conscripts. The lower portion of the IQ distribution showed larger gains than the higher end, probably because in the more recent decades more of the lower portion under the bell curve received more educational attention and better education, and also probably better pre- and post-natal health care and nutrition. [3k] As Jensen indicates: "Whatever causes the rise in IQ, it has its greatest effect on those at the lower end of the scale, with a corresponding shrinkage of the standard deviation." [3l]

Thus, I propose that even it were true, it is likely does not affect EIQ individuals very much. Most of the researchers who have addressed the issue have argued that the gains are hollow [28; 29], with exceptions [39] like Colom [39], who argued that there is at least some genuine gain in intelligence. This inconsistency may be due in part to different data sets and methods.

Effectively, there is no reason why younger individuals should be more intelligent than older ones, other than a different environment such as increased preparation for testing, and more consistent health at the time of testing.

Indeed, many tests do not take into account the circumstances. A mean of 100 in the population may be based on say 5% or even 20% of candidates not being optimally available, for example, they may be ill, distracted, sleep deprived or reacting to medication. This may result in the mean IQ appearing higher, but they are confounding rather than fundamental intrinsic factors.

A parallel time-based question is *who was better at chess amongst four great world champions, Jose Capablanca, Bobby Fischer, Garri Kasparov or Magnus Carlsen?* If you use all of what is available today, every later world champion would beat the earlier one because there is more "chess theory" that has been mastered. But was that later player inherently better? We can debate that. Today part of professional chess is computers; before it never was. Today, there is so much chess knowledge that someone playing at a Master's level could conceivably have beaten a Geza Maroczy who was at his peak say in 1903. [40] On the other hand, computer programs are now achieve extremely high levels of play. Remarkably, applying an analysis algorithm to such a champion computer, the great Paul Morphy in the mid 1800s scored in fact as well as later and current world champions in the middle game! After 160 years, the best computers are hardly better than Paul Morphy. [41]

Finally, there are variations amongst populations that apparently have shown a consistency in the

[k] p49-50
[l] p48-50

variation even over time. Some populations appear to score higher, for example, Ashkenazi Jewish populations may score a mean of 10 (in different research the range is 5 to 18 IQ points) above the average population definition of 100 [42; 43] That difference is huge, but it raises the age-old chicken-egg question: Is this difference genetic or is it learning or is both? The likelihood is that it both, and that this reflects a complex issue where we might need to analyze differences in and changes over time for that population over childhood to adulthood to senior years.

Sources of variation of IQ scores:
A major one may be not taking into account Standard Errors. In psychometry, individuals know that each individual subtest varies: Commonly, a single Standard Score in an IQ test may vary greatly statistically. For example, an individual test sub-score of 10 may reflect (depending on the statistics) a variation from the mean of say 3. This means that the person may score between even 7 and 13 in say two thirds of cases. The total score may show a 1.5 the variation and that would be say 8.5 to 11.5.

Because IQ scores are variable, the more confirmation the better and this can be based on several tests. The problem is that often tests have a "sky limit". Eventually, when one correlates many different scores the variation becomes less and less. This is why clustering several IQ tests together may be more accurate than one, particularly when looking at the Exceptional Intelligent population—but this is so, of course, only if each test does not exceed its maximum limits.

IQ scores have more variance the further away from the mean, they go.
When the WAIS IQ test is done, the mean, median and mode for the population should be standardized for IQ 100 mean with the standard deviation of 15. By the time it reaches 2 SD (130) already there is more variation. [3] There are questions of standardization by 145 and it is likely that one cannot even score above 3.2 or 3.4 Sigma – IQ scores of 148 (SD 15) or 151 (SD 16) reflect outer limits. So it is difficult on conventional standardized IQ scores to score above 1 in 1000 or 1 in 1400 certainly. However, new high level battery tests are set with different norms concentrating on the high IQ population.

Individuals with exceptional intelligence (EIQ)
How does one address these problems for exceptional individuals?
First, the construct needs to be different. It has to reflect something real such as real life achievement.

Second for individuals who are extraordinarily intelligent, there needs to be more than just convergent intelligence (answering a single very complex question with one correct answer). This is the nature of many of these high level batteries. Moreover, these assume a continuity on the curve projecting upwards despite the absence of or minimal sample size. [3]. Neither may be correct: The distribution curve is as indicated likely non-linear, and the projection to higher levels may not take into account limits to the projection, and even if there were no limits, there is no empirical data to support that and also the tests are ordinal and not interval. [3].

Moreover, new qualities such as creativity come into being. There is more than one answer to a question. A favorite of mine is *"give me as many ways you can in which you can show how the eye and ear are similar."* An outstanding answer may be to supply at least thirty, even forty answers. That reflects divergent thinking.
But that is insufficient. How is this translated into the environment of life? So, the very divergent thinker can supply a remarkable number of answers to a trivial creativity question. Does that mean that they can generate exceptional creative achievement? The paper below cogently proposes that there is far more to genius than just creative divergence and IQ test convergent skills.

Also, it may be that some creative demonstrations are too far ahead of the curve.
Galileo may have argued about the earth being round, when everyone knew it to be flat.
And Einstein spent from 1915 to 1919 frustrated that no-one could prove special relativity.

Such are the travails of creative advanced thinking.
But at the end, the title “genius” is not something that one labels oneself. It requires the bestowing of public recognition. To me, that recognition must conform with the specific genius criteria that are stipulated.

The "Old" Factors in Intelligence Research ("g" and "s") (Section 2).

Vernon M Neppe [m] [n]

Charles Spearman in 1904 recognized there may be certain mental abilities that may be common to many aspects of intelligence. This became known as the general (or g) factor. But there were also abilities that were needed and specific (s factors). A musician benefits from "tone", an artist for "color perspectives". But these do not correlate highly with many mental abilities.
These g and s factors are both required as ways to convergently think in geniuses.

There are other factors, too but those are new and will be discussed in Section 5 and 6 because the development of historical features for prodigies and successful adults in Section 3, may give us some clues.

The g-factor

The g-factor allows intelligence scores to be expressed by a single number, which we call IQ or Intelligence Quotient score.

Spearman*'s psychometric g* factor involves the cluster of tests that refers to the existence of a general intelligence. This is responsible for overall performance on mental ability tests and on all cognitive tasks.
[44; 45 46; 47]. It's as important today as it was a century ago. Jensen [46-49] indicates that almost all present-day researchers in psychometrics now accept that individual differences in all complex mental tests are positively correlated. Moreover, applying a hierarchical factor model, consisting of a number of group factors, g is at the apex—the highest level of generality— and best represented by the correlations of mental abilities. Effectively, all factor analyses of IQ test data produce a single factor (g). That factor is found using factor analysis procedures, even when the first order factors are extracted pointing to a unitary latent factor.

The "generality" of g is because it's found in conjunction with every other intelligence factor. [47] It represents a combination of all of the distributive criteria that contribute to intellectual processing everywhere in the brain. [o3]

However, the IQ scale we use is not a true interval scale (though we assume it to be such). We therefore cannot fully extrapolate linearly the g loadings to any endpoint. [3]

We could look at g like a thermometer.
It measures temperature but could correlate with blood count and metabolic rate, but it measures

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[o] P71

temperature mainly. G is the distillate. [3] [p]It isn't a mixture, but a *distillate* of this one factor where g is *a unitary individual source of limited variances that measures the restricted differences common to all cognitive tests, however diverse.*

Crystallized and fluid g. [50; 51]

Raymond Cattell divided general intelligence into 2:

- Fluid intelligence —$G_{F:}$ This is the ability to reason quickly and to think abstractly. It is our current ability to reason and deal with complex information around us. This type of intelligence tends to decline during late adulthood: Like a fluid, it can run away.
- Crystallized intelligence — G_C: This kind of g involves learning, knowledge and skills that are acquired over a lifetime. It, so to speak, crystallizes over time.

Whereas these concepts are worth mentioning, at this point, the idea of g is far more important and we seldom differentiate the kind of g.

Key elements of "g" in regard to intelligence testing

What elements make up "g"? One useful approach is simply to list our latest adult IQ test, the WAIS-4 (the Wechsler Adult Intelligence Scale version IV). David Wechsler [52] recognized this early and his scale was founded on his definition of intelligence *"... the global capacity of a person to act purposefully, to think rationally, and to deal effectively with his environment."*
He regarded intelligence as made up of specific elements that could be isolated, defined, and subsequently measured. These individual elements were interrelated and composed of various specific and interrelated functions or elements that can be individually measured. So this is the epitome of "g".

The latest version of the WAIS-IV The WAIS-IV (2008) has10 core subtests comprising the Full Scale IQ with five supplemental subtests.

The verbal/performance subscales from previous versions were removed and replaced by the index scores.

The WAIS-IV (2008) has10 core subtests comprising the Full Scale IQ with five supplemental subtests. The raw scores on a test are converted to normalized z scores and then converted to IQs, ensuring that the IQs are normally distributed in the standardization sample. If we assume that intelligence should be normally distributed, and if the IQ distribution is made perfectly normal (i.e., Gaussian), then we can claim that IQ is an interval scale. But it's not "There is nothing that actually compels these assumptions; they are merely plausible and statistically convenient." [3]

Intelligence tests and "g"

The WAIS-IV [53] was standardized on a sample of 2,200 people in the United States ranging in age from 16 to 90. An extension of the standardization has been conducted with 688 Canadians in the same age range. Therefore to talk of someone who is 1 in 1000 in intelligence reflects an

[p] p5

extreme. The degree of variation would be significant and theoretically, this was based on one subject, which is fair enough because the distribution curve would be potentially skewed at that point, unless statisticians reconverted to a normal distribution curve arguing the upper limit of IQ was 155.

The ones that possibly are most linked with g-factor are marked with an X in that these scores remain maintained over time.

Table 1: Subtests of WAIS-IV

Verbal Comprehension	***Core***	***Proposed abilities measured***
Similarities	X	Abstract verbal reasoning
Vocabulary	X	The degree to which one has learned, been able to comprehend and verbally express vocabulary
Information	X	Degree of general information acquired from culture
(Comprehension)		Ability to deal with abstract social conventions, rules and expressions
Perceptual Reasoning	***Core***	***Proposed abilities measured***
Block Design	X	Spatial perception, visual abstract processing, and problem solving
Matrix Reasoning	X	Nonverbal abstract problem solving, inductive reasoning, spatial reasoning
Visual Puzzles	X	Spatial reasoning
(Picture Completion)		Ability to quickly perceive visual details
(Figure Weights)		Quantitative and analogical reasoning
Working Memory	***Core***	***Proposed abilities measured***
Digit span	X	Attention, concentration, mental control
Arithmetic	X	Concentration while manipulating mental mathematical problems
(Letter-Number Sequencing)		Attention, concentration, mental control
Processing Speed	***Core***	***Proposed abilities measured***
Symbol Search	X	Visual perception/analysis, scanning speed
(Digit Symbol) --Coding	X	Visual-motor coordination, motor and mental speed, visual working memory
(Cancellation)		Visual-perceptual speed

Algorithms: learning and innate

An algorithm is a process or set of rules to be followed in calculations or other problem-solving operations. Commonly computers perform this today. But it is a fundamental skill of g. However, various thinking or problem- solving algorithms can be trained and even made automatic through extensive practice. There are thousands of algorithms that one can learn in chess positions for example.

Learning new algorithms is still a skill. Neuroplasticity may be relevant in training, and the innate capacity for learning may reflect individual differences in pertinent brain attributes. [q] [3]

What feature then makes for g? It may be the acquisition of specific algorithms for thinking and problem- solving per se, may be the basis of the g factor. Algorithmic training is remarkably specific to a particular subject-matter and has surprisingly little transfer beyond the material on which it has been trained. [r] [3]. However, this is one of the problems with most conventional IQ tests, both verbal and nonverbal tests as not only is G being measured but learned algorithmic thinking and problem-solving skills [3]. These confound in the total score on the test. Ironically, therefore, it may be that a young prodigy is reflecting more g because he/ she has not learned the algorithms that adults do. IQ tests, are intended to assess g not special abilities unrelated to IQ necessary in outstanding achievement. Therefore, sufficient "g" may be a necessary, but not sufficient for Exceptional Creative Achievement.

Algorithmic learning is a big problem, often insufficiently recognized by the users mental ability tests. It is much less a problem in explicit achievement
tests. [3] [s] An algebra test, for example, may be a poor way of assessing g, though it's a good way to find out where a person stands in knowledge and use of algebra.

"g" is a factor common to all mental abilities. [t]These various mental abilities in many different can be hierarchically classified by factor analysis of their generality—the amount of variance they have in common with other tests and other factors. The factor called g (for general) is at the top of the hierarchy only because it is the one factor that all other mental abilities have in common. [47] [3u]

For many types of subjects and skills, high levels of mastery depend upon a fairly high g threshold. E.g. Abstract problem solving is highly g loaded, more than simpler or less abstract problems, and provides a relatively quick efficient method of measuring an individual's IQ relative to their reference population. IQ tests are intended to assess the g factor and therefore they include mainly test items that best reflect g. [3v]

To Jensen, the g factor will eventually be explainable completely in terms of brain physiology[w]. Genetics makes a rodent more intelligent than an insect and a primate more intelligent than a rodent, and human beings differ in genetic constitution from other primates, g is biologically plausible as well as empirically confirmed.
Some of these criteria clearly have a genetic basis, e.g. neural conduction velocity, neural and synaptic density, size of brain and grey matter density, quality of neurotransmitters, control

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[q] P45-46
[r] P45-46
[s] p45
[t] P6-7
[u] Chapters 3 and 4; p6
[v] p7
[w] P21

mechanisms, glial density or degree of axon myelinization. Even locations in the brain (e.g. the fusiform area of face recognition may be useful in certain chess skills, such as visualization of the board blind-fold [54] although I would postulate this is likely an s-factor, not a g-factor though not evaluated as such.

We could look upon g as the clinical thermometer that measures temperature but could positively correlate with blood count and metabolic rate: g isn't a mixture, but a *distillate* of the one *unitary individual source of limited variances —a factor measuring those restricted differences common to all cognitive tests, however diverse.* [3x]

Three facts are clear.
(1) There is a g factor,
(2) the distribution and overall level of g in the population is causally related to the level of civilization and the quality of life in a modern society, and
(3) g is highly heritable (i.e., influenced by genetic factors). [y 3]

Genetics of g
Genetically, Robert Plomin and others have already identified several different sections of DNA (for example, on chromosome #6) which reliably differ between large groups of people of average IQ and of very high IQ. [z 3]

This research is progressing at an accelerating rate as the human genome becomes more comprehensible. The importance of such research is to trace just how the identified genes chemically and electrically affect the development of the brain variables that cause individual differences in g. The heritability of IQ and of psychometric g as the main basis of IQ heritability has long applied quantitative genetics based on the correlations of various kinships such as monozygotic and dizygotic twins reared together and reared apart. [aa 3]

The g loading of a given test or some lower-order factor in the factor hierarchy does not reflect the measure of importance of the given ability but of its generality.
Any kind of intellectual pursuit always some minimum threshold level of "g ability": But often that degree is correlated only slightly [3; bb]. This is where "s" and other factors come in.

