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Julia Hanschell

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Intelligence, Testing and Discrimination

Introduction

This paper will consider the models underlying cognitive assessment and how intelligence has been interpreted, researched and tested for over a century. It includes an informal survey on how intelligence is perceived and offers opinions as to the purpose, rationale and impact of assessing intelligence. The theory behind the scientific study of intelligence and the facility to measure it is examined through three psychological models (those of Gardner, Sternberg and Cattell-Horn-Carroll, with a brief preface on Spearman) and compared in relation to the client, whose case forms the scenario for this paper. Also considered, are the factors of bias and discrimination, alongside environmental factors, which are all of importance and impact in intelligence testing. Consideration of these is also examined in association with the client. Current legislation is also inspected, focusing on how accommodations are mandated for individuals whose abilities are compromised. Finally, specific reference to testing bias in the Caribbean and educational discrimination in the Barbados, in particular, is discussed.

The Perplexing Definition of Intelligence

“Viewed narrowly, there seem to be almost as many definitions of intelligence as there were experts asked to define it.”

R. J. Sternberg (quoted in Gregory, 1998)

The great minds, accepted authorities and respected psychologists of the past one hundred years have been unable to agree on a definition (and the conclusive specificity of factors) of what constitutes intelligence. Opinions also have, and do, vary on how it can be accurately tested and the part discrimination may play in effective testing. Therefore, it is no wonder that when the question, “What do you consider intelligence to be”, is asked of a random group of ordinary people, no two answers are the same. Yet, the answers are all relevant when looked at

in terms of the hypotheses, theories and models of Carroll (1993), Cattell and Horn (1987), Gardner (1983), Knox (1997), Spearman (1904) and Sternberg (1985), among others. Even the philosopher John Locke (1632-1704), one of the ancestors of modern psychology, defined intelligence two hundred years before Spearman, as, “it is what the genius has in surfeit and the idiot in deficit”. Fortunately, we now think of ‘intelligence’ in far broader terms, as this paper will discuss.

Had the question, “Do you think intelligence can be accurately tested” have been asked, “Would tests of intelligence run the risk of discrimination?”, or “Could tests of intelligence be administered in a discriminatory manner?”, it is possible that the opinions offered by the same group of ordinary people polled for this paper, would be equally valid, as well as dissimilar, when considered in conjunction with the concerns and criticisms expressed by and of those, whose professional lives have been devoted to defining intelligence in general and methods of measuring it, in particular.

For the purposes of investigating for this paper the layman’s definitions of intelligence, an informal survey was conducted as is outlined below.

The Random Sample Conducted for the Purpose of this Essay

“Intelligence is a very general mental capability that, among other things, involves the ability to reason, plan, solve problems, think abstractly, comprehend complex ideas, learn quickly and learn from experience.”

L. S. Gottfredson, 1997.

What follows are the responses (in order of receipt) of a random sample undertaken between July and September, 2013, shown in Table 1 below. The sample group includes random gender, age, ethnicity, minorities, social background, cultural origin, parental status, education and differing abilities:

Table 1: Question: “What do you consider intelligence to be”

The ability to put knowledge to use in an effective way.
How much someone knows about anything.

