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Symphonies and Cultural Cognition in Perfect Pitch

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Abstract
The idea of nature versus nurture has intrigued scholars of different epochs since the mid-19th century and as such, the precursors of innate intelligence remain at the center of the debate. Psychologists have narrowed the arguments and in different ways the argument could be framed as culture versus cognition. That dichotomous dialect, however, reduces the arguments too far, and researchers realize that there is an interaction between the two, with the two camps wanting to reward or discount their own scholarly predilections. One of the sticking points in arguments of intelligence and the Intelligence Quotient (IQ) are when the interaction between mind and body, or what René Descartes referred to as mind-body dualism, offer clear skills that are heritable beyond eye color. Perfect pitch is one such skill. The extent to which training can compensate for perfect pitch depends on the cultural traits from which the individual originates. Using the filter of an ethnomusicological methodology, the multicultural facets of IQ can be seen in the Western musical tradition of the full orchestra used for symphony. The outcome of this research will be to use this deconstruction of this cultural object (that correlates to IQ by argument) as the foundation for a new expression in symphonic forms explored in our creative research by utilizing Kenyan traditional folk music and rhythms.
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1. Introduction

The argument of whether human intelligence is acquired by nature versus nurture has intrigued theorists of different epochs since the mid-19th - century and as such, the precursors of innate intelligence remain at the center of the debate (Galton, 1869; Tabery, 2014). Psychologists have narrowed the arguments and in different ways the argument could be framed as culture versus cognition (Fessler, 2012). The scientific method is not without flaws, simply because human beings are not without flaws. In fact, the psychological states of the scientist themselves can impact their own defense of a certain theory, no matter how many predictions can be drawn from their theory (Livio, 2013).

Psychologists find their roots in biology to some extent. In many biological systems, a unique feature within the population, may lead researchers to not only draw conclusions, but also make predictions. Arguably, Darwin's *Origin of the Species* has drawn the social scientists to follow suit in trying to prove or disprove theories about the human condition (Darwin, 1874; Gould, 1981, 1996, 1999, 2003; Gould & Purcell, 2000). One of the most prominent theories to emanate from this line of thinking addressed the nature of human intelligence. An odd quirk of scientific history is that the first empirical forays into measuring intelligence came from a first cousin to Charles Darwin- Sir Francis Galton (Gould, 1981). His modern scholarly descendants are the cognitive scientists of today, who unlike Galton, have new frontiers to explore with the so many advances in neurosurgery and brain imaging. At the base of these explorations, however, is the positivist attitude among scientific theorists. Empirical data trumps any subjective commentary that might come from a school of thought that wants to comment on the data with a cultural framework. Other psychological theorists benefitted from other paradigms found in sociology and anthropology. With Galton introducing statistical modeling into intelligence theory, however, the positivist reigns supreme among many circles.

This commentary will start with the positivist viewpoint and then ask, for the sake of argument, that certain ideas be entertained with rhetorical tools instead of empiricism, as would have been the case with Socrates, Plato, or Aristotle (Livio, 2009; Plato 2007). The bias of empiricism can sometimes appear invisible, leaving questions concerning paradigms unsettled, because these questions are not congenial to the scholars who are often divided by opposing paradigms at the onset of the argument.

2. Perfect Pitch

An individual is considered to have a perfect pitch (PP) if that individual has the ability to identify or produce a

musical note in isolation and independent of other musical stimuli. The cognitive skill of an individual with a perfect pitch offers an opportunity for an initial argument. For instance, this was one of the factors that led Galton to theorize that certain empirical facts about sensory discrimination could be correlated with intelligence (Acton & Schroeder, 2001). This idea was further refined by Spearman who encapsulated the notion of intelligence with *g*.