Specific factor: The s-factor
The "s" factor is a well known element in intelligence research. "s" is for specific as differentiated from "g". We are dealing with special abilities in "s". These were originally advanced by Charles Spearman in 1927: his "two-factor theory" and research looked at factors "specific" to each test as opposed to general [55; 56].

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[x] p5
[y] P76
[z] p79-80
[aa] p80
[bb] p7

Whereas there are strong "g" correlates overall in intelligence, there can be aspects of testing where specific individuals demonstrated widely different ranges of special skills: They have lower correlations with "g" and are therefore are not part of the distilled "g" in overall "intelligence testing" scores. However, the variation in individual testing is very useful in neuropsychological interpretations. We seldom need to talk about "s" per se. But it's valuable because there are individuals whose score vary enormously on certain subtests. And also a great deal is sometimes not measured in some IQ tests: Robert Sternberg developed a Triarchic theory [57-60] and Howard Gardner wrote about seven talents [61], for example.

But individuals with *exceptional intelligence* may exhibit special aptitudes and abilities, with special abilities relating to highly developed "s" in specific areas which far exceed their general "g". When we conceptualize very high g individuals (equivalent to *exceptional intelligence)*, for example those less than one in a thousand, we might find they may exhibit those certain special, specific aptitudes and skills, equivalent to "s" but not necessarily because these correlate positively but only to a limited degree with "g".

Some "s" scores may not even be measured on IQ testing: For example, great music, profound art and literary abilities.

There are special abilities that do not broadly correlate with other intelligence mental skills. However, they reflect many skills and abilities that are essential occupationally.
For a musician: Pitch discrimination has low g loading (r ~.30), is a crucially important ability
For an artist: Hue discrimination also has a g loading (r ~.30) and is critical.
But the musician does not benefit from great hue discrimination, and the artist does not need hues!

The best illustration of s factor may be for the (so-called but inappropriate term)*"idiot savant"*. He may have a very high level of some special ability but this combined with a very low g score (and hence IQ). But this skill is seldom important enough to reflect any exceptional creative achievement (ECA). [3]
These s-factor skills still correlate positively but only to a limited degree (like r=0.30). No tests known, so far, exclude some degree of correlation with g. [cc] However, the g factor, can be mathematically "regressed out" of a measure of some other factor that we wish to measure independently of g. This is how one can by factor analysis and regression calculate out basic musical aptitudes, such as discrimination of pitch, duration of tones, timbres, and memory for rhythms. These are all correlated with g but to a limited degree, and one may be interested in measuring these independently of an individual's level of g. [3]

The s factors and g factor together

The rare constellation of traits, like g + special abilities can really help with success. Add to this motivation and character, and this will determine whether potential exceptional individuals can identify important problems, and secondly, be able to solve them or at least materially contribute

[cc] P12

to their eventual solution. [3dd]. There can, of course, be several "s factors" as there are several skills potentially involved.

But is this sufficient for genius? I do not think so. Some of these individuals may even be exceptional, but they might still not be geniuses. Certainly, those who receive Nobel (not Peace) or Pulitzer prizes, or may have developed new patents, or founded a new journal on a new topic, or have become Fellows of the Royal Society all may be substantiating remarkable achievements, but, with great respect, they need to combine a cluster of remarkable qualities together into a composite for me to regard them as geniuses.

[dd] P24

The concept of genius and prodigies (Section 3)

Vernon M Neppe [ee] [ff]

Genius, the term

I maintain that the term "genius" is bandied around much too easily. There are very few true geniuses and their achievements must relate to exceptional creative achievement: But to do so requires many qualities and the correct timing.

Often I hear in Exceptional IQ societies: *I'm a genius; I belong to a 1 in 1000 IQ society.* Impressions are in the eyes of the beholder. My standards are much higher. I don't believe 1 in 1000, or for that matter 1 in 30,000 outside the intelligence curve (if that could be accurately measured, which is dubious) makes someone a genius. It may just say their convergent intelligence qualities (like "g") score very high on a suitable test.

Paradoxically, the true genius may see beyond certain answers, and give the "incorrect" alternative solution, and actually, score lower on some questions. I conceptualize genius as a very special and rare subset of exceptionally intelligent individuals, with certain necessary qualities. Certainly the genius requires= exceedingly high "g" and with "c" (creativity elements). Neither is independent of each other as they still weakly correlate. But the genius also requires other factors.

I think one major necessary construct measure has to be Exceptional Creative Achievement (ECA). This can be translated into a collection of all the characteristics for GENIUS that I apply in a mnemonic which I call “GENIUSES”. [62]

Let us conceptualize genius further. In exceptional intelligence, whereas one must demonstrate high skills on g (on convergent intelligence measures), the key to differentiate the very gifted (let's say someone at the 1 in 1000 level) from the truly exceptional might be the creative spark plus the zeal and persistence to not only light one's own flame but to keep it glowing and enduring. That is what genius, to me, is all about. That sometimes is not easy because the genius is commonly a pioneer who goes against the grain.

Definition

The question of whether the notion of genius itself has any real meaning has long been a subject of debate [63]

There is no scientifically accepted precise definition of genius, though the features I suggest are becoming more acceptable:

I have adapted my definition from a common Wikipedia one where the word or is replaced by necessary requirements.[63]

A genius is a person who:

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[ff] We thank the Pacific Neuropsychiatric Institute © for permission to publish.

- displays exceptional intellectual ability plus
- creativity, or originality,
- to a degree that is associated with the eminent achievement of new advances in a domain of knowledge.

A genius may be a scholar in a single subject (such as Albert Einstein or Charles Darwin) or may be a *polymath* —a scholar showing genius abilities in many subjects (such as Gottfried Wilhelm Leibniz or Leonardo da Vinci or Maimonides)
The key is persons showing the exceptional natural capacity of intellect, especially as shown in creative and original work in science, art, music, mathematics or other disciplines.

What genius is not:

- A person having an extraordinarily high intelligence rating on a psychological test, as an IQ above 140 (SD 16; sigma >2.5) simply reflects *giftedness*. I would place an IQ of 1 in 1000 or above as *very gifted*.
- A genius is more than just a natural ability or capacity or strong inclination. It requires demonstrable exceptional achievement that is creative.

Certainly, most experts recognize that the development of genius must involve very high g plus other influences producing talent and the appropriate personality characteristics of drive and persistence. These are combined into the factors I suggest later in this series.

Derivation
noun, *plural* geniuses, genii; genius is a conflation of two *Latin* terms: genius, from Latin verb genui, genitus, *"to bring into being, create, produce"*, and ingenium, a related noun referring to our innate dispositions and talents.

History
To understand the concept we must look at the historical roots.

- In ancient Rome, the genius (plural in Latin genii) was the guiding spirit or tutelary deity of a person, family (gens), or place (genius loci). [64];
- the achievements of exceptional individuals implied the presence of a particularly powerful genius.
- However, by the time of Augustus, its secondary meaning of "inspiration, talent" was used.
- Genius acquired its modern use in the eighteenth century.

How do two philosopher geniuses of yesteryear perceive genius?

Immanuel Kant, recognized that the genius must be able to independently arrive at and understand concepts that would normally have to be taught by another person. For Kant, originality was the essential character of genius. [65] Respectfully, this to me is insufficient reflecting creativity. It may in children reflect a prodigy but genius requires more than a talent for non-imitative producing ideas but carrying through.

Bertrand Russell, recognized the unique qualities and talents that make the genius especially valuable to the society in which he or she operates. So here is an important link: not only creativity, but also cultural applicability. [66].
These criteria fit part of the conceptualization of essential qualities.

There was a historic hiccough: Based on the historical findings beginning with the Terman study [4] and on biographical examples such as Richard Feynman, who had an IQ of 125 and went on to win the Nobel Prize in physics and become widely known as a genius[67], the current view of psychologists and other scholars is that a minimum level of IQ (approximately IQ 125) is strictly necessary for genius. This is a problem because Feynman's story is anecdotal and many features have been criticized. Jensen does not believe that Feynman's IQ was so low. And I, like Jensen, would argue cogently that a true genius needs to have exceptional g factors. I regard this as likely at least 3 sigma (Jensen talks of 2.5 sigma as a minimum) [3].

By 1939, a major change had occurred: David Wechsler emphasized that "we are rather hesitant about calling a person a genius on the basis of a single intelligence test score." [52]. So thereafter, genius was recognized as a much rarer and more special constellation of abilities.

Expression
Genius is expressed in many ways such as the sciences, mathematics, literature or music, art, or in games like chess.

Exceptional intelligence and genius: revisiting Feynman
Because of the dispute about Richard Feynman, Nobel Laureate in Physics, and accomplished genius and the peoples scientist, lets re-examine him to establish if he were an exception. Others and I have raised these points in this case. [67 3] We don't know, so can speculate at the time of testing:
Limited motivation, uninterested, illness with the performance is not necessarily reflecting best effort.
Test standardization questions: These are usually based on norms for average intelligence. What limits were being tested? Were there areas that should have been further explored and would have scored higher scores.
3. Creativity can diminish convergent test scores. Was there more than one legitimate option to an answer.
4. Test circumstances: How accurate was a group test, particularly for example in a school environment? We don't know the circumstances here.
5. Although limited possibly here, extra knowledge may actually produce wrong answers. Its limited because these tests are generally so easy that utilizing extra knowledge may not produce extra results anyway.
6. This was apparently at school: teenager or less. This may require further corrections and measures of maturations.
7. When you look at Feynman's achievements at that point, the part that was wrong was the interpretation of his IQ score, not of Feynman! [3]

Of course, let's remember that Nobel Prizes are dependent on many issues, particularly political demands and what is fashionable. A Nobel does not make someone a genius by any means, and missing one does not make someone not a genius. But it is one sufficient but necessary measure for exceptional performance (not necessarily creative performance).

These explanations are important to reflect beyond the limitations of individuals and because the common thesis is at least a minimum degree of exceptional g is required as a necessity not a sufficiency for genius.

Rejecting all modern geniuses: Is that appropriate?

Let's now look at another this time modern writer, Andrew Robinson [68; 69]. He begins his exploration of this subject by identifying ten undisputed geniuses of old: five artists and five scientists namely, Homer, Leonardo da Vinci, Shakespeare, Mozart, and Tolstoy; Galileo, Newton, Darwin, Curie, and Einstein. The contributions of all ten individuals through their work permanently changed the way that humanity perceived the world: each possessed something we call genius. [69]. He recognizes heredity (? G factor), education (algorithms learnt), intelligence (g and s), creativity (what well call c factor), hard work and training (what Jensen calls zeal) [3]. But then he argues that true genius seems to have disappeared. What has happened to society's geniuses, and where are they today? He argues that there aren't any true geniuses today. [69]. This view is an extreme one. I argue genius exists but is rare.

Frequency of genius:

We do not have figures, because this is definition dependent. As indicated, many are regarded as "geniuses", yet are better termed "gifted". It is criterion dependent and I apply the criteria in these sections to base my opinion.

I arbitrarily set exceptional IQ individuals (EIQ) as those who score above the 1 in 1000 threshold. Using that criterion, I speculate that only possibly one in a hundred, or even only one in three hundred are geniuses. The others are not because they do not exhibit the requisite exceptional creative achievement. Some of these features such as just "g" and "s" with special skills in certain directions such as "abilities/elements/aptitudes" at a specific level are insufficient. There has to be the ECA: the creativity, the achievement, and the several other factors. I do not arbitrarily regard "genius" as possible below the 1 in 1000 intelligence level because at minimum there needs to be sufficient "g" as well as the necessary "creative expression". This is besides the extra factors of zeal, "s", inspiration, and neurological and ego-strength factors all in the correct skill-achievement environment that I argue is necessary.

Prodigies

A prodigy is someone endowed with exceptional abilities: The prodigy does not need to be creative; and does not need to achieve; nor does the prodigy need to have the persistence and zeal that the genius has. We almost always refer to prodigies who are children or at latest, adolescents.

Prodigies are rare. One component may be the response that is evoked by others: The child is perceived as an unusually gifted or intelligent (young) person whose talents excite wonder and admiration. Prodigies may exhibit gifts in one specific area, or may show remarkable abilities in many areas. On IQ testing, when performed, the prodigy, should invariably score extremely high (e.g. >3 Sigma), although testing may be linked with boredom which may diminish the score somewhat.

Some would define "child prodigy" as a prodigy presenting before the age of ten who produces meaningful output in some domain to the level of an adult expert performer. Child prodigies are rare. To us, this would be the "advanced child prodigy" as opposed to the "creative child prodigy" who is not only advanced, but performs at the level that adults cannot perform, for example, developing one's own system of mental multiplication at age 5. Prodigiousness in childhood does not always predict adult eminence. And importantly, absence of being a prodigy does not exclude later genius. Intelligence research recognizes "late bloomers" and an example may be none other than Albert Einstein.

Child Prodigy criteria

I have used the concept of Prodigy in our SCHIQ study [1; 2] (see Section 4) applying the following two subgroups. We recommend its general use, in the absence of alternatives.

- *The advanced prodigy: (AP)*This is a rare group, but far more common than creative prodigies. These individuals have profoundly advanced milestones as a child, and this is not necessarily recognized at that time as prodigy behavior. Advanced prodigy (AP) requires exceptional IQ (i.e. e.g. ≥3.2 or 3.4) implying very high G factor, but also Specific elements to focus on specialized skills. This requires general very high-level skills in childhood (not just being a savant savant).
- *The creative prodigy:* The creative prodigy is an Advanced Prodigy who also exhibits profound creative achievement as a child demonstrating skills or discoveries or inventions that cannot be replicated even by adults trained in the area. The creative prodigy is rare even amongst the advanced prodigies. [70-72] so is better called a *Creative advanced prodigy* (CAP = AP + Demonstrable creativity) as an advanced prodigy who also exhibits high C factor (Creativity factor). Some would regard this exceedingly rare group as the only kinds of prodigies: They are the ones who make the news, and the children are exposed to added attention. If AP plus high creativity then CAP.

Prodigies can either succeed or fail in adulthood, depending possibly on ego-strength and the appropriate environment. Exceptional demonstrable accomplishment or education in adulthood does not make the person any less of a prodigy, but the logical focus for research is to include those who have continued to succeed as adults obtaining e.g., a doctorate or a career leading in that direction). [72; 73] Of course, there are other routes, such as significant business entrepreneurship, as epitomized by a Bill Gates or a Steve Jobs, where we can apply outside measures of success as an excellent alternative criterion for formal education.