Knowing about the things that are important in your life.
The other side of common sense.
When it is easy to learn.
Being good at academics.
The ability to discern, learn and express information, thoughts and feelings.
Some cultures are more intelligent due to good education.
The ability to sense, process and make beneficial use of the information that we encounter and interact with in the world around us.
When you can learn from your mistakes.
Being aware of your surroundings.
The ability to adapt and develop.
Some people have it naturally and others find it and some develop it with help.
Intelligence is the measure of a living creature's ability to learn, retain information, and use guesswork to solve problems.
The ability to listen to a concept or point of view intently and then draw from many resources to form a unique hypothesis.
Being able to solve problems.
To learn from your mistakes.
Intelligence is to do with academics while common sense is to do with survival.
Intelligence I believe is not only based on knowledge that is acquired from books but what is also gleaned from every day interaction.
Intelligence is not a high score on a standardized IQ test. An intelligent person demonstrates good social skills, has the ability to think critically and logically, and then, have the ability to communicate effectively.
To be smart naturally.
The ability to successfully acquire or learn skills and information in order to apply them in a beneficial or valuable manner.
The ability to understand that you don't know everything, but you could in fact possibly learn a great deal of it.
The use of pure common sense which has a lot to do with how we are raised, what we believe and what we are taught; what we are taught has more to do with life and it's lessons rather than what we learn from a book.
The degree to which one is able to understand and interpret any idea.
The ability to assimilate / interpret knowledge and ideas.
Brainpower, elevated judgement, reasoning, understanding, comprehension, analysis, inference & precise action for the betterment of mankind.
To repeat what others have said, requires education; to challenge it, requires brains/intelligence.
When you observe an action or hear a directive and then be capable of applying the same or modifying slightly to get the same or better result.
I think Aristotle said it best: "It is the mark of an educated man to be able to entertain a thought without accepting it."
I view intelligence as not just knowing but understanding... whatever the situation may be.
To me intelligence is reading, understanding, yet sometimes still going with what you feel is

right and not just what you are told. Using your own judgement can be intelligent.
I think it is a person's ability to comprehend, regurgitate and apply knowledge to suit the conditions of the moment in order to produce the outcome desired.
Intelligence is the ability to understand information and apply the information appropriately so that it becomes knowledge.
The ability to comprehend, analyse and interpret information.
Knowledge of information, ability to work through problems and find solutions. Smart. Know things.
Ability to understand.
The ability to learn.
The ability and desire to learn about the world and to have an open mind regarding all aspects.
How fast you grasp things.
Intelligence is based on an individual's ability to master certain task or tasks.
There are different kinds of intelligence like academics, practicality, and creativity. If you don't excel in one area, that doesn't make you any less intelligent. It just means that you are intelligent in a different way.
I consider intelligence to be the ability to apply knowledge acquired using this in logical and practical thinking.

The Scenario in relation to Intelligence, Testing and Discrimination

Below is the scenario presented for the purposes of this paper which will be referred to throughout the paper in italics.



Imagine that you have been asked to undertake an assessment for a client - a middle-aged woman. As part of the assessment she explained that when she was a six-year old child, people considered her to have such a low level of measured overall cognitive ability (IQ) that she almost did not enter mainstream school. However, as an adult she has now realised that she has achieved a considerable degree of success in a number of areas, even though others believe that she still has a number of social shortcomings.

After the discussion, you reflect and wonder if the early measurement of cognitive ability for this woman was valid. You query if it had been a true measure of her 'intelligence' and whether it had been fair, given her personal circumstances at the time. She has also told you that when the intelligence was assessed, her physical development was delayed, she had poorly developed social skills, and she was experiencing significant stress at home.

For the purposes of this paper, the client will be referred to as, Marjorie. Before discussing the three theories of intelligence, it is interesting to examine the rationale and impact of testing intelligence in the first place.

The Rationale and Impact of Testing Intelligence

“Sensation, perception, association, memory, imagination, discrimination, judgement and reasoning.”

N.E. Haggerty (Quoted in Handbook of Intelligence, 2000)

Above and beyond the ‘scientifically’ acquired data in intelligence testing, there should also be a clearly stated and agreed purpose which dictates rationale of the test being conducted. Perhaps intelligence testing is used to function as a benchmark, to inform for a specific reason (for example, to form part of a medical investigation), to measure progress, to ascertain potential, to identify strengths, weaknesses, their specificity and, or extent, to ascertain intervention strategies and so on.