Premised on the assumption that scores on a measure of intelligence could be partitioned into two components—a general, or *g*, component and specific, or *s*, component (Spearman, 1904; 1023). Acton and Schroeder (2001) in fact found such a correlation when they replicated sensory discrimination among both the visual and auditory realms among a population. Using the latest psychometric battery of intelligence tests, they indeed found a correlation, but admitted that it was not as large as first theorized by Galton and Spearman. The debate over the correlation with pitch discrimination still rages because it goes to the core of the heritability of cognitive skills (Briley & Tucker-Drob, 2013). By argument, Galton and Spearman reasoned that if pitch discrimination was a variable among populations, then perhaps such a cognitive skill correlated to intelligence (Galton, 1869; Spearman, 1923). The question comes in why they would choose such a cognitive skill? Long since Plato, and Aristotle, music has been found to be closely linked to mathematics (Plato, 2007; *A*ristotle & Hippocrates, 1966; Schoen-Nazzaro, 1978). Classical thought spoke of harmony as a cosmological ideal, trying to use the term to talk in terms of not just music, but of the movement of stars (Miller, 1986). That classical reasoning drove the question as to why a person having perfect pitch is closer to being a person of intelligence (Wong, Ngan, Cheung, & Wong, 2020)

However, Spearman and other later researchers had to abandon the hopes of finding almost a causal variable to intelligence in the phenomenon of perfect pitch. As the debate has raged over the years, beyond the low mathematical correlation to *g,* perfect pitch was found to have a higher incidence among different linguistic and ethnic groups (Profita & Bidder, 1988). It must be qualified at this point, that researchers have extrapolated the logic of the colloquial perfect pitch to the rarer condition of absolute pitch (Naomi & Radin, 2014). People displaying this quality can identify tones without the referent pitch being played first. More than people who can seamlessly identify something as "out of tune" without a machine displaying A 440 Hz, people with absolute pitch can sing a C# simply by seeing that letter on a page. Even with that more stringent identification of the variable, pitch discrimination has been distinguished among children speaking Asian languages, such as Mandarin and Japanese. People speaking Asian languages have a higher incidence of this attribute than their counterparts in North America (Bidelman, Hutka, & Moreno, 2013; Schellenberg & Trehub, 2008; Trehub, Schellenberg, & Nakata, 2008).

Pfordresher and Brown (2009) broadened that identification when they pointed out that the linguistic structure of certain languages tends to produce improved pitch discrimination, but this is because very early certain languages generate distinct neural pathways around pitch and the phoneme of the language. For instance, Mandarin uses four different tones for the same phoneme in many cases, with the tone changing the meaning of the grapheme (word) (van de Weijer & Sloos, 2014). Likewise, certain languages in Eastern Africa, such as Chad, use a series of clicks. These clicks, as a linguistic building block, route the neural pathways around language and pitch in quite a different manner than a Western language where pitch is disconnected from the phoneme (sound), morpheme (meaning) and grapheme (word) (Johnson, 2012; Pfordresher & Brown, 2009).

The reason that the followers of Spearman need to connect sensory discrimination to *g* is that intelligence, as expressed as a linguistic construct, quickly falls short in its measure. Linguistic constructs are again cultural objects. The reason the brain decides to connect pitch to a linguistic construct is that the language derives a morpheme from not only a symbol, but a distinct sound as well.

Alphabetic languages are visual constructs of language where pitch has little to no bearing on the morpheme (Mark, 1992). For instance, a child learning Mandarin must master four distinct tones for the same grapheme. A child learning English, or any alphabetic language, simply has to learn one phoneme per grapheme (Larsen et al., 2020). The profound challenge this creates is that typical IQ tests given children in the United States have a verbal and mathematics score attached to achievement. We surmise that there are non-verbal measures used to determine ability, but in the end, the variance introduced by linguistic constructs in the first place create a cultural conflict of interest. In our view, even from a positivistic viewpoint, having Spearman as the root of their logic, this argument is not well considered – and therefore, studies continue to be undertaken to try and correlate pitch discrimination to *g.* The chief concern is that when Spearman's *g* is used to predict achievement, it must be understood that *g* is looking for a narrow range of achievement in the human condition. As scholars continue to study these correlations, ethnomusicology brings other questions to bear on the subject.