Based on readings of the literature: Creative prodigies with these criteria also exhibited profoundly advanced milestones. In terms of a mnemonic e, they may manifest the qualities in

the mnemonic GENIUS (Table 1) The qualities that are needed for Genius are not necessarily exhibited by Child Prodigies as I postulate that even the Creative Prodigies will commonly miss the essential E and S.
Some prodigies may progress on to genius exhibiting the zeal and achievement that are required while maintaining their other qualities. These are the exceptional "early bloomers". Other geniuses may be "late bloomers" who do not exhibit any remarkably advanced milestones as children.
Successful creative prodigies hypothetically require the GENIUS component and true geniuses require the energetic zeal and demonstrable skills to succeed at any age. (GENIUSES). This may occur at any age.

I have hypothesized several new factors that may be relevant not only in exceptional intelligence but in the concept of prodigies. [62] This is a preliminary theoretical model that requires far more research. This is based on the literature in the area [3], and also my own perspective.

Genius summarized by GENIUSES
The best way to portray Genius is literally to use a mnemonic genius but pluralized to GENIUSES. In our SCHIQ study [1; 2], and in equivalent studies, successful creative prodigies hypothetically required the GENIUS component. True geniuses require the energetic zeal and demonstrable skills to succeed at any age. (GENIUSES).

Table 2: GENIUS as a mnemonic for creative child prodigies (CAP)

G:	G = g-factor of intelligence (say 1 in 1000)
E:	Ego strength / ego-strength / emotional; Normal communication: biopsychofamiliosociocultural (this means the child prodigy will be functioning within normal limits).
N:	Nervous system integration of creative uniqueness (if it exists) with g (general intelligence) and s (specific) factors (often links of g and s with the discipline in which the prodigy behavior occurs). The creative prodigy may or may not exhibit any special intuitive element (AHA moment)
I:	Intuition / inspiration elements; non-locality elements: i factor
U:	Unique, creativity c-factor; divergence; originality, imagination; lateral thinking
S:	S = s-factor: specific aptitudes.

Current factors that are well established in high intelligence
"g" factor general factor implying highly correlative convergent thought but this does not correlate very well in the exceptional individual. Also, the so-called "s factor" — specific factor— is insufficient to describe non-convergent thought.

Key besides the "g" and "s" reflecting specific skills that are not well correlated with "g" are the several new *hypothesized factors. These were not formally proposed prior to 2008 when I presented the information at the ISIR conference, in Atlanta.* [1; 2]

Each of these new factors is discussed further later (Sections 5 and 6): For the present:

- ***The c factor****: Creativity factor.* We use the U in GENIUS to reflect the Uniqueness or Unique Creativity. Reflects creative intelligence; Unique, innovation demonstrated in one of several disciplines; convergent thinking; music, mathematics, science, chess are easier to quantitate than art and literature
- ***The z factor*****:** *The zeal factor* with motivation to completion; persistence with a task is great but insufficient: it requires task initiation and carry through to completion. Jensen likes the term "zeal" here. To me, this is more than zeal, because it requires action, usually continuous or repetitive, in the face of sometimes profound antagonism. This is the "skills" (second "s" in Geniuses) as it requires actualization. Components of the z factor are not only the zeal, but also the concomitant energy, motivation, drive, volition, persistence, pursuit, and perseverance. This requires resolute determination: How much does he want it? (here the E is for energy in GENIUSES.
- ***a factor*** *(*achievement) pioneering or redirecting cultural comprehensible skills. Sometimes the genius must be born into the correct time. Leonardo's plane prototype was much too early!
- ***e factor (ego-strength):*** This is critical as given the uniqueness of the experience, and the potential for isolation and rejection, this inner emotional-cognitive-volitional strength is required.
- ***i factor (intuition):***The intuition-inspiration factor This is a difficult concept: It could reflect the Eureka (AHA) moment, the awareness of what is correct even though most of the detail is not calculated, or it could be ongoing. I have proposed that this requires action beyond the brain involving a Higher Consciousness. [74; 75 76; 77]
- ***n factor (nervous system integration):*** Extraordinarily important is central nervous system integration, particularly higher brain functioning both integrative (e.g. temporal lobe) and executive (e.g. frontal lobe). [78] This is the neurological equivalent of the psychological ego-strength factor. [79-81] N factor implies nervous system integration of creativity and ego-strength and general with specific plus the volitional factors of executive function zeal leading to the skill.

Table 3: Dr. Vernon Neppe's preliminary theoretical model for genius for further research.
(pni.org/intelligence/genius) [62] *Current factors that are well established.*

The MULTISYSTEM approach to genius and prodigies using the mnemonic "*Geniuses*"	
G:	G = g-factor of intelligence.
E:	Ego strength / ego-strength / emotional; *Normal communication*: *biopsychofamiliosociocultural e factor*.
N:	*Nervous system integration* of C with G and S factors. N factor. G, E, I, S, C, *using z*.
I:	Intuition / inspiration elements; *non-locality* elements: i factor
U:	Unique, creativity c-factor; divergence. Originality, imagination; lateral thinking.
S:	S = s-factor: specific aptitudes.
E:	*Energy. Relates to z factor, zeal / persistence / drive / volition / ardor / keenness / will / motivation / perseverance*.
S:	Skills manifesting within the cultural fabric, achievement or "a" factor.

These new factors are incorporated into the model of Genius spelling out the mnemonic GENIUSES.
Successful creative prodigies hypothetically require only the GENIUS component, but true GENIUSES require, additionally, the energy / zeal and demonstrable skills to succeed at any age.
GENIUSES with the ES that requires extra:

- E energy relates to z factor, zeal / persistence/ drive/ volition/ ardor/ keenness/ will / motivation/ perseverance.
- S: skills manifesting within the cultural fabric.

Psychopathology in geniuses

The question comes up about the so-called "psychoticism" of the genius.
"Trait psychoticism is a constellation of characteristics that persons may show to varying degrees; such persons may be aggressive, cold, egocentric, impersonal, impulsive, antisocial, unempathic, tough-minded, and creative. This is not a charming picture of genius perhaps, but a reading of the biographies of some of the world's most famous geniuses attests to its veracity." [82]
Psychologist Hans J. Eysenck described these traits, and he called them *psychoticism* feeling it was an essential ingredient in high-level creativity. [3] [gg] Jensen points out that the "psychoticism trait" is not itself a psychiatric disorder or disabling condition. However, it is associated with proneness for such and a constellation of intercorrelated personality traits have been found in most famous creative geniuses he had studied.

A number of people commonly regarded as geniuses have been diagnosed with mental disorders, for example, artists and writers like Vincent van Gogh, Jonathan Swift and Ernest Hemingway. John Forbes Nash, Jr. is a Nobellist mathematician who developed game theory and was diagnosed with schizophrenia.

To Dr. Jensen: *"history provides numerous examples of creativity and insanity or (near-insanity) in close conjunction."* [3] [hh] Jensen also argues that people are not maladjusted because of their having a very high IQ. [3ii] Furthermore, although IQ and mental health have only a slight positive correlation with each other, emotional and inter-personal problems prevail in all groups as the incidence is so high of mental illness and disability can be blamed on a person's having a high IQ per se.

Jensen uses an illustration: Amongst composers and conductors, Richard Wagner was far more creative than his son Siegfried Wagner and perhaps Siegfried's lack of one or two traits in the rare constellation permitted Richard to become recognized as one of the world's great musical geniuses. [jj] However, Richard, but not Siegfried, had a high level of the trait "psychoticism," [3]

[gg] p38
[hh] p38
[ii] P66-67
[jj] p19

Trait psychoticism has many mixed metaphors, and not one listing of why this is "psychoticism" in the sense of psychotic. Therefore, this description should not have the name *"trait psychoticism"*. I regard the use of the term *psychoticism* as most unfortunate and quite inappropriate psychiatrically. Geniuses by virtue of their creativity and different processing cannot validate new reality experiences for themselves. So, they may appear to have different challenges. I prefer to describe these individuals as *divergently special*.

Those doing the labeling were not psychiatrists and such personality descriptions are common amongst many general population individuals and for many reasons.
This prototyping appears very premature, though its been *"known as a fact for decades"*. It needs re-examination: We will, no doubt, find there are "geniuses" who fit many of these traits; and we will also find many others who do not have any of these traits. Until this is tested, this must be limited to the mythology that goes with such studies.
The labeling as such, at this point is inappropriate because it suggests a profile which is not generalizable to the majority of this "genius" population. But, of course, then, in such a study we must define the subgroup we're including under "genius" and I use the term in a very restrictive sense of rare individuals who have demonstrated "recognized exceptional creative achievement" and who have the appropriate ego-strength as well.

So, is this pure mythology related to "geniuses"?
These behaviors must be demonstrated to far exceed a comparison population, and instead possibly we should focus on achievement. I have evaluated many with some of these traits, and they're not geniuses by any means. We need to look at the controls of other non-geniuses who might also show "a constellation of characteristics that persons may show to varying degrees; such persons may be aggressive, cold, egocentric, impersonal, impulsive, antisocial, unempathic, tough-minded."

The German Philosopher, Arthur Schopenhauer, perceived a genius as someone in whom intellect predominates over "will" much more than within the average person. To Schopenhauer, the geniuses remoteness from mundane concerns means that they often display maladaptive traits in more mundane concerns. *"they fall into the mire while gazing at the star"*.
Schopenhauer was not a psychiatrist. I suspect that his conceptualization of intellect over will may be untrue; but the perception of maladaptation for mundanities could sometimes be true.

But let's revisit this in theory:
We could dichotomize two groups: Scientist and artist geniuses:
If they were severely ill, it is unlikely scientists, mathematicians and philosophers would produce as much—Nash may be a very unusual exception. However, artists, writers and musicians might find their bipolarity and alcoholism at times assists in finding the extremes of expression that the need.

The supposed demonstrated relationship between creativity and mental disorder may reflect subpopulations of artistic, musical and literary skill where dark moods or manic highs in bipolars

or bizarre ways of seeing reality in schizoaffectives may be pertinent. These have a higher incidence among creative writers and artists than in the general population and bipolarity may be part of the inspiration.

I would further argue that the genius may be exposed to some stressful elements putting them at risk: If geniuses did not have sufficient n (nervous system integration) and particularly e (ego-strength), they may, indeed, be prone to mental illness. They might need very strong ego-strength because the "I" factor of inspiration/ intuition/ higher consciousness implies transcendence of self because it is inspirational and ultimately involves and impacts many. Similarly, the zeal/ motivation/ drive/ persistence can be very isolating. Similarly, their unique creative thinking may not allow them to validate their reality as easily as most.

Perspective

Christopher Langan points out that *"scant attention is paid to perhaps the most important problem of all: selecting a problem worthy of one's time. Historically, the term "genius" has been associated with people who have solved this problem, and having solved it, went on to solve the very urgent, very complex problem(s) they had chosen." …… " a more realistic measure of genius might be obtained by studying a brilliant subject in his or her "natural habitat", analyzing the importance and computational complexity of the real-world problems that he or she has solved or failed to solve (and with further research, perhaps even the intelligence factors required)."* [3kk]

I think that Langan is spot on with this. One major challenge would be a Theory of Everything. And in our book, *Reality begins with consciousness: a paradigm shift that works* [83] we analyze 25 different Theories of Everything. That is the kind of task that I regard as worthy for geniuses to solve. [84]

[kk] Chris Langan p16

Development of a history taking exceptional intelligence assessment (the SCHIQ) in a subpopulation (child prodigies who achieved in adulthood) that is not based on directly testing certain questions, but history of exceptional performance: A promising entirely new method of measuring exceptionally high intelligence and related new theoretical concepts (Section 4) [ll]

Vernon M Neppe [mm] [nn]

Abstract

This research involved the first time where very high intelligence in child prodigies who had performed very well in all areas of intellectual endeavor as children, and who had demonstrable achievements in adults were quantitated by a historical IQ method called the SCHIQ. [1; 2]

In this paper, we report a preliminary pilot study to evaluate intelligence at the higher ranges using a different technique, namely applying historical data about the accomplishments of child prodigies. Child prodigies were chosen because the extent of their advancements could relatively easily be compared with older age peers (The Advanced Prodigy) Exceptional creativity was preliminarily recognized to be rare but included in the Creative [Advanced] Prodigy.

This paper discusses two aspects: The theoretical concepts and the empirical research pertaining to child prodigies and its links with genius. The research uses a historical IQ method, the SCHIQ and pioneered the quantitation of very high intelligence in that subgroup of child prodigies who had both performed very well in all areas of intellectual endeavor as children and who also had demonstrable achievements as adults. [1; 2]

Seven prodigies, coincidentally born in seven different countries and unselected for gender but all male, were carefully evaluated based on several case vignettes each of their child and adult performances.

Three raters experienced in high IQ evaluations independently and as blindly as possible ranked each case vignette for an IQ score. They were then asked to match the children's achievements with the appropriate consequent adult. The requisite items were given together for each individual, and the raters then ranked each cluster.

Their overall deviation from the mean IQ assessments spread over the 28 items was <1.0 per item.

There was individual greater variance in subjects:

a. with less vignette items,

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[nn] We thank the Pacific Neuropsychiatric Institute © for permission to publish.

b. with profound intelligence (guesstimated at sigma >4.6 d))

c. with the specific vignettes reflecting the very young.

These items were taken into account to prepare a Standardized Corrected Historical IQ (SCHIQ) score. [1; 2]

In the 2 subjects with most vignettes, there were strong correlations with established factors for correlating very high IQ.

The raters could not appropriately match the children with the correct adults.

Formulae were derived to correct for variances.

This early empirical data preliminarily justifies empirically the concepts of Advanced Prodigy (all 7) and suggests that Creative Advanced Prodigies (only 1) in this sample may be rare even in these populations.

In the one creative prodigy, the data preliminary supports the idea of necessary new hypothesized factors, namely c factor = creativity factor; z factor = zeal factor with motivation to completion; e factor (ego-strength) factor: i factor (intuition) factor; n factor (nervous system integration) and an "a" factor of achievement, demonstrable skills in addition to the known g and s factors.

The SCHIQ evaluation was Neppe's attempt to resolve how to measure exceptional creative achievement. This test is based on construct validity of performance issues measured by experts in milestones, creativity, and exceptional intelligence. Dr. Vernon Neppe presented data in this regard to the International Society for Intelligence Research in Atlanta in December 2008. [1; 2]. *Subsequently, the key data has been posted for several years and peer examined by colleagues.* [62] *as: THE SCHIQ: A new method of measuring the exceptionally intelligent (child prodigies)*

Collaborators on this research were Stevan Damjanovic and Dr. Greg Grove. [1; 2]

Key Words: SCHIQ, historical IQ, child prodigies, advanced prodigies, creative prodigies.