The impact of testing intelligence can be a double-edged sword. Of all of the above purposes, a benchmark is perhaps the most complicated. While a measure of intelligence may be used by a teacher as a starting off point to take a student back, or move him or her ahead to a point of proficiency, it may be interpreted by a parent as a significant (and perhaps inaccurate) marker of potential. Ascertaining potential through testing intelligence alone is likely to be inaccurate at best, given the nature of a singular performance on a particular day, coupled with the assumption that several factors will likely emerge over time. Any of these may reflect differently on the test results. Seeking specific information, measuring progress, identifying the extent and type of strengths and weaknesses and possible intervention strategies are far more realistic reasons for testing intelligence.

As with all tests, whether a score, percentile or descriptive, forms part of a conclusion, a ‘label’ is, or may be, provided and, or assumed and labels are, by their very nature, open to personal interpretation. Subjective response may follow this, at the very least, by the client or parent. Schools and teachers also pay close attention to the ‘label’ and even more opinions and

presumptions may then enter the arena. Interpretation has profound power to alter thought, expectation, management and consideration, any of which may drive or sustain a course of action which may stand alone rather than become part of a wider understanding and consequently, appropriate action for the individual being assessed.



Marjorie, far beyond the years in which testing is carried out for educational purposes, obviously is still concerned about the comments directed at and to her, by others pertaining to her 'social shortcomings'. It would therefore appear as though she seeks to understand exactly what these may be or what areas they may be in, as she may feel that they have persisted alongside the areas of success she considers she has attained throughout her life. In other words, she recognises that some weak areas she has never been able to overcome, compensate for or strengthen. Therefore, it appears that she is considering testing as a means to identify, quantify and rectify them, if possible.

Marjorie mentions that historically she was considered to be of such low intelligence that mainstream school was questionably suitable for her. Therefore, it could be ascertained that she considers her 'social shortcomings' to stem from a lack or low level of cognitive ability, or intelligence, as would have been told to, or about her when she was a child.

The 'considerable degree of success' Marjorie recognises that she has achieved in 'a number of areas of her life' as an adult, would suggest that an intelligence test, like the Wechsler Adult Intelligence Scale—Fourth Edition (WAIS-IV) could answer some of her concerns. It is expected that rigorously standardised intelligence tests in today's world are designed to minimise discrimination. Thorough inspection of the test construct and the information presented in the test manual should be undertaken. It is also the responsibility of the test administrator to ensure that no aspect of the test is administered in a discriminatory way. Marjorie appears to feel as though she has lived a lifetime of discrimination against her and finally is seeking to understand why she is 'different'; to understand herself. However, sensitively sharing the results and offering reasonable and manageable recommendations, which could hopefully affect a level of improvement (in self-esteem or quality of life) would appear to be the rationale for testing.

Testing intelligence is based on sound scientific study and research, which will now be discussed.

The Scientific Study of Intelligence and the Facility to Measure It

"Individuals differ from one another in their ability to understand complex ideas, to adapt effectively to the environment, to learn from experience, to engage in various forms of reasoning, to overcome obstacles by taking thought."

Intelligence: Knowns and unknowns. *American Psychologist*, 1995.

The idea that intelligence is a measurable quality has been a fiercely contended topic for a century and there is still no clear consensus as to the universal attributes which represent intelligence and how to indisputably measure it with accuracy. Obviously measuring intelligence is a complex task as many factors can influence the outcome. However, in the very simplest forms, a composite description of intelligence consists of three broadly accepted factors as illustrated through Figure 1 below.

Figure 1: Factors of Intelligence



All kinds of formal and informal learning through many or combinations of channels – such as education, experience, training, trial and error, intuition and so on.



The ability to recognise and/or identify a problem situation, break the problem into manageable chunks and clearly define each area of the problem for the purpose of subsequent action or response..



The capacity to problem-solve, accomplish a set task, create or fashion an instrument or device to overcome the problem or to work out how a complex project may be approached and completed.