The elements of Spearman's *g* highlight factors that are universal among cultures (Warne, & Burningham, 2019). That is why linguistic constructs were first used in assessment. Every human can speak a language. However, it must be noted that as early as the 1920's Yerkes was wavering on the effectiveness of using verbal measures (Johnson, 2012). Since language is a universal, it generally be surmised that everyone speaks a language wherefore *g,* can be extrapolated if one gains an adequate translation. Cameron, Bentley & Grahn

(2015) looked at another cultural construct, seen to be universal to cognition to see how transferrable they are to other groups. They looked at ability to recognize and reproduce distinct rhythm patterns. It is notable that the researchers were not looking to correlate their findings to *g* but rather, so that there can be a justification for empirical, observational data for scholars to either be amend or confound the theories. These researchers in fact noted that when an African language does not rewire the brain to adapt to a cultural linguistic construct, then pitch discrimination among African or European groups becomes moot. These types of findings are promising in support of Spearman's two-factor theory of intelligence claim that *g* can predict certain areas around achievement (Kura & Dutton, 2019). In our view, we posit that there is a deficit in Western music to be able to master the poly-rhythmic elements of African music. Additionally, cross-cultural transference of different musical skills, the European group are just as adept at learning African tonal harmonic structures as to when African groups learn their Western counterparts. In this research, we submit that the reason sensory discrimination continues to be a tested variable is that if more universal variables can be found, then a better picture of intelligence can be determined, without cultural confusion, mixing up the correlations such as tonal languages creating different neurological pathways.

3. The anthropic principle

For the positivist, what seems to require fundamental considerations for psychologists in research cultural nuances. The cultural constraints remain suspect for "hard sciences", such as physics, chemistry, and astronomy which rely purely on quantum and thus providing an entirely different standard to "soft sciences." Multivariate statistics are only as good as the theory, constructs and variables. Multivariate statistics, however, is simply a very refined tool. It has been refined ever since Galton introduced the notion of correlated variables to the social sciences and specifically, intelligence. Physicists have a higher standard because the mathematics is not simply a tool. The mathematics must fit hand in glove with the theory or both are suspect, or even unacceptable (Livio, 2002, 2005, 2009, 2013). Proposed by in 1974 by physicist Brandon Carter, the *anthropic principle,* therefore has three components as follows:

1) Observations are subjected to "selection bias" by the mere fact that they are executed by humans.
2) Some of the foundational "constants of nature" are accidental rather than fundamental
3) Our universe is one member of a gigantic ensemble of universes.

The first two are applicable in the use of mathematics as a predictive model with the social sciences and specifically the cross-cultural influences on *g.* As much as the statistical models seek to diminish selection bias, the fact is these all fall within an epistemology of psychometric testing that makes an initial choice in the cognitive skill set that they think will most likely correlate to *g.* The challenge is that this relies on a majority cultures variables agreed upon to continue with a civil sense of government (Diamond, 1997). We need rules. That's why there are movements, such as in Mainland China to inculcate their population with a specific dialect. That one move has made them one of the most powerful economic forces in the modern economy because increasingly advances in math, science, and linguistics must be transferable into Mandarin. Again, one of the deepest challenges to the verbal measure of *g* still revolves around the sticking point that speakers of Mandarin and some Eastern African languages demonstrate stronger pitch discrimination.

Although an arbitrary and repeated correlation of *g* in predicting some achievement, the second anthropic principle also holds in this case. A similar set of parameters for *g* could make it as "accidental instead of fundamental" because its mathematical basis shakily relies on less empirical data than the concept of gravity. For the sake of argument, if *g* was tested with abilities in rhythm reproduction and pitch with the exclusive use of African modalities, then many Europeans would be found deficient. Further, these would be valid in non-verbal tests because they would eliminate verbal bias dictated by language. Certain tests of rhythm could conveniently turned into calculations for mathematics, as we will tease out later in this essay when we discuss the symphonic form.