THEORETICAL BACKGROUND WITH NEW KEY IDEAS.

Limitations of the current testing of exceptionally intelligent individuals.

Quantifying the validity of the scores in current IQ testing in the *exceptionally* intelligent is fraught with problems and several difficulties in conceptualizing such testing as valid intelligence measures. Several questions on these tests reflect this:

1. Does their *construct* validity reflect *accurate gradations of very high intelligence*?
2. Does their *face validity* strongly correlate with specific outside creative, occupational, and educational *achievements*?
3. Is the *statistical validity* of "IQ tests" compromised by:
   - limited sampling at ≥ 4d or even ≥ 3.4d IQ
   - these curves not being "normally distributed": Are there Any "twisted pear" or bimodal curve or other distortion? Is there more frequent occurrence than expected?
   - such data being treated parametrically and with ratio scales when the information is often ordinal.

4. Does IQ testing focusing on the *"convergent"* questions (e.g. difficult to solve problems of mathematical or symbolic or logical kind) correlate strongly with "divergent" measures that could more accurately reflect exceptional intelligence?

Whereas these purported IQs certainly measure a high level of accomplishment on these tests, there is a known lower correlation of the "g factor" at "high IQ" levels [3]: These "convergent IQ tests", despite being ingenious at times, may not necessarily reflect the increased intelligence itself, but a related skill subset. [58]
This is particularly so as creative intelligence (Neppe called this the "c factor" [1; 2; 62]) is usually ignored as not easily measurable. This may involve ostensibly divergent skills added to the requisite convergent measures (as in conventional intelligence IQ tests). Multiple appropriate creative answers complicate accurate measurement of correct answers in these potentially very exceptional individuals. These factors together suggest a possible new approach.

In this paper, I report on a preliminary pilot study to evaluate intelligence at the higher ranges using a different technique, namely applying historical data about the accomplishments of child prodigies. Child prodigies were chosen because the extent of their advancements could relatively easily be compared with older children and any rare exceptional creativity would stand out. Moreover, their performance during childhood could be compared with adulthood.

HYPOTHESES AND QUESTIONS

Using analyses based on outside validated specific milestone achievements, with short vignette descriptions, the following questions required answering:
1, To develop a new method of determining exceptional intelligence based on key historical childhood and adolescent vignettes combined with outstanding general achievement in adulthood, and exceptional achievement in childhood. This would produce a new "IQ" measure called the SCHIQ (Standardized Corrected Historical IQ). [1; 2]
2. To establish if there can be high inter-rater reliability with historical measures.
3, To establish what areas of the SCHIQ are most difficult to estimate particularly
a. Profoundly high IQ
b. Very early age achievement
c. Number of vignettes required for improved inter-rater reliability
4 To recognize this would be a pilot study where data would be small enough not to apply rigid statistics.
5. To establish composite scores for each individual subject.
6. To answer questions about the construct, face, inter-rater and statistical validity and reliability of such approaches.
7. To make guesstimated corrections of scores as and when necessary based on post hoc analyses of the data. This was anticipated to be necessary given that it was a pilot study.

METHODS

a. Admission Criteria for subjects:

Criteria: Child Prodigy criteria

All prodigies were chosen who met the following two criteria:

1. *Profoundly advanced milestones as a child*, even when it was not necessarily recognized at the time as prodigy behavior. This includes any subgroup that also exhibited profound creative achievement as children (which skill / discovery/ invention could not even be replicated by adults trained in the area). Advanced Prodigies incorporate the subset of Childhood Creative Prodigies).
2. *Demonstrable achievement in adulthood*. This generally related to exceptional accomplishment or education e.g. doctorate (or in young adults, a career leading in that direction). We excluded the prodigy subgroup who became limited achiever adults or even disabled. (High functioning in adulthood Advanced Prodigies). The Endpoint follow-up of prodigies to adulthood were trichotomous. Specifically this study used:
    - Successful, demonstrable adult achievement (excellent but not necessarily
    - outstanding). This study excludes two possibly more frequent child prodigy groups:
    - Failure often with psychiatric illness
    - Clearly there may be a grey area between those adults who were "without active psychopathology but no achievement". If there were any doubt as to their achievements in adulthood, the subject was excluded.

Creative advanced prodigies, the special subpopulation of Advanced Prodigy (CAP = Advanced Prodigy + Demonstrable creativity): CAPs also exhibited a high Creativity level. This group appears so very rare that we could locate only one for this study. Based on readings of the literature: Creative prodigies in these criteria also exhibited profoundly advanced milestones. The most important distinguishing factor was demonstrable creative accomplishment. Such subjects were further evaluated for any features that would suggest any genius elements. These include not only the g and s factor components and the creativity. Also, included are any inspirational elements as a child, ego strength and neurological integration, achievement descriptions and any possible essential component of true genius requiring the demonstrable cultural achievements, skill and zeal factors to carry through performance. We recognized that certain prodigy skills like Mathematics, Chess, and perhaps Science and Music are easier to measure than the more subjective Art and Literature, which are challenges to quantitate.

Population for this research

An attempt was made to locate prodigies by using high IQ societies (like ISPE), as well as approaching very creatively accomplished adult outsiders known to the author, and asking about very advanced childhood behavior. Their experiences were recorded, made into vignettes which were then approved by the subject. The subjects would remain anonymous.

Information

These achievements were each succinctly summarized in 2-4 lines. Examples are listed in Table A: not all items are listed so that further research selection of raters will not be contaminated. Generally, the individual subjects were required to describe these vignettes. However, outside validating information, when available, was requested so as to ensure maximal accuracy.

A standard deviation of 15 was used in scoring.

Three raters were stipulated who had to meet the criteria of

a. major interest, personal involvement, knowledge and experience in the high IQ measurement domain,
b. substantial knowledge in research or theory of intelligence, and
c. involvement in evaluating high IQ individuals e.g. for admission to various high IQ groups.

In the event of any raters also being subjects the ranking of their own data on themselves would be extracted out of the analysis, and also combined in to ensure there was no compromise of ratings. That data would be analyzed and any contradictions pointed out but to ensure anonymity of the subjects and confidentiality would not be shared in a public setting such as a publication.

RESULTS

This initial pilot study involved only 7 subjects as true prodigies are rare, A total of 21 achievements were described during their childhood years (youngest, 6 months; oldest age 19) and their composite 7 adult achievements were also described.

This initial pilot study involved only 7 child "prodigies". By coincidence not design, the subjects were all male and raised in 7 different countries). A total of 21 achievements were described during their childhood years (youngest, 6 months; oldest age 19) and a composite of each subject's adult achievements were also described (therefore 7). Four of these subjects were members of exceptional intelligence societies, three of them were not. Their ages varied at the time from late twenties through to late sixties. All subjects who preliminarily qualified after a search lasting several months were admitted. Only one in the group of Creative Advanced Prodigy, could be located for this study. CAPs appear to be extremely rare.

Generally, the individuals described the childhood accomplishments, but outside validating information, when available, was requested so as to ensure maximal accuracy. In every instance, the information was validated as genuine to the satisfaction of the principal investigator, who, in addition, personally interviewed and interfaced with every subject.

Table A illustrates some of the items. The reader may want to go through the vignettes at this point and score them based on the criteria (SD 15; range acceptable then provide the mean of that range).

Table A

Examples of the 28 items: some items have been deliberately withheld in the interests of standardization for future raters.

Section A: Early childhood: How would you score the following children?

____1. Aged 6 months, he unscrewed a loose plastic screw on his/her baby bed using

his/her fingers and then screwed it back in. This task was apparently performed spontaneously and completely without any prior teaching.

____3. Aged 2 years 6 months, he could show on the map of the world, the country, major cities, major mountains and rivers: more than 100 items were involved.

____4. Aged 3.5, he was able to tell the time perfectly to the second (analog watch). He had never been taught to tell the time, nor had he been formally shown how to read including arithmetical or roman digits. This was discovered accidentally by his father when somebody asked the time and the child responded.

__9. Aged 6 years old, he *both developed* his own system of mental multiplication for any numbers under 100, and he would *apply* it by answering in at most 5 to 20 seconds depending on the item. He would multiply any 2-digit numbers together in his head with 100% accuracy. (A university mathematics graduate did not understand how he did it until explained in some detail…apparently not otherwise ever been used for mental multiplication although algebraically sound, and almost no adults can replicate even the calculation feat.[oo]

____10. Aged 6.5, he wrote a 80- 90 page book on astronomy. This was loaded with digits, tables and statistics, terminology and enormous detail, without error. He would study encyclopedias and all available books on the topic. His knowledge in the area was regarded as encyclopedic…

Section B: Later childhood:

___11. Between ages of 5 and 8, he developed what he regarded as a "metalanguage" as he wanted to speak English but was not allowed to so would find English words in the other two languages he knew. (His parents had been in a Japanese concentration camp and the English speakers were regarded as the enemy). He also began to study the stars in detail by looking up at the sky. Exposed to three languages in his early childhood by his family, and fluent in them.

____12. By age 7.5, his reading age was regarded as that of a 15 year old, with reasonable comprehension. He learnt to read at 5.

___18. Aged 19, he gave a simultaneous chess exhibition to 60 chess club opponents: He won almost all the games. He had had no previous practice in any kind of simultaneous chess exhibition. Previously he had never lost at school at chess in his state. He had no formal chess lessons.

Section C: older adults.

____15. Theoretical physicist, internationally respected for his creative ideas despite not being formally educated in any area (even by Nobel Laureates).

____16. Made major pioneering creative international contributions in *nine completely different* disciplines, including one impacting on millions of people; author reflecting five completely different disciplines; MD, PhD; recognized with numerous rare international awards… recruited internationally

____17. Graduated with highest honors in Bachelor's degree, with distinction in his Master's degree, and did his doctorate in German with distinction although he could not

[oo] This is an illustration of creative prodigy behavior as it surpasses adult creativity

speak it previously, and developed a complex technology on the Internet that had not been solved in sixteen years.

Table B lists the overall results: When totaling the 28 items, the mean differences between the 3 raters were extraordinarily close: Remarkably, they had a range of 1.9 total; implying <0.1 IQ point per item (see the bottom line Mean).

The three carefully chosen raters conformed to criteria, as required.

The raters independently of each other, ranked the estimated IQ score for each of the 28 individual items described. The rankings were blind, if possible, as some subjects may have been known to the raters (and in two instances, guesses as to identity failed!) but the principal investigator (me: Vernon Neppe as one of the raters) was not blinded as to the subject identity but this did not affect his mean ratings (see Table B) compared with the other raters. Based on the ranking scores, the scores were recorded applying the standard deviation of 15 so that if a rater scored an item as 3.4D, for example, that would be equivalent to scoring an IQ of 151.

The mean IQ estimates of each item were also used to compare interrater reliability, though all raters recognized the need for an item IQ range. Separating out the raters, all three, at times, exhibited the most variance from the overall mean ranking, but that was generally very little: of the 28 items, only 4 of the 28 showed any ranking ≥15 away from the mean. 15 was chosen because all these ratings were ultimately scored (converted if needed) as with a Standard Deviation of 15, like most IQ tests today: The raters had, at times, preferred to give the score based on SD of 15 or 16, or, at times, ranked based on sigma deviation from the mean.

The raters scores were, by their choices, often given as ranges usually of about 10 to 15 in all three instances, and the mean score for each item was given. Therefore, even though the rankers were remarkably precise overall on the Mean scores and the extent of variation (variation) was remarkably small, they still recognized that there was a much greater variation in their estimated scores. This is also so in psychometric intelligence measures, where subscale scores can be ±3 on a mean of 10, and the total scaled score can be ±1.5, for example, even on results that are close to the mean, and on well constructed standardized IQ scores like variants of the WAIS. Therefore, "IQ" is always expressed in a range, and the ostensible limited correlations in subtests of "g" for example are more comprehensible.

The scores at that point were the Historical IQ estimates (HIQ) and they were then recalculated producing a composite IQ score called SCHIQ (standard, corrected, historical IQ) for the 7 subjects. [1; 2] We realized the need to correct these more variant results. Given the paucity of comparable outside child research to validate this technique, we applied our preliminary results to further correct by guesstimation by applying an increased standard error for:

- younger age groups,
- very exceptional intelligence, and
- less test items for the subject.

The final estimated IQ scores ranged from 146 though to 179. Two of the individuals with the largest number of data points *correlated exactly* with their estimated IQs using other techniques (179, 169), after corrections, namely Scoville's correction for mental/chronological age [23] and Ferguson's combination of scores calculation [85].

Table B: Rankings of each vignette item based on means of the 3 raters A, B and C

Item #	Rater B	Rater C	Rater A	Mean	Most difference	Least difference	Rater most out / item
1	175	170	175	173.3	5	0	C
2	170	173	183	175.3	13	3	A
3	160	161	160	160.3	1	0	C
4	145	163	153	153.7	18	8	C+
5	155	158	145	152.7	13	3	A
6	170	156	162	162.7	14	6	B+
7	160	158	160	159.3	2	0	C
8	180	170	168	172.7	12	2	B
9	145	135	134	138.0	11	1	B
10	170	168	168	168.7	2	0	B
11	180	173	183	178.7	10	3	C
12	152	155	150	152.3	5	2	C
13	150	145	153	149.3	8	3	C
14	125	130	130	128.3	5	0	B
15	135	135	149	139.7	14	0	A
16	120	128	140	129.3	20	8	A+
17	145	139	145	143.0	6	0	C
18	130	154	153	145.7	24	1	B
19	165	163	160	162.7	5	2	A
20	160	168	175	167.7	15	7	B+
21	175	168	170	171.0	7	2	B
22	147	153	157	152.3	10	4	B
23	140	145	140	141.7	5	0	C
24	150	144	148	147.3	6	2	C
25	170	149	165	161.3	21	5	C
26	170	159	156	161.7	14	3	B

27	155	153	153	153.7	2	0	B
28	150	160	153	154.3	10	3	C
Mean	155.3	154.8	156.7	155.6	9.9	2.4	11B, 12C, 5A

The results of the other five subjects also appeared appropriate based on the data available, as two had been formally tested for exceptional intelligence and qualified for 1 in a 1000 societies. We believe our results reasonably represent these exceptional subjects.

Provisional illustrations from this data allowed us to re-examine individual item variances:
The intra-rater variation between 2 raters is very little. Remarkably, 24/28 items were scored ≤5 on least difference compared with the mean. 9/28 were still scored as ≤5 on most difference in the variation analysis.
Consequently, several individual items showed more marked variations in scoring.