Measuring intelligence accurately, through carefully constructed tests which do not discriminate, either by design or careless administration practice, has been the subject of discourse, criticism, research, theories and models, all of which have, at times, created as many

questions as they have answered. Are intelligence tests designed to quantify intelligence, are they developed to measure ability or are they constructed to ascertain potential? In education, the purpose has fluctuated between using them to segregate, intervene and accommodate among other reasons. So, it is important to understand as clearly as possible, the theory of intelligence and how this has evolved in the past century.

The Theory of Intelligence

“It seems to us that in intelligence there is a fundamental faculty, the alteration or the lack of which, is of the utmost importance for practical life. This faculty is judgement, otherwise called good sense, practical sense, initiative, the faculty of adapting one’s self to circumstances.”

S. Binet, 1905.

The original theories of intelligence have evolved through a chain of ‘models’ which have sought to psychologically measure intelligence in a scientific manner and will be outlined in Table 2 below.

Table 2: Models of Intelligence

Psychometrics	Cognitive Psychology	Cognitivism and Contextualism	Biological Science
To scientifically measure individual differences through a composite of ability, aptitude, intelligence through psychological tests.	To examine the mental processes including how people think, perceive, remember and learn.	To study the interaction between the mental processes of an individual and the environment they function in	This considers the neurological processes which impact on intelligence

These models of intelligence all appear to relate to the pioneer of intelligence theory, Charles Spearman.

Charles Spearman – A Pioneer of Intelligence Theory

“Intelligence is a general factor that runs through all types of performance.”

A. Jensen (1923-2012)

One of the earliest psychometric theories (used to first define and then measure intelligence) was published in 1904 by the British psychologist Charles Spearman (1863-1945), concluding that just two factors were at the base of all individual differences in test scores as seen in Table 3 below.

Table 3: Spearman's Factors of Intelligence

'The General Factor' or 'g'

If in any given task, intelligence is required, it requires 'g', which Spearman concluded was the most important factor, as it was common to all tests. An individual's generability 'g' has an impact on his or her performance on any test.

'The Specific Factor' or 's'

This factor was related specifically to whatever mental operations were required for a specific task, as distinct from the thinking required of another specific task.

Spearman's theory is known as 'The Two Factor Theory of Intelligence' and is based on the statistical technique that analyses correlations. This was the first noteworthy contribution to intelligence testing: the premise was that to a certain degree all aspects of intelligence were correlated. By extension, the value in the history of psychometric testing is that Spearman laid the foundation from which the criticism that intelligence cannot be measured from one score, has played its part in the development of testing intelligence.

The first of the three theories of intelligence to be examined will be that of Howard Gardner.

Howard Gardner – The Theory of Multiple Intelligences

"An intelligence is the ability to solve problems, or to create products, that are valued within one or more cultural settings."

H. Gardner, 1993



Gardner's opinion is that intelligence is more complex than the abilities selected for measurement within the format of intelligence tests. Gardner, first Published in *Frames of Mind: The Theory of Multiple Intelligences* in 1983. He is an author of eighteen books and several hundred articles, is abundantly honoured, internationally renowned and profoundly


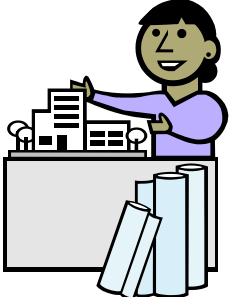

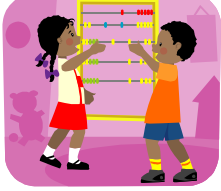
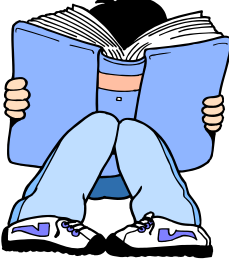
respected. His reputation is perhaps most revered in educational circles for his theory of multiple intelligences (MI) which critiqued the idea that human intelligence can be singularly tested by a standard psychometric instrument. Gardner's theory is based on seven multiple intelligences and his cognitive research "documents the extent to which students possess different kinds of minds and therefore learn, remember, perform, and understand in different ways," (Gardner 1991).