This is the cleanest argument, in the selection bias of what should be included in testing for *g.* This essay is not trying to disprove the foundation of I.Q. It has been replicated too often as an experiment, thus giving its centrality in the construct. However, for U.S. educators there is a more palpable case study that brings up the cultural choice of variables related to achievement and I.Q. It comes in the curious case study of an NFL football player named Michael Ohr (Lewis, 2007). All of the coaches that saw Michael Ohr when he was a sophomore in high school complimented him as a *freak of nature* and he was courted by almost every major university in the country so that he could play the lineman's position of left tackle. Lewis (2007) explains the history of why this position suddenly became the most valuable player on the field after the quarterback. Lineman, in the past, were the lowest paid, unsung heroes of the game. So, due to the confluence of NFL priorities and Michael Ohr's athletic ability, he became one of the most sought-after assets for the cultural artifact called football. Like the I.Q. test and any theory, football has all its own idiosyncrasies, rules, and foibles.

Here is where the story adds *g* into this equation. Michael Ohr tested in the 3% in elementary school. He recorded 46 absences in the first grade. Due to how public schools run, Michael was passed from grade to grade,

even though he didn't go to class. So, when you fast forward Michael to his sophomore year of high school, a group of concerned adults were all scurrying around as to how to get Michael to pass classes, so he could meet the NCAA requirements. The dynamics of poverty are well delineated, but the most compelling part of the story, is that when Michael was finally tested for ability and achievement, he was so bereft of referent cultural knowledge that is necessary to do well on these tests that he was qualified as learning disabled. It was not organic. It was environmental. Beegle (2007) and Jensen (2009) offer reasoning as to why the cultural rules of wealth are more of an indicator of IQ and achievement than ability. While theirs is anecdotal (Beegle herself, has a parallel story to Michael Ohr), others have analyzed this with such respected measures as the Weschler Intelligence Scale for Children-III (WISC-III). Weiss (2003), indeed found that the general trend for achievement on these exams correlates more to familial income than it does to race, as other types of studies have tried to document. African Americans from wealthy families fare just as good or better than their white counterparts in the U.S.

The fascinating part about Michael Ohr is that with the goal of playing in the NFL all his surrounding supporting adults were cramming twelve years of schooling into two. Michael Ohr responded, not overcoming all his gaps, but that isn't the deeper point for this discussion. Football, like music has its own environment, and when one excels in either arena, the majority culture reinforces that learning and rewards the effort. Likewise, for both sports and music, even the person who is not as extreme a case as Michael Ohr, or Donna Beegle, find that the positive rewards of having those skill sets can set them up for improving in reading and math.

The point here is to highlight that multicultural elements of IQ come from social constructs that offer a student referent knowledge. As an example, the test for getting into Mensa, plays on the weakness of portion of the IQ test because it is almost all non-verbal analogies using pictures. A person with large sweeping referent cultural knowledge, may, or may not, prove that they are the top 2% of the population for IQ. The test for Mensa diminishes that advantage.

This brings the article full circle to the title. A symphony is a very precise cultural construct that did not exist in the west in a strict format until Hayden and some other confluences of wealth and innovation came to the west (stable enough economies to allow the invention of the stringed instruments to such a refined state.) So, what do American football and Hayden's symphonic construct have in common? Specific rules. One of those rules is for a violinist to stand up and offer A-440 Hz for the orchestra to use as a standard for tuning. Football uses a hundred-yard field with each eleven players in a position. If you can adhere to enough of the rules well enough in either cultural construct, you "pass the test" and enjoy the achievement allowed by the people watching.

At first blush, the test to get into Mensa and prove that you are in the top 2% of IQ fits one of those criteria. An arbitrary set of rules and constructs. However, since this argument with the positivist seeks to question and not dethrone IQ it needs to be mentioned that what it takes for Michael Orr (being in the bottom 3%) to excel at American football, is something like testing into Mensa (being in the top 2%.). Both take a skewed skill set with massive cultural support around a construct. There cannot exist a dichotomous causality with all the modern Archimedes in the room yelling "Eureka!" As with the cross-cultural studies in linguistics and pitch memory, the symphonic construct of Hayden (Bidelman, Hutka, & Moreno, 2013; Schellenberg & Trehub, 2008; Trehub et al., 2008). With that consideration in mind for the positivist, this offered anthropic principle to analyze the nature of the symphonic form and how, or why, it may be adapted to African musical traditions as a way to spur further discussions into the nature of intelligence on a multicultural level.