However, using this analysis, several items showed more marked variations in estimate. The most difficult to estimate IQ items, as postulated based on the literature and our prior experience and knowledge, needed to be accounted for and became part of the correction:

- the accomplishments in the very young (particularly <5 years old and even more so under 3 years)
- those ranked as extremely intelligent (≥4.5d [d here refers to statistical sigma where 1 is 1 standard deviation]).
- Overall assessments of "IQ scores" were more difficult with fewer than 4 items listed per individual prodigy. There were more estimated uncertainties when fewer items about an individual subject were given.
- Matching the prodigy children with the correct corresponding creative and educational accomplishments in adults was complex, though rank ordering the adult-child pairs correlated adequately and had errors, but the sample was too small, and this was not regarded as successful.

We provide examples below when examining the ranking of item differences of 15 or more in the raters rankings. Clearly that issue needs addressing as it reflects a very large difference in rating the IQ score. Fortunately, that is a rare phenomenon with these results, but rather predictable as to the items:

Early age items: The items "Unscrewed" and "told time at a very young age" don't correlate well, yet the geography item had far less variability in the rankings. This suggested estimating IQ under the age of 4 years was not consistent and might exhibit far more variance than at higher age ranges (where this phenomenon did not manifest except with some of the more variant items ranked in the profound intelligence group). We, therefore, reanalyzed taking out the three offending items #10, #11, #17, resulting in 25 items.

We furthermore also re-analyzed the data after extracting all those below age 6 unless there were

direct statistics about mental age elements. (#1) At times we did not know the exact age, instead we had been given an age range, like 5 to 8: under those circumstances, we then averaged it, to e.g., the 6.5.

Specifics: Reading was not clear for mental age because kids are sometimes trained to read. When further eliminating these early age uninterpretable items and also combination items (#3, #4, #13 (+ #15 as based on 2 items), #16, #17 (as higher score would be #16), #25, #26 then: 18/20 scored ≤5 on the least; with 7/20 on the most. This markedly diminished the variance (there was less noise).

Given the paucity of comparable outside child research to validate this technique, we used these preliminary results to further correct by guesstimation, applying an increased standard error for younger age groups, very exceptional intelligence, and less test items.
The scores were then recalculated producing a composite IQ score called SCHIQ (standard, corrected historical IQ) for the 7 subjects. [1; 2]

Early data from case vignettes of scoring intelligence (excludes age <5 unless can justify milestone) produced GASE= *Guesstimated Age Related Standard Error.(Table 3).*

TABLE C: GASE estimates compared with the original SHIQ data

Item #	Rater B	Rater C	Rater A	Mean	Most difference	Least difference	Rater most out / item
Mean previous	155.3	154.8	156.7	155.6	9.9	2.4	11B,12C, 5A
Mean on GASE	154.8	154.6	156.3	155.2	10.4	2.4	10B,7C,3A

The SHIQ is the historical score obtained prior to the correction which therefore then was called the SCHIQ reflecting the corrected historical score.

In Table C, there is less variation of the rater scores: This is an expected tautology because that was part of the analysis, but, nevertheless, on face value, the extracted figures do not profoundly affect the variation in all the test scores overall, though there was slightly less variance amongst the two of the three raters (range Mean GASE is B 0.4 vs 1.3; C 0.6 vs 0.8; A 1.1 vs 0.9).

Table D: The GASE variations analyzed by age.

The younger the age, the more the variation.	
aged 20 or over:	-3 to +7;
aged 13- 20:	-4 to +10;
aged 11 to 12:	-5 to +13;
aged 9 to 10:	-6 to +14;
aged 7 to 8:	-7 to +15;
aged 5 to 6:	-8 to +16;

aged 4: -10 to +18;
aged 3: -12 to +20;
aged ±under 3: -14 to +22
Effectively with each increment below age 6 to < age 3 the GASE range went up by 4.

Because of this a formula was derived, not discussed here, beyond illustrating that it exists:

SCHIQ = (SHIQ) +NIQ= (ULIQ-ASEC) +NIQ= (ULIQ-ASEC) +NIQ= (MLMIQ+TADS [if TADS≥0]-ASEC) = (MLMIQ+TADS [if TADS≥0]-ASEC).

Essentially, this formula corrects for just estimating means via several raters. It adds in corrections for numbers of vignettes. This is so as to recognize the potentially greater reliability of several vignettes on the same person. The formula also takes into account the difficulties of estimating profoundly high intelligence: This may be so in part because there is no comparative base possibly, other than documented creative achievement. Furthermore, in the formula we recognize the difficulty of predicted "super-intelligent" estimations based on very young age, These allow us to take into account of the limitations of testing, and the possible lack of attainment of limits based on simple case vignettes.

Adjustments therefore were made for the SCHIQ [1; 2]. These are complex calculations, so the steps are left out, and this is for illustration only. (Table E). The formula is still available to be adapted, is provisional and uses guesstimations which may be incorrect, and allows further researchers to have a useful starting point.

Table E: Corrected "IQ scores" of each of the 7 child prodigies.

Subject	Vignettes	max	min	#PAD	PADS	NADS	TADS	SHIQ≥	
		mean	mean	Sub	base	*		MLMIQ	SCHIQ
D	8	191.3	174.7	5	182.7	169.3	172.7	174.7	179
E	5	182.5	164.7	3	175.7	162.7	166.2	168.2	168
F	2	153	138.7	2	148.7		148.7	148.7	146
G	4	178	168	1	178	162.3	163.6	168	168
H	4	167.3	144.3	3	149.7		149.7	149.7	150
I	2	169.7	159.7	2	161.7		159.7	159.7	156
J	3	176.7	154.7	3	161.3	154.7	159.3	159	157

Subject: Each subject / participant in the study is listed by letter.
Vignettes: number of vignettes per subject
Max and min means: Maximum and minimum means based on raters A, B and C
Adjusted IQ follows: based on rankings of age, profoundness and early vignette corrections:
PAD; PADS IQ score: positive differences vs NADS negative difference;
TADS IQ = total additional difference IQ score;
MLMIQ = Mean limiting median IQ;
SHIQ = standardized uncorrected historical IQ;
SCHIQ= standardized historical corrected IQ
a. age above was analyzed, two other adjustments were made.
b. number of items vignettes —at least 4 appears critical;
c. profound IQ to >4d SCIQ adjusted. In all, a sliding scale was used.

Table F shows item examples are based on statistical definitions illustrating using SD=15: there were 28 items—a few are below. There is data suggesting the IQ skills above this level of ≥4d may be at least 8x more frequent than these statistics appear at the lower ranges, and that the higher the IQ scores, the more this variation, so these figures indicate greater rarity at that higher range. [23]. We know that IQs are not normally distributed at the skewed extremes of these high levels. [3]. These are statistical translations of estimates. This distortion possibly begins at the 3 or 4 sigma level but increases substantially markedly as one goes higher in sigma.

Table F: Statistical distributions of rarity of IQ scores at different levels: D or d = sigma deviations from the mean.

IQ 100 = 1d = 50th percentile = average;
IQ 115 = 1d = superior or roughly 1 in 6.
IQ 130 = 2 d = very superior or roughly 1 in 44;
IQ 145= 3d = exceptional = 1 in 741;
IQ 153 = 3.5d = 1 in about 5,000;
IQ 160 = 4d * = 1 in about 30,000
IQ 164 = 4.27d* = 1 in about 100,000;
IQ 170= 6.67 d* = I in about 500,000
IQ 175 = 5d * ~= 1 in about 3.5 million;
IQ 180 = 5.33d* ~= 1 in about 20 million
IQ 190= 6d * ~= 1 in about billion.

DISCUSSION

This study required special psychometrists skilled in high IQ assessment. That is why we used those involved with establishing very high IQ societies and psychometrist allocations for those societies – present and future. Apparently, that choice was successful because the data generated achieved very strong correlations of results between psychometrists—the inter-rater reliability was extraordinarily high. This allowed us to account for external validating features such as exceptional achievement. This is possibly the most important validated measure, as it allowed a historical measure of very high IQ based on achievement. Testing measures had previously largely been limited to examining convergent intelligence at very high levels applying, for example, problem solving logic or culture-free diagrams. However, the divergence linked with creativity has almost always been ignored in these high-level battery tests. Nevertheless, it these should strongly correlate with SCHIQ, if both are measuring the ultimate construct of high intelligence.

Corrections hypothesized to be because of variance should be higher with skill vignettes at very young ages, at very exceptional levels (>4 and even 4.5 d), with fewer vignettes to build on (more vignettes make scoring easier, plus imply several examples of exceptional skills or maintained advanced skills) and preliminarily validated.

The single creative child prodigy is further described here: Even as a child, this subject had

exhibited significant zeal to persist, and accomplishment to achieve. Without training, he exhibited exceptional creative achievement even as a child, far beyond what even advanced adults with training in that area could achieve. He recognized no intuitive awarenesses (AHA moments), but did as an adult. He also exhibited some profoundly advanced milestones in his area of endeavor. As a child and an adult, he was well-adjusted.

The particularly high IQ scores disputably require extremely high creativity as well as profound divergent intelligence skills. It is therefore debatable whether any current IQ questionnaire tests can appropriately measure these scores because:

- of rarity of the statistic, there is no population;
- creativity is generally not measured and
- even high IQ tests measure complex convergence and not divergence.

This is why these genuine individual case histories may assist. All the facts have been confirmed and these individuals are current.

The SCHIQ, and its principles, can potentially be applied to other settings as well, including highly accomplished adults, creative individuals, polymaths, very high IQ individuals who were not prodigies, and prodigies who did not succeed as adults.

A replication is hoped for. More data could allow for more accurate standard error estimates, and a way to apply validity information for high IQ. We hope to apply this standardized questionnaire for this second round of testing on a new population and by so means accumulate data. However, our technique certainly depends on the experience and background of the raters, implying careful choice.

Applying this history taking technique using key illustrative vignettes appears to be a promising way to measure IQ in child prodigies who then become high achiever adults. This is so as the SCHIQ measures allow for a possibly accurate measure of extremely high intelligence using outside validators of creative, academic, and other recognized achievement. [1; 2]

To return answer the hypotheses in this study:
Using analyses based on outside validated specific milestone achievements, with short vignette descriptions, the following questions are answered:
1. We have developed a new method of determining exceptional intelligence based on key historical childhood and adolescent vignettes combined with outstanding general achievement in adulthood, and exceptional achievement in childhood. This produces a new "IQ" measure called the SCHIQ (Standardized Corrected Historical IQ).
2. We have established that there can be high inter-rater reliability with historical measures.
3. We have preliminarily established what areas of the SCHIQ are most difficult to estimate and these include:
a. Profoundly high IQ
b. Very early age achievement
c. Number of vignettes required for improved inter-rater reliability
4 We recognize this is a pilot study where data would be small enough not to apply rigid statistics.

5. We have established reliable composite scores for each individual subject.
6. The SCHIQ shows good construct, face, inter-rater and statistical validity and reliability.
7. We can make and have made guesstimated corrections of scores plus when necessary adjusted for post hoc analyses of the data. It was anticipated and necessary given that it was a pilot study.

CONCLUSIONS

The empirical data preliminarily appear to represent these exceptional subjects well. This technique appears promising in measuring IQ in child prodigies who then become high achiever adults.

This is a preliminary model that requires far more research, but it may already when applicable be the most useful measure we have for exceptionally intelligent individuals because it is based on Constructs of Achievement as opposed to test scores.

Our research paper reports on a preliminary pilot study to evaluate intelligence at the higher ranges using a different technique, namely applying historical data about the accomplishments of child prodigies. Child prodigies were chosen because the extent of their advancements could relatively easily be compared with older age peers and as adults.

The SCHIQ appears a promising tool for measuring Exceptional Intelligence but is limited in population. [1; 2]

This is early work, as it attempts to pioneer several new concepts and may clarify too the differences between exceptional intelligence and prodigies and add somewhat to our knowledge of genius.

The area of exceptional intelligence and its correlations with IQ are very complex indeed. Our work with the SCHIQ is probably the closest we will get to measuring exceptional intelligence in an exceptional population. But the SCHIQ is limited by the population able to be tested (child prodigies who have become functioning adults), and the testing procedures (consensus amongst experts in the area).

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The creativity quotient and the hypothesized c factor: the property of creativity (Section 5)

Vernon M Neppe [pp] [qq]

Introducing the Creativity factor ("c")

Whereas purported exceptional IQs certainly measure a high level of accomplishment on certain tests, there is a known lower correlation of the "g factor" at "high IQ" levels. In other words, these distilled tests of all our mental abilities may become a little conflicted at that exceptional level. It is paradoxical because exceptional intelligence should be based on exceptional IQ and that in turn is based on "g". But effectively, we don't really test "g" and cannot accurately. These "convergent IQ tests", despite being ingenious at times, may not necessarily reflect increased intelligence itself, but a related skill subset.

I describe this as reflected by all the factors that go into "c" —the "c factor" —as a distillation of everything divergent but in a productive way. But this creative intelligence is usually ignored because it is not only not easily measurable, but hard to quantitate systematically. "c" may involve ostensibly divergent skills added to the requisite grounding convergent measures. This results in multiple appropriate creative answers complicating accurate measurement of correct answers in these potentially very exceptional individuals.

This is one reason why we developed the SCHIQ: So at least in a small well defined but advanced population, this could be measured. And it is a reason why we encourage those who are eligible to join the Exceptional Creative Achievement Organization. [rr]

My classification of *creativity —c factor*—contains several different features, just as "g" contains several highly correlating attributes. The problem, again, is measurement of what are sufficient but not necessarily necessary features. The literature recognized *originality*, as one component; *simplicity*, may be another; *divergent thought*, a third; and *lateral thinking* a fourth. With creativity, it makes up the mnemonic COLDS. That is one time when having a cold is good! These elements all likely correlate, but I propose that creativity is all of the above qualities, distilled into one "c" factor.

Creativity and exceptional intelligence

Creativity is certainly often directly linked with exceptional intelligence. However, most "IQ" testing does not measure creativity at all, and there can be times when creative answers actually impair higher scoring on formal IQ testing, even using the high-level battery tests. This is

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[rr] www.Ecao.us or www.5KIQ.com (redirects to the same website)

because creativity is *divergent* in character, in general, as opposed to "g" which involves the convergent—single linear directions. There may be several solutions to a problem—the very bright individual can find other solutions, which are lost on others.

IQ scores above roughly the 1 in 1500 level become increasingly suspect because the usual IQ tests are not standardized for such extreme values. Those that are used rarely do not have sufficient population to standardize test on. So they need to accurately project anticipated results for subjects that are outside to the right of the curve, but with skewed distribution curves, that is difficult. Moreover, the test constructor may have what appears to him a great solution, but they are necessarily idiosyncratic answers and the person who scores highest may be based on data that only or like convergent thinkers decides is correct. Yet, there may be several correct answers. This is why the "creative" thinker is compromised. Tests at that extremely high level (say >3.1 SD to the right of the curve) should take divergent thinking into account.

Simplification

I pointed out that "simplification" is sometimes a creative action. Often creative inspirational endeavors *simplify* greatly and frequently, once one is shown something it becomes easy. However, IMHO, I would not regard simplicity as an indispensable. For example, at higher chess levels, sometimes it is the sheer complexity of the game that distinguishes chess genius. And certainly, the presence of recognizing the limitations of a restricted 3S-1t experiential reality is simpler than the complexity of 9 spinning dimensions [74; 76; 83; 84; 86; 87], but that parsimony contradicts the creativity of genius.

However, "simplicity" is certainly a common result though, and *actualized achievements* often are demonstrable because of their ease and simplicity, allowing for the "cutting of corners" that becomes relevant in *actualized creative achievement*. Of course, simplicity is not necessarily a creative endeavor, and may be found in solutions of high complexity because of the simpler convergence approach.

Originality

A high C factor requires examples. One could go through the history of geniuses and use their originality as key elements for creativity. More pragmatically, the approach to Creative Advanced Prodigies [62] may be useful because these creative manifestations require skills that even an adult skilled artisan in that area cannot demonstrate. Some skills like Mathematical, Musical, Chess and Science skills are easier to measure than literary and art skills because Creativity is clearly the major core that allows for Genius to be conceptualized and therefore its measure could provide a preliminary theoretical model for genius. But this requires far more research.

Essentially, creativity sometimes begins with being different. That differentness allows for solutions that diverge. This divergence may or may not be recognized. Creativity is not just achievement but originality in that. That is why learning new algorithms and practicing them, is far more difficult than inventing them.

Lateral thinking and divergent approaches.

Lateral thinking involves creativity. We think crookedly, not on a straight line. We see divergent options that open. We take nothing for granted. This is one way of measuring the divergent lateral originality in creativity.

I sometimes ask people to list as many similarities as they can between an eye and an ear. My expectation is that people in the exceptional categories would find at least 30 similarities, and as long as they can justify their reasoning, however, esoteric, they can score as correct as many as they want. This allow for as much creativity—lateral and divergent thinking—as possible. This would be a simple example of creative thought. Yet, it is trivial, in that, one could say *"So what! We* must also perceive the great virtues of this initially neutral "c" factor and just reciting many similarities does not reflect on real world creative achievement. That is true, but it is hoped that such items would ultimately be shown to strongly correlate positively with demonstrable creative achievement. This contrasts with those who are tested on "similarities sub-tests" on the WAIS IQ test for example, where the answers are so structured that they require convergent responses to be correct. This is not meant to reflect creativity but "g" factor correlated thinking.

Creativity measurements frequently include tests asserting they're about creativity. "Multiple uses" for example, measure fluency [88], but this may correlate only weakly with creativity. Alternatively index scores are based on creative recognition [89; 90]. This has some face value to this but is it like just testing problem solving and regarding that as "g"? Time will tell.

There is a remarkable literature on creativity but a limited one on divergent thinking. Much of that literature has found sometimes remarkably creative (!) ways to solve the problem of increasing this skill, or measuring it, or maximizing its use. This is outside the domain of this discussion. But essentially, creativity lacks an adequate scale and is often interpreted subjectively and within the limitations of the percipient. There is so much written that this may provide the beginnings of a bibliography. [82; 91-125]

And yet, no one has dared to regard Creativity Factor ("c") as a necessary entity. I do. And that is why I postulated it in 2008. It is a key feature in genius. [1; 2]

This is clear in the Arts and in Music. How do we measure the truly great artists, directors or composers. It is unlikely that they were all geniuses but that they were performing well in their career based on their training and experience with a rare creative idea, at a not necessarily remarkable level. How much of this is pertinent to the contemporary social style of music? We respond to these artistic elements, but some art today may be awful tomorrow; and artistic inspiration is very subjective.

But it is a dilemma that some of us have even in the sciences. Pioneering new areas and creating new paradigms are lofty ideas fraught with problems. Here is a personal, rather frustrating example, but where we have persevered for some five years, knowing that the creative awareness is larger than ourselves.

Some in the exceptional intelligence area may not be in synch with others. This may produce frustrations. Here's an illustrative example:
Currently we (Ed Close and Vernon Neppe) have proposed a theory of everything model based on strong empirical, mathematical, logical and creative thinking: In essence, the axiom is that Space, Time and Consciousness are separate substrates. However, they are always at least in part tethered together. And this tethering has always been from their finite origins. [74; 76; 83; 84; 86; 87]Moreover, we postulate that these finite elements are embedded together in the infinite.

Now, here is the question. Is such a model a creative rambling because not many understand it? We're on our own and we also recognize that we may be two decades ahead of scientists and that we might be wrong. But would that make us or the model any less creative?

Returning to the "c" factor
We've suggested a new factor, creativity, which some would perceive as divergent thinking. Even Arthur Jensen recognized its primacy and its links with genius: *Some talents, like mathematical, physics and chess are easier to measure than music, art, or literary skills.* [ss] *...Most with exceptional IQs, are not geniuses, because genius requires truly outstanding creative achievements to be recognized.* [3]. These are more challenging to measure what is useful, special, and valuable and often based on our judgement. That may restrict "c" interpretations even more.

But Jensen also recognized the difficulty:

> *Of the important variables in psychology, "intelligence" is one of the few that may lend itself to being researched strictly as a natural science. Much of present-day psychology is, at best, a kind of applied technology, some of it highly useful.*
> *A serious part of the problem is the importance of measurement.*
> *There are, as yet, no psychometric tests for significant degrees of creativity and we can't (yet) predict creativity or measure it as an individual trait, but*
> *can only examine its products after the fact.* [3tt]

Creativity "c" and "g"
We know that "c" creativity factor is positively correlated with g, just as many other factors are but the correlation is relatively low. If it were higher, it may be part of "g". In fact, g likely has sky limits certainly as a measure and "c" may begin at a much higher level, but is difficult to measure. This may distort and skew the distribution curve even for "g" intelligence because incorrect answers may be given because of the creative element. It is likely that "c" is shifted significantly in distribution to the right but for it to function valuably, there needs to be plenty of "g", otherwise one would instead of being creative and positive, exhibit an irrational divergence of thought. Theoretically, then, the divergent laterality of creativity may impair scoring exceptionally on convergent testing. This is why we need to apply the construct of creative

[ss] P5
[tt] P27

achievement. Yet, the elusive problem is measurement, and if it were measured would we be belittling creativity?

My experience with a large number of exceptional individuals is that they exhibit far more creativity by the time they are distributed beyond 4D compared with 3D. But my samples may be biased, though others have pointed out similar observations. [3] This has just not been adequately studied because it creativity is so elusive to measure. Indeed, a fairly high level of g acts as a necessary threshold as creativity, in most fields, requires adequate mastering of much of the knowledge, techniques, and skills needed to work in that field. *"These cognitive essential levels of mastery may be considerable and are often highly g-loaded."* [3 uu]

However, it appears that creativity is often almost completely absent in individuals <1SD above the mean intelligence. Below 2SD we see very little. It starts showing itself slightly at 2.5SD, by 3SD it manifests somewhat, and by 4SD it is significant. But measuring construct validity is pertinent because the measures of intelligence are very restricted at that level, never mind creativity.

Creative expression becomes more pronounced as one advances in intelligence. Hence the small positive correlation with "g", but in my experience (and this is significant), it is limited even at 2SD above the norm. [3] That means, for example, that most Mensa members will exhibit very little creativity. However, as one advances, say beyond, the 3SD and particularly the 4D level there may be more creative expression, based on my empirical experience including detailed history taking.

This may explain why there are only low correlations of creativity with "g" factor of intelligence. [3] Most "g" measures involve average individuals. The great majority of the population (read normally distributed round the population mean of IQ 100) exhibit very little creativity. With respect, IMHO, some individuals do not even have a creative idea of pertinence in their lifetimes!

The dichotomous creativity.

The construct of creativity is very difficult to measure and so is creative genius. [vv] But there is a downside: Professionally, I have frequently encountered highly creative individuals who do not have the convergence intelligence capacities to actualize their whole potential: their "g" is insufficient for their "c". This imbalance is often associated with significant problems sometimes manifesting as psychopathology. I speculate that that may provide a risk because it does not ground their thinking which cannot be validated. Moreover, they may actually become more creative by injury to their brain: This has been linked in my research with temporolimbic instability. Effectively, there are ways to modify one's critical sensors of the brain, and sometimes this allows more lateral thinking and different utilizations of broader consciousness, but this is the broad idea [79-81; 126-130]. [ww]

[uu] P36

[vv] See again pni.org/intelligence

[ww] See www.brainvoyage.com

Perspective

As I understand it, creativity may be multidisciplinary or involve one specific discipline. The phrase is better described as

"Unique innovation demonstrated in one or more of several disciplines; divergent thinking after applying convergent thought in those disciplines; music, mathematics, science and chess may be easier to quantitate than art and literature. It is used above in the context of the U for Unique Creativity."

I postulate that the Higher Consciousness, conceptualized as "outside the brain, opening into the infinite knowledge will prove highly correlated with "c" *creativity*. [75]

The "c" factor for creativity has elements of lateral, original and divergent thought but all are difficult to measure unless tests are modified markedly. At the ultra-high levels of IQ, particularly beyond 4 SD, it may be that creative achievement is important to document

The SCHIQ as the Standardized Corrected Historical Intelligence (Quotient) does so somewhat, and the ECAO (Exceptional Creative Achievement Organization) allows assessments with limitations, but may be better than using a one-factor "g" fix-all approach that we have available currently. When we try to apply g across the board even at extremes of higher intelligence and encounter some psychoses, we might generalize when "like must be compared with like" not "not like" [131] But a task for later times has to be to develop the adequacy of the measure for "c" with appropriate factor analyses.

However, these do not distinguish between actions that are mediocre versus extraordinary.

We all have our own special song to sing in this world. Let's sing it out aloud and not only actualize, but transcend.

The unsung "new factors" differentiating Genius and Prodigies (Section 6)

Vernon M Neppe [xx] [yy]

The focus of this lengthy series has been to portray the concepts of genius and to differentiate it from prodigies, from exceptional intelligence, from "giftedness" and to show that one kind of genius may be a polymath but another may be more unidimensional. We have explored with a historical IQ study to try to tame the whole area and in so doing, in conjunction with the great literature out there, we have consolidated the need for several factors besides the fundamental "g" general factor that distills the mental abilities we call intelligence. We've seen how "s" specific factors, like all factors, correlates weakly positively with "g" but which is a key to individuals who need specific skills: The musician needs his perfect pitch, and the artist his remarkable abilities with hues, and perhaps neurophysiology also comes in with the blindfold chess-player having a far more developed fusiform gyrus.

We then explored the remarkable need for a new factor, what I call the "c" factor for creativity and how essential that is to both genius and the creative prodigy. However, we have also recognized that despite the great pertinence of "g", of a relevant "s" and of "c" there are other factors that are critical.

We've mentioned them briefly, en passant, before and recognized that they make up the mnemonic "geniuses". We again revisit here, applying the further knowledge learnt with our SCHIQ study.

I introduced the concept of several new factors in intelligence, particularly applicable to the exceptional individual, because I argue they are needed, particularly in our conceptualization of genius.

Current factors that are now well established to us.
g factor general factor implying highly correlative convergent thought.
s factor specific factor less correlative with the "g" of specific mental abilities, and almost softer but still requiring a convergence of thinking.

And the new, well motivated but very elusive to measure factor, Creativity or *"c" factor.*

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[yy] We thank the Pacific Neuropsychiatric Institute © for permission to publish.

This is our creative intelligence: This reflects COLDS—Creativity, Originality, Laterality, Divergent thought, and yet Simplicity. This reflects Uniqueness and that U is the U in GENIUSES. Creativity reflects innovation demonstrated in one of several disciplines with the divergent way of thinking. Music, mathematics, science, chess are sometimes easier to quantitate than art and literature. But all constitute Unique Creativity.

There is a need for consolidation of other elements. Table I.

Table I: The New factors revisited.
i factor: intuition-inspiration factor
z factor: zeal, energy, motivation, drive, volition, persistence, pursuit, perseverance (here the E for energy), how much does he want it?
a factor: achievement; this is our social context; achievement pioneering or redirecting cultural comprehensible skills. Plus:
c factor: creativity; uniqueness

and also
n factor implying nervous system integration of c and e with g and s. Also involves volitional factors of executive function z,
e factor: ego strength with emotional-cognitive functional combinations.

Clearly, such new factors are unproven and speculative. They are likely to stay that way because we don't have easy measures to purport to measure these qualities, plus if we are talking "genius", there are very few. So these ideas for the solid monocular scientist may correctly be regarded as ridiculous. But re-examining the geniuses through history and these qualities become vibrant.

First, let's briefly examine an interesting idea of multiple intelligences:

Gardner's Concept of multiple intelligences
Howard Gardner has emphasized "multiple intelligences" as more salient in the achievements of geniuses than their usually high g and just g[61] To me, this is as close as one gets to realizing there are more features necessary for genius than just "g" and some "s". This too motivates extra proposed new factors, provided we do not equate it with "g". This may not usually be noted because some of these multiple intelligences are at extremes at the distribution curve. [3]
However, *below an IQ threshold of at least g below +1.5 sigma and +2 sigma and more likely 3 sigma (IMHO) individuals cannot even develop high-level complex socially significant achievements.* [3]

Some of Howard Gardner's "multiple intelligences" haven't adequately been included in any large-scale factor analyses, "so we don't know if they would show up on already established factors or would add new factors to the overall map of the factor structure of human abilities." [61]

Several of Gardner's "multiple intelligences" would at best qualify as lower-order factors in direct intelligence "g" measures, and are not measured by IQ tests (with likely only low correlations with IQ) [132] [3]

Let's examine these:

The most complex and disputed factor of all, the "i" or Inspiration / Intuition factor.
Whereas we have stuck rigidly with the brain functions, we now move away.
Persons with genius tend to have strong intuitions about their domains, and they build on these insights with tremendous energy. Carl Rogers, the great Humanistic Psychologist, argued that the genius needs to trust his or her intuition in a given field. [133] He gives the examples of *El Greco*, and his early work: 'good artists do not paint like that.' *Yet, "he trusted his own experiencing of life, the process of himself, sufficiently that he could go on expressing his own unique perceptions. It was as though he could say,* 'Good artists don't paint like this, but I paint like this.'*"*
And Rogers then refers to Ernest Hemingway *"good writers do not write like this." "But fortunately he moved toward being Hemingway, being himself, rather than toward someone else's conception of a good writer."*
To Rogers, these are examples of how strong intuitions about their "domains" led them to build on these insights with tremendous energy. But I argue that such intuitions are even more fundamental, and linked up with higher consciousness. [75]

In a recent publication on Consciousness, I distinguished one kind of paradigm called "higher consciousness". There may even be varying levels of *"Higher Consciousness" (H-C):*

- a separate transfinite *discrete* meaning (*Transfinite Consciousness*); and
- an unending *continuous information repository* resulting in meaning in the infinite.