This remains a rudimentary start, but it points out the cultural disadvantages of African composers using this musical metaphor. Broken into its separate parts with broad sweeps of history teases out why Spearman's *g* falls further and further from a causal relationship to IQ on a world scale. For brevity consider strings, woodwinds, the piano, horns, and drums with some ancillary components of dance and choral movements.

3.1 Strings

As mentioned before the string section exists because of a confluence of factors from an advanced and wealthy civilization. Wealthy nations permit citizens to specialize (Diamond, 1997.) Thus, in Hayden's time, a composer could be paid by a wealthy patron to keep such a bevy of musicians on retainer to play such complicated music. There have been stringed instruments since Plato's ancient Greece, but this era decided to offer multiple octaves on such refined instruments. What would it take to be a truly African orchestra? Would the string section be reinvented for 2023 with global strings? Would the Western orchestra fall to the backdrop?

3.2 Woodwinds

The same argument exists in history for the woodwinds. African flutes typically, utilizes one flute. Folk tunes take on a lead call metaphor. Folk tunes reference the differences in cultures and the contrast in governmental structures. Diamond (1997) implies the governmental phase of development among Africans would fall along tribal or chieftain organizational hierarchies (prior to encountering Europeans and the extensive slave trade.)

A tribal or chieftain group (for larger tribes) created a structure that remained flatter, offering fewer economic resources and physical stability. With that mechanism in place the outside world knows African instruments has hand carved from objects in their environment that can stand tests of weather. When you contrast that to the woodwind section in an orchestra, you can imagine trying to play a double reeded bassoon in the Congo, or the along the Sahara.

3.3 Piano

Perhaps this should have started the conversation about symphonies. Invented for the Medici family, this invention came about because of Bartolomeo Cristofori (1655–1731) and is hailed as being, … *whether solo, chamber, or with orchestra—is at the heart of Western classical professional performance* (Powers, 2003).

In remains a small inference how a composer would need to have people inventing more and more refined instruments to match different octaves, as what they could create on the piano became more and more complex (Diamond, 1997). What about the marimba? First invented in 1850 by a Mexican musician, this hardy instrument mimicked the tonal scale, but at its heart leans more on the percussive elements of musical metaphors.

3.4 Horns

Horns rely on the same arguments earlier in the article. Achievement has more factors and scoring well on an IQ test. Why doesn't a trumpet stay in tune? Physics. It becomes too cold and changes pitch. One idiosyncrasy to point out is the tuning valve. Here is where we get back to *g*. Again, there is perfect discrimination and, absolute pitch creates the largest hurdle for the positivist in continuing the nature side of the argument for intelligence. If a pitch discrimination (knowing A 440 Hz without the grapheme of a note written in front of you) can be corrected with an adjustment to a metal tube on a trumpet, then what does the African counterpart to the trumpet player adjust? An African horn is probably a horn that has been carved and in a tribal sense, may or may not be used in a composition that serves the greater good of a certain indigenous people. The African horn plays in one key if that can serve has the analogy. It will never compete with a trumpet.

The challenge here, from the ethnomusicological standpoint is the value judgements of culture that weights the innovations of the West as the eternal gold standard above other constructs. When cultures come to be on equal footing the weights fall away. More progress can be made.

3.5 Drums

Value judgements aside, what a culture makes more of are what outsiders sometimes take to see as the most valuable. Drums and shakers of all shapes and sizes can be seen in many parts of the world and especially in Africa. The modern construct of jazz brings the drum kit to the mix, but if Mexico gave Africa the marimba, Africa gave Mexico the drum. Both the instruments, again, are hardy and speak to smaller groups performing in their origin. This also speaks to the larger conversation about if percussive discrimination could be correlated to *g* better than pitch discrimination.

3.6 Dance

Dance typically becomes quite infused into African folk tunes, and the audience becomes encouraged, often to participate to the level that they can afford to at the venue. Movement is deemed necessary. While symphonies are said to "move people" when they generate emotions, dance music is left to dance halls and left sophisticated types of compositions.