However, the core is that there may be "aha" moments which may be picked up in higher consciousness, outside the brain. We have proposed that Higher Consciousness may not be experienced almost at all by many living sentient beings [75]
, and may be accentuated by such *states* as dreams or meditation, or may occur as a *trait* in, for example, mystics. I also see it as an essential in creativity. Some would argue this is an extension of his Psychological Consciousness, and still based within the brain. The Transpersonal Psychologist like Rogers, would be well prepared to perceive a transcendence of self as possibly accessing more than just brain psychology. It may well in fact, reflect an altered state of consciousness that allows the creative genius to tune in to realities that most don't access. [75]. We (Neppe and Close) [75] maintain there is a valuable stage before science is applied empirically: Some call these "Eureka moments" and some "opening to the infinite". We could also call it a "prescient perspicacity", or even an "epiphany". Now you might say: Where is the data for this? The data is the repetitive biographical history of tens of Nobel laureates and other original thinking scientists: These ideas do not just develop from solid work; they develop often as dramatic insights. [134; 135] They happen long before the published correlative data. We have a place for subjective, spontaneous experience and thinking in this world. [136] [75]

and I motivate based on the history of great geniuses, that this is critically important.

Is it inspiration? Is it intuition or psi? Is it higher consciousness? The data is there to support it, but the reader can choose. Importantly here, it is pertinent for the crystallization of the ideas of the genius. [74; 76; 83; 86; 127].

The "n" factor: Neurological.
The brain is the final common pathway and special parts have special functions. The temporal lobe is the great integrator of polymodal perceptual input, both arising from elsewhere in the brain, or from the outside. The frontal lobe is the great executive, for example. All these functions are key and need to function. But for the genius, the wealth of extra connections that may allow different ways of perceiving the world, a fluency of perception and response, may make such phenomena supernormal. This is why the work being done on the brain is so important in intelligence research. Many different physically measured brain variables are correlated with g though they work together to cause individual differences in abilities yet their Interco relations are still mysterious. [137] To assume this all just linked up with one functioning factor, "g", in genius when we've seen more factors than just "g" involved, may be naïve. What about other areas like motivation (frontal lobe) and the required "zeal"? [78] It may be the "n" factor is the glue that puts genius together. [79-81; 126].

The "e" factor: Ego-strength.
We've repetitively alluded to the need to function for genius to be in full play. We've discussed psychopathology and the potentials for psychological lability and decompensations, and the specific stresses that creative originality and uniqueness are linked with. We've seen how artists and writers may even paradoxically benefit from bipolar illness. But most pertinent is that ego-consciousness and that strength of being able to handle information.

The "z" factor: Zeal.
I've called this "zeal" z-factor, out of respect for Arthur Jensen, who kept emphasizing zeal in genius. [3] I regard the need as more than just "zeal". zeal, energy, motivation, drive, volition, persistence, pursuit, perseverance (here the E for energy), how much does he want it? Essentially, the genius often has to go his own way: He often encounters enormous opposition. This requires more than just assiduous zeal to go ahead. It is the persistence to continue in the face of antagonism. It requires drive and motivation, again examples of frontal lobe function. This "zeal" factor is the ability to light one's own fire, to kindle it and keep it aglow even against opposition hurricanes, maintained during the midst of the greatest head-winds.
In GENIUSES, the zeal that is needed, z factor, is reflected by the "E" in energy because it requires the requisite energy, persistence, motivation, volition and drive.

The "a" factor: Achievement
Leonardo Da Vinci did not invent the aeroplane or any kind of flying machine. But he did outline the prototype that may or may not have worked. He was a great genius but sometimes contributions must be at the right time, in the correct place, and in the proper milieu. Today,

research for example is expensive and until such time as this is appropriately funded, genius may be lost because the achievements cannot be actualized. A is for achievement and actualization factors: Obvious, yes, but geniuses must work in their social milieu.
In GENIUSES, "a" factor is reflected by the second "s" as in skills. Skills reflect the endpoint of genius.

Perspective
Of course, again. our task for later times has to be to develop adequate validating and reliability measures for all these extra factors. This requires not only special criteria but appropriate factor analyses which allow them to be correlated with other factors, and with the criteria making them up. Only then do we move from speculation to true empirical science.

Our voyage into genius comes to an end but yet it is a beginning: This is one reason why I established the Exceptional Creative Achievement Organization (ECAO) [zz]. Those individuals who exhibit the fundamental quality that distinguishes the genius from just the exceptionally intelligent individual can have the opportunity to interface and consult on their areas of skill with large companies or even small countries, all based on their choice. They can publish, peer reviewed, the most creative articles they want in DIJECA —The Dynamic International Journal of Exceptional Creative Achievement. They just need to qualify for ECAO, which in a way epitomizes genius, so that itself is a challenge.

GENIUSES, yes.
g-factor general intelligence
e-factor ego strength
n-factor nervous system functioning optimally
i-factor intuition and inspiration Aha moment factor
u for uniqueness and reflecting the c-factor of creativity
s for s-factor as specific, special areas of mental strength
e for energy and reflecting zeal as part of the z-factor
s for skills and reflecting a-factor of achievement

The genius requires many multidisciplinary factors. And these geniuses, like everyone else, have their very special, unique song to sing.

[zz] For more on ECAO, go to www.ecao.us or 5KIQ.com

1. Neppe VM: Intelligence assessment by history taking in child prodigies with adult achievement—the SCHIQ, in International Society for Intelligence Research Conference Book. pp. 21. Decatur, GA: 2008.
2. Neppe VM: December. Intelligence assessment by history taking in child prodigies with adult achievement—the SCHIQ. Program, International Society for Intelligence Research, Decatur, GA, www.pni.org/intelligence/SCHIQ/ 2008.
3. Jensen AR, Langan C: *Discussions on genius and intelligence: Mega Foundation interview with Arthur Jensen*. Eastport, New York: Mega Press, 2002.
4. Terman LM: *The measurement of intelligence: An explanation of and a complete guide to the use of the Stanford Revision and Extension of the Binet-Simon Intelligence Scale: Riverside Textbooks in Education*. Boston, MA Houghton Mifflin, 1916.
5. Terman LM: Psychological Approaches to the Biography of Genius. *Science* 92:2388; 293-301, 1940.
6. Terman LM, Merrill M: *Measuring intelligence: A guide to the administration of the New Revised Stanford-Binet Tests of Intelligence*. Boston, MA Houghton Mifflin, 1937.
7. Terman LM, Merrill M: *Stanford-Binet Intelligence Scale: Manual for the Third Revision Form L-M*. Boston, MA Houghton Mifflin, 1960.
8. Terman LM, Oden M: *Terman, Lewis M.; (). The gifted group at mid-Life: Thirty-five years' follow-up of the superior child.* Genetic Studies of Genius Volume V. Stanford, CA: Stanford University Press, 1959.
9. Child D, Croucher A: Divergent thinking and ability: Is there a threshold? *Educational Studies* 3:2; 101-110, 1977.
10. Jauk E, Benedek M, Dunst B, et al.: The relationship between intelligence and creativity: New support for the threshold hypothesis by means of empirical breakpoint detection. *Intelligence* 41:4; 212-221, 2013.
11. Majumdar S: A systems approach to identification and nurture of scientific creativity. *Journal of Indian Education* 1:2; 17-23, 1975.
12. Albert RS: *Genius and eminence (2nd ed.)*:International series in experimental social psychology, Vol 22: (1992). Genius and eminence (2nd ed.). 410 pp. Elmsford, NY, US: Pergamon Press., 1992.
13. Aliotti NC, Blanton WE: Creative thinking ability, school readiness, and intelligence in first grade children. *J Psychol* 84:1st Half; 137-143, 1973.
14. Alpaugh PK, Parham IA, Cole KD, et al.: Creativity in adulthood and old age: An exploratory study. *Educational Gerontology* 8:2; 101-116, 1982.
15. Andreasen NC: *The creating brain: The neuroscience of genius*. (2005). The creating brain: The neuroscience of genius, 2005.
16. Argulewicz EN, Kush JC: Concurrent validity of the SRBCSS Creativity Scale for Anglo-American and Mexican-American gifted students. *Educational & Psychological Research* 4:2; 81-89, 1984.
17. Cattell RB: Classical and standard score IQ standardization of the I.P.A.T culture-free intelligence scale 2. *J Consult Psychol* 15:2; 154-159, 1951.

18. Wainwright M, Wright MJ, Geffen GM, et al.: Genetic and environmental sources of covariance between reading tests used in neuropsychological assessment and IQ subtests. *Behav Genet* 34:4; 365-376, 2004.
19. Schroth ML: The use of IQ as a measure of problem solving ability with mongoloid and nonmongoloid retarded children. *J Psychol* 91:1st Half; 49-56, 1975.
20. Jensen LR: Diagnosis and evaluation of creativity, research and thinking skills of academically talented elementary students. *Gifted Child Quarterly* 22:1; 98-110, 1978.
21. Bridgeman B: Unbelievable results when predicting IQ from SAT scores. A comment on Frey and Detterman (2004). *Psychol Sci* 16:9; 745-746; discussion 747, 2005.
22. DeLa Jara R. IQ percentile and rarity chart. from http://www.iqcomparisonsite.com/IQtable.aspx. 2006.
23. Anonymous. The Terman study. from http://hiqnews.megafoundation.org/Terman_Summary.htm. ND.
24. Burt C: Eugenics; intelligence and genius. *Br Med Bull* 6:1-2; 78, 1949.
25. Eysenck HJ: *Intelligence: A new look*: (1998). Intelligence: A new look. 227 pp. New Brunswick, NJ, US: Transaction Publishers., 1998.
26. Eysenck HJ: *Genius: The natural history of creativity*:Problems in the behavioural sciences, 12. New York, NY: Cambridge University Press., 1995.
27. Herrnstein RJ, Murray C: *Bell Curve: Intelligence and class structure in American life* New York, NY: Free Press, 1996.
28. Williams RL: Overview of the Flynn effect. *Intelligence* 41753-764, 2013.
29. Williams RL: Understanding the Flynn effect. *Vidya*:282-283; 30-49, 2011.
30. Rowe DC, Rodgers JL: Expanding variance and the case of historical changes in IQ means: a critique of Dickens and Flynn (2001). *Psychol Rev* 109:4; 759-763; discussion 764-771, 2002.
31. Daley TC, Whaley SE, Sigman MD, et al.: IQ on the rise: the Flynn effect in rural Kenyan children. *Psychol Sci* 14:3; 215-219, 2003.
32. Kanaya T, Scullin MH, Ceci SJ: The Flynn effect and U.S. policies: the impact of rising IQ scores on American society via mental retardation diagnoses. *Am Psychol* 58:10; 778-790, 2003.
33. Bradmetz J, Mathy F: An estimate of the Flynn Effect: changes in IQ and subtest gains of 10-yr-old French children between 1965 and 1988. *Psychol Rep* 99:3; 743-746, 2006.
34. Mingroni MA: Resolving the IQ paradox: heterosis as a cause of the Flynn effect and other trends. *Psychol Rev* 114:3; 806-829, 2007.
35. Dickinson MD, Hiscock M: Age-related IQ decline is reduced markedly after adjustment for the Flynn effect. *J Clin Exp Neuropsychol* 32:8; 865-870, 2010.
36. Agbayani KA, Hiscock M: Age-related change in Wechsler IQ norms after adjustment for the Flynn effect: estimates from three computational models. *J Clin Exp Neuropsychol* 35:6; 642-654, 2013.
37. Flynn JR: IQ gains and fluid g. *Am Psychol* 55:5; 543, 2000.
38. Flynn JR: Requiem for nutrition as the cause of IQ gains: Raven's gains in Britain 1938-2008. *Econ Hum Biol* 7:1; 18-27, 2009.

39. Colom R, Garcia-Lopez O: Secular gains in fluid intelligence: evidence from the Culture-Fair intelligence test. *J Biosoc Sci* 35:1; 33-39, 2003.
40. Neppe VM: A detailed analysis of an important chess game: Revisiting 'Maróczy versus Korchnoi'. *Journal Soc. Psychical Research* 71:3; 129-147, 2007.
41. Dunne A: Paul Morphy vs. Rybka: Most chess players agree that Morphy was one of the best. But what does Rybka reveal? *Chess Life*:November; 38-39, 2013.
42. David H, Lynn R: Intelligence differences between European and oriental Jews in Israel. *J Biosoc Sci* 39:3; 465-473, 2007.
43. Lynn R, Longley D: On the high intelligence and cognitive achievements of Jews in Britain. *Intelligence* 34:6; 541-547, 2006.
44. Jensen AR: *Spearman's hypothesis*. Collis, Janet M (Ed); Messick, Samuel (Ed). (2001). Intelligence and personality: Bridging the gap in theory and measurement, 2001.
45. Lynn R: Does Spearman's g decline at high IQ levels? Some evidence from Scotland. *J Genet Psychol* 153:2; 229-230, 1992.
46. Jensen AR: The g factor and the design of education, in *Intelligence, instruction, and assessment: Theory into practice*. Edited by Sternberg RJ, Williams WM. Mahwah, NJ: Lawrence Erlbaum. 1998.
47. Jensen AR: *The g factor: The science of mental ability. Human evolution, behavior, and intelligence*. Westport, CT Praeger, 1998.
48. Jensen AR: Level I/Level II: Factors or categories? *Journal of Educational Psychology* 74:6; 868-873, 1982.
49. Jensen AR: The definition of intelligence and factor-score indeterminacy. *Behavioral and Brain Sciences* 6:2; 313-315, 1983.
50. Caruso JC: Increasing the reliability of the fluid/crystallized difference score from the Kaufman Adolescent and Adult Intelligence Test with reliable component analysis. *Assessment* 8:2; 155-166, 2001.
51. Hofer SM: *On the structure of personality and the relationship of personality to fluid and crystallized intelligence in adulthood.* Hofer, Scott Michael: U Southern California, US, 1995.
52. Wechsler D: *The measurement of adult intelligence* 1 Edition. Baltimore, MD Williams & Witkins, 1939.
53. Developers: *Wechsler Adult Intelligence Scale, Fourth Edition*. Los Angeles, CA: Pearson, 2008.
54. Boggan AL, Huang C-M: Chess expertise and the fusiform face area: Why it matters Available at: http://www.jneurosci.org/content/31/47/16895.full Accessed: 2011.
55. Jensen AR: Psychometric g: Definition and substantiation, in *The general factor of intelligence: How general is it?* Edited by Sternberg RJ, Grigorenko EL. Mahwah, NJ, US Lawrence Erlbaum. pp. 39-53 2002.
56. Kranzler JH, Jensen AR: Unitary g: Unquestioned postulate or empirical fact? *Intelligence* 15:4; 437-448, 1991.
57. Sternberg RJ: Beyond IQ: A triarchic theory of human intelligence, in *Beyond IQ" A triarchic theory of human intelligence*. Edited by. pp. 411 1985.

58. Sternberg RJ: A unified theory of intellectual exceptionality, in *Intelligence and exceptionality: New directions for theory, assessment, and instructional practices*. Edited by Day JD, Borkowski JG. New York, NY: Ablex. pp. viii, 262 1987.
59. Sternberg RJ, Williams WM: Does the Graduate Record Examination predict meaningful success in the graduate training of psychologists? A case study. *Am Psychol* 52:6; 630-641, 1997.
60. Tigner RB, Tigner SS: Triarchic theories of intelligence: Aristotle and Sternberg. *Hist Psychol* 3:2; 168-176, 2000.
61. Gardner H: Creativity: An interdisciplinary perspective. *Creativity Research Journal* 18-26, 1988.
62. Neppe VM. Exceptional intelligence. from http://www.pni.org/intelligence/. 2014.
63. Anonymous. Genius. from http://en.wikipedia.org/wiki/Genius. 2014.
64. Anonymous. Genius derivation. from http://dictionary.reference.com/browse/genius. 2014.
65. Hafner S: [Immanuel Kant--a genius of pedantry and punctuality]. *Fortschr Neurol Psychiatr* 77:11; 655-661, 2009.
66. Russell B: *The Conquest of Happiness* New York: Liveright / Norton, 1930 (reprinted 2013).
67. Gleick J: *Genius: The life and science of Richard Feynman*. USA: Open Road Media, 2011.
68. Robinson A: *Sudden genius? The gradual path to creative breakthroughs* Oxford, UK: Oxford University Press, 2010.
69. Robinson A: *Genius: A very short introduction*. Oxford, UK: Oxford University Press, 2011.
70. Ruthsatz J, Urbach JB: Child prodigy: A novel cognitive profile places elevated general intelligence, exceptional working memory and attention to detail at the root of prodigiousness. *Intelligence* 40:5; 419–426, 2012.
71. Shavinina LV: The psychological essence of the child prodigy phenomenon: Sensitive periods and cognitive experience. *Gifted Child Quarterly* 43:1; 25-38, 1999.
72. Maazel M: What to do about the child prodigy. *Etude* 68:8; 12-13, 1950.
73. Parin-Matthey L: The adjustment problems of a child prodigy. *Psychologie* 247-267, 1962.
74. Neppe VM, Close ER: *Reality Begins with Consciousness (RBC) — Glimpses and Glossary* 2nd Edition. Seattle, WA: Brainvoyage.com, 2014.
75. Neppe VM, Close ER: EPIC consciousness: A pertinent new unification of an important concept. *Journal of Psychology and Clinical Psychiatry* 1: 00036:6; 1-14, 2014.
76. Neppe VM, Close ER: The most logical Psychology: The "vertical" approach" to the transcendental and Transpersonal Psychology in the TDVP context: Part 4. *IQNexus Journal* 15:2; 25-38, 2014.
77. Neppe VM, Close ER: The most logical Psychology: The "horizontal" approach" to Transpersonal and Humanistic Psychology in the TDVP context: Part 3. *IQNexus Journal* 15:2; 18-24, 2014.
78. Neppe V, Chen A, Davis JT, et al.: The application of the screening cerebral assessment of Neppe (BROCAS SCAN) to a neuropsychiatric population. *J Neuropsychiatry Clin Neurosci* 4:1; 85-94, 1992.
79. Neppe VM: Symptomatology of temporal lobe epilepsy. *S Afr Med J*, 60:23; 902-907, 1981.
80. Neppe VM: Non-epileptic symptoms of temporal lobe dysfunction *S Afr Med J*, 60:26; 989-991., 1981.

81. Neppe VM: Differing perspectives to the concept of temporal lobe epilepsy. *The Leech* 52:1; 6-10, 1982.
82. Eysenck HJ: *Creativity, personality and the convergent-divergent continuum*: Runco, Mark A (Ed). (2003). Critical creative processes. (pp. 95-114). xiii, 410 pp. Cresskill, NJ, US: Hampton Press., 2003.
83. Neppe VM, Close ER: *Reality begins with consciousness: a paradigm shift that works (5th Edition)* Fifth Edition. Seattle: Brainvoyage.com, 2014.
84. Neppe VM, Close ER: A Proposed Theory of Everything that works: How the Neppe-Close Triadic Dimensional Distinction Vortical Paradigm (TDVP) model provides a metaparadigm by applying nine-dimensional finite spin space, time and consciousness substrates and the transfinite embedded in the infinite producing a unified reality. *IQNexus Journal* 16:3; 1-54, 2014.
85. Ferguson GA, Takane Y: *Statistical analysis in psychology and education, 6th edition* 6 Edition. New York, NY: McGraw-Hill, 1971 (republished 1989).
86. Neppe VM, Close ER: *Reality Begins with Consciousness (RBC)—Key Features* 2nd Edition. Seattle, WA: Brainvoyage.com, 2014.
87. Neppe VM, Close ER: The Triadic Dimensional Distinction Vortical Paradigm (TDVP): The nine-dimensional finite spin metaparadigm embedded in the infinite *Dynamic International Journal of Exceptional Creative Achievement* 1401:1401; 4001-4041, 2014.
88. Arabadzhev S, Glavsa J: Suggestive effect of music and aphorisms on fluency in tests of creativity. *Studia Psychologica* 20:3; 203-212, 1978.
89. Baker M: Teacher creativity and its relationship to the recognition of student creativity. *Creative Child & Adult Quarterly* 3:2; 106-115, 1978.
90. Kanter SH: *An investigation of the concurrent validity of selected subtests of Torrance Tests of Creative Thinking among individuals at high levels of recognition in art and science.* Kanter, Steven H.: U Pittsburgh, 1984.
91. Belcher TL, Rubovits JJ, DiMeo PA: Measurement of creativity: A factor analytic study. *Psychological Reports* 48:3; 819-825, 1981.
92. Bollinger G: Creativity assessment by means of tests of divergent thinking? *Zeitschrift fur Differentielle und Diagnostische Psychologie* 287-106, 1981.
93. Hocevar D: Measurement of creativity: Review and critique. *Journal of Personality Assessment* 45:5; 450-464, 1981.
94. Visser D: An evaluation of "creativity tests" as regards their rationale and psychometric standards. *South African Journal of Psychology* 11:4; 130-138, 1981.
95. Neppe VM: Intelligence, IQ and the medical practitioner. *South African Medical J* 61:16; 574, 1982.
96. Seddon G: The measurement and properties of divergent thinking ability as a single compound entity. *Journal of Educational Measurement* 20:4; 393-402, 1983.
97. Zhang D: An exploratory study of creative thinking in adolescents. *Information on Psychological Sciences No* 220-25, 1985.
98. Konig F: Creativity testing as an essential component of intelligence testing. *Diagnostica* 32:4; 345-357, 1986.

99. Runco MA, Albert RS: The threshold theory regarding creativity and intelligence: An empirical test with gifted and nongifted children. *Creative Child & Adult Quarterly* 11:4; 212-218, 1986.
100. Brown RT: *Creativity: What are we to measure?*: Glover, John A (Ed); Ronning, Royce R (Ed); Reynolds, Cecil R (Ed). (1989). Handbook of creativity. (pp. 3-32). xxi, 447 pp. New York, NY, US: Plenum Press., 1989.
101. Davis GA: Testing for creative potential. *Contemporary Educational Psychology* 14:3; 257-274, 1989.
102. Hocevar D, Bachelor P: *A taxonomy and critique of measurements used in the study of creativity*: Glover, John A (Ed); Ronning, Royce R (Ed); Reynolds, Cecil R (Ed). (1989). Handbook of creativity. (pp. 53-75). xxi, 447 pp. New York, NY, US: Plenum Press., 1989.
103. Michael WB, Wright CR: *Psychometric issues in the assessment of creativity*: Glover, John A (Ed); Ronning, Royce R (Ed); Reynolds, Cecil R (Ed). (1989). Handbook of creativity. (pp. 33-52). xxi, 447 pp. New York, NY, US: Plenum Press., 1989.
104. Vernon PE: *The nature-nurture problem in creativity*: Glover, John A (Ed); Ronning, Royce R (Ed); Reynolds, Cecil R (Ed). (1989). Handbook of creativity. (pp. 93-110). xxi, 447 pp. New York, NY, US: Plenum Press., 1989.
105. Godwin LJ, Moran JD: Psychometric characteristics of an instrument for measuring creative potential in preschool children. *Psychology in the Schools* 27:3; 204-210, 1990.
106. Meltzer P: Creativity tests of the Dutch Psychological Service: A study of 2 divergent-production tests--DMI and DMC. *Nederlands Tijdschrift voor de Psychologie en haar Grensgebieden* 45:3; 138-141, 1990.
107. Michael WB, Bachelor P: Higher-order structure-of-intellect creativity factors in divergent production tests: A re-analysis of a Guilford data base. *Creativity Research Journal* 3:1; 58-74, 1990.
108. Puccio GJ: William Duff's eighteenth century examination of original genius and its relationship to contemporary creativity research. *Journal of Creative Behavior* 25:1; 1-10, 1991.
109. Runco MA: *Divergent thinking*:Creativity research: (1991). Divergent thinking. xi, 199 pp. Westport, CT, US: Ablex Publishing., 1991.
110. Kitto J, Lok D, Rudowicz E: Measuring creative thinking: An activity-based approach. *Creativity Research Journal* 7:1; 59-69, 1994.
111. Hunsaker SL, Callahan CM: Creativity and giftedness: Published instrument uses and abuses. *Gifted Child Quarterly* 39:2; 110-114, 1995.
112. Goldman BA, Mitchell DF, Egelson PE: *Creativity*: Goldman, Bert A; Mitchell, David F; Egelson, Paula E. (1997). Directory of unpublished experimental mental measures, Vol. 7. (pp. 203-204). ix, 501 pp. Washington, DC, US: American Psychological Association., 1997.
113. Runco MA, Richards RE: *Eminent Creativity, Everyday Creativity, and Health*. New York, NY: Ablex, 1998.
114. Morais M, Maia J, Almeida LS: A cognitive differentiation of extreme creative performances. *Psicologia: Teoria, Investigacao e Pratica* 6:1; 149-169, 2001.

115. Mouchiroud C, Lubart T: Children's original thinking: An empirical examination of alternative measures derived from divergent thinking tasks. *Journal of Genetic Psychology* 162:4; 382-401, 2001.
116. Han K-S, Marvin C: Multiple creativeness? Investigating domain-specificity of creativity in young children. *Gifted Child Quarterly* 46:2; 98-109, 2002.
117. Kaufman JC, Baer J: Could Steven Spielberg manage the Yankees?: Creative thinking in different domains. *Korean Journal of Thinking & Problem Solving* 12:2; 5-14, 2002.
118. Baer J: *Evaluative thinking, creativity, and task specificity: Separating wheat from chaff is not the same as finding needles in haystacks*: Runco, Mark A (Ed). (2003). Critical creative processes. (pp. 129-151). xiii, 410 pp. Cresskill, NJ, US: Hampton Press., 2003.
119. Hunsaker SL, Callahan CM: *Creativity and Giftedness: Published Instrument Uses and Abuses*: Treffinger, Donald J (Ed). (2004). Creativity and giftedness. (pp. 175-186). xxx, 192 pp. Thousand Oaks, CA, US: Corwin Press., 2004.
120. Runco MA: *Divergent Thinking, Creativity, and Giftedness*: Sternberg, Robert J (Ed). (2004). Definitions and conceptions of giftedness. (pp. 47-62). xxvi, 182 pp. Thousand Oaks, CA, US: Corwin Press., 2004.
121. Urban KK: Assessing Creativity: The Test for Creative Thinking - Drawing Production (TCT-DP): the concept, application, evaluation, and international studies. *Psychology Science* 46:3; 387-397, 2004.
122. Dollinger SJ, Shafran M: Note on Consensual Assessment Technique in Creativity Research. *Perceptual and Motor Skills* 100:3; 592-598, 2005.
123. Runco MA, Illies JJ, Reiter-Palmon R: Explicit Instructions to Be Creative and Original: A Comparison of Strategies and Criteria as Targets With Three Types of Divergent Thinking Tests. *Korean Journal of Thinking & Problem Solving* 15:1; 5-15, 2005.
124. Batey M, Furnham A: Creativity, intelligence, and personality: a critical review of the scattered literature. *Genet Soc Gen Psychol Monogr* 132:4; 355-429, 2006.
125. Benedek M, Jauk E, Sommer M, et al.: Intelligence, creativity, and cognitive control: The common and differential involvement of executive functions in intelligence and creativity. *Intelligence* 4673-83, 2014.
126. Neppe VM: Subjective paranormal experience and temporal lobe symptomatology. *Parapsychological Journal of South Africa* 1:2; 78-98, 1980.
127. Neppe VM: Curing the incurable, in *Cry the Beloved Mind: A Voyage of Hope*. Edited by. Seattle: Brainquest Press pp. 311-343 1999.
128. Palmer J, Neppe VM: A controlled analysis of subjective paranormal experiences in temporal lobe dysfunction in a neuropsychiatric population. *Journal of Parapsychology* 67:1; 75-98, 2003.
129. Palmer J, Neppe VM: Exploratory analyses of refined predictors of subjective ESP experiences and temporal Lobe Dysfunction in a neuropsychiatric population. *European Journal of Parapsychology* 1944-65, 2004.
130. Neppe VM: Temporal lobe symptomatology in subjective paranormal experients. *Journal of the American Society for Psychical Research* 77:1; 1-29, 1983.

131. Neppe VM: Phenomenological consciousness research: ensuring homogeneous data collection for present and future research on possible psi phenomena by detailing subjective descriptions, using the multi-axial a to z SEATTLE classification. *Neuroquantology* 9:1; 84-105, 2011.
132. Carroll JB: *Human cognitive abilities: A survey of factor analytic studies*. Cambridge, UK: Cambridge University Press, 1993.
133. Rogers C: *On becoming a person* Boston, MA: Houghton Mifflin, 1995.
134. Schwartz SA: Trends that will affect your future. Genius. *Explore (NY)* 5:1; 16-19, 2009.
135. Schwartz SA: Nonlocality and exceptional experiences: a study of genius, religious epiphany, and the psychic. *Explore (NY)* 6:4; 227-236, 2010.
136. Neppe VM: A multiaxial classificatory system for anomalous experience. *Parapsychological Journal of South Africa* 6:1; 57-72, 1985.
137. Deary IJ: *The g factor: Looking down on human intelligence: From psychometrics to the brain*. Oxford, UK: Oxford University Press, 2000.

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