3.7 Chorus

It's nice to end on a collaborative note on this deconstruction. As the article is being written the memory of Beethoven's *Ode to Joy* in his Ninth symphony comes to mind. What also comes to mind are the Zulu tribe's *isicathamiya*- harmonies specific to an African tribe. Kenya also has specific harmonies and folk tunes.

So, in the end, Spearman's *g* was too culturally loaded in its original form and scholars have come along since and took a good idea and strengthened the construct of the I.Q. The end of this article could be a sociological diatribe, but that ground is well covered. Suffice it to say that in 2023 the global village is going through another set of innovations as important as the pianoforte was during the time of the Medici.

4. Conclusion

To the positivist: the unanswered question remains for those in the anthropic principal to whom this debate is predicated. Instead of *g* being fundamental, there are a plethora of accidental tenets that are created by humans. Asian languages show a slight advantage sometimes to pitch discrimination, but don't correlate to the extent one might think with IQ tests. Accidental. Likewise, testing into Mensa does not preclude doing well on tests or being culturally supported at the level of Michael Ohr. Accidental. Finally, (but not accidental) there are people who have talent and work extremely hard to play in orchestras and delight audiences with symphonies. Do they

all have perfect pitch discrimination? No. Likewise, there are Kenyans and many other African nations who do the same. Do they all have perfect pitch discrimination? No.

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Doug Johnson, PhD wanders as a polymath in his intellectual pursuits. His dissertation concentrated on multilingual cognitive issues among impoverished Latinx teens. He works among the poor as a high school teacher. His educational journey started with a Bachelor of Arts in Bilingual Education (BA) from Heritage University in the state of Washington. He gained a Master of Arts degree in School Psychology focusing Assessment, Equity and Linguistic issues (MA) from Capella University in Minnesota. He continued that line of study to deepen his knowledge, completing a Doctor of Philosophy (PhD) in Educational Psychology from Capella University in Minnesota. Outside the high school, he follows mentors and studies three specific arenas-music, art and writing. He is a member of the American chapter of Mensa. He remains an active musician. He collaborated in composing an anthology of Kenyan folk tunes for the Western band metaphor. He composed a small piece for symphony for President Obama and received a kind 'Thank You' note. He advocates for peace through artwork. This can be viewed at www.pazarteproject.com. Finally, he is the founding editor and publisher at Cave Moon Press. This small, independent press helps scholars bring their work for universities to light. This last year the press expanded into children's books to help budding writers and artists find a place to thrive. This can be viewed at www.cavemoonpress.com. He is happy to collaborate in these arenas. Feel free to contact him at cavemoonpress@gmail.com.

David O. Akombo, PhD is professor of music education and interdisciplinary musicology and Founding Dean of the Faculty of Culture, Creative and Performing Arts at the University of the West Indies, Barbados, West Indies. Professor Akombo's extensive educational training include Bachelor of Education (B. ED) degree with a double major in Music and Education from Kenyatta University in Kenya, Master of Arts (M.A.) degree in Teaching Learning and Technology from Point Loma N. University in California, USA, Master of Music (M.Mus.) degree in Ethnomusicology from Bowling Green State University, Ohio, USA, and Doctor of Philosophy (Ph.D.) in Music Education from The University of Florida in Gainesville, Florida, USA. With a long-standing career of teaching and research in several institutions of higher learning in the United States, he is the author of several books, articles. He has made presentations at many international conferences and workshops including National Association for Music Education (NAfME), Society for Ethnomusicology (SEM), Society for the Arts in Healthcare (SAH), World Federation of Music Therapy (WFMT), American Music Therapy Association (AMTA), Research in Music Education (RIME) among others. He has presented public lectures at various institutions including Brigham Young University in Utah, USA and The University of Glasgow, United Kingdom. His selected publications include: *The Unity of Music and Dance in World Cultures*, McFarland Press (2016), *Music and Medicine: Connections Found*, Seaburn Press, (2009), *Music and Healing*

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