Gardner says that his theory on multiple intelligences, "challenge an educational system that assumes that everyone can learn the same materials in the same way and that a uniform, universal measure suffices to test student learning. Indeed, as currently constituted, our educational system is heavily biased toward linguistic modes of instruction and assessment and, to a somewhat lesser degree, toward logical-quantitative modes as well" ...“The broad spectrum of students - and perhaps the society as a whole - would be better served if disciplines could be presented in a number of ways and learning could be assessed through a variety of means." (Gardner, 1995).

Below, in Table 4 (a and b), Gardner's Theory of Multiple Intelligences, is summarised and linked to the scenario presented in relation to Marjorie, relative to her access to mainstream school.

Table 4(a): Gardner's Theory of Multiple Intelligence


Intelligence	Learning Strength	Learning Avenues	
Verbal-Linguistic Intelligence	These learners have highly developed auditory skills and often think in words. They learn and use language more easily than others, like authors and lawyers.	Encouraging discussion and word harvests, reading books together. Tools include computers, games, multimedia, books, tape recorders, and lecture.	
Musical Intelligence	They love music, and are also sensitive to sounds in their environments. They can appreciate the pattern and sequencing in music and like composers and singers they can link language to sounds.	They can be taught by turning lessons into lyrics, speaking rhythmically, tapping out time. Tools include musical instruments and multi-media. They may study better with music in the background.	

Logical/Mathematical Intelligence	<p>Think conceptually, abstractly and are able to see and explore patterns and relationships. They like to experiment, solve puzzles, ask cosmic questions; these are the analysts like mathematicians and scientists.</p>	<p>They can be taught through logic games, investigations, mysteries. They need to learn and form concepts before they can deal with details.</p>	
Visual/Spatial Intelligence	<p>Very aware of their environments. They like to draw, do jigsaw puzzles, read maps, daydream. They understand both abstract and concrete spatial patterns, like pilots and artists.</p>	<p>They can be taught through drawings, verbal and physical imagery. Tools include models, graphics, charts, photographs, drawings, 3-D modelling, video, texts with visuals.</p>	
Bodily Kinaesthetic Intelligence	<p>Keen sense of body awareness. They like movement, making things, touching and can handle things skilfully. They communicate well through body language like dancers and athletes.</p>	<p>They can be taught through physical activity, hands-on learning, acting out, role playing. Tools include equipment and real objects.</p>	
Interpersonal Intelligence	<p>These students learn through interaction with others. They have many friends, empathy for others, street smarts. Like teachers, they are able to motivate people and work co-operatively with them.</p>	<p>Teaching through group activities, seminars, dialogues are effective. Tools include time and attention from the instructor, writing, computer conferencing, E-mail.</p>	
Intrapersonal Intelligence	<p>These learners understand their own interests and goals, but tend to shy away from others. They're in tune with their inner feelings; they have wisdom, intuition and motivation, as well as a strong will, confidence and opinions.</p>	<p>They can be taught through independent study and introspection. Tools include books, creative materials, diaries, privacy and time. They are the most independent of the learners.</p>	
<p>Source: http://www.tecweb.org/styles/gardner.html</p>			

When Gardner’s theory is applied directly to the educational setting, it makes sense to consider the interpretation that intelligences are independent of, rather than, all linked to each other. This has played a considerable part in how curriculum can deliver value and the diverse ways different talents, abilities and preferences can be tapped into: how educational approaches have been designed and developed, lesson plans are devised, differentiation is structured, academic weaknesses are scaffolded, individual strengths are integrated and progress is charted. However, a key criticism is that there is no valid tool available to measure multiple intelligences through quantitative, statistical measurements.

In 1998, an additional intelligence was identified and added to the previous seven, although this type of intelligence has been met with more resistance than the previous seven as shown in Table 4(b).

Table 4(b): Gardner’s 8th. Theory of Multiple Intelligence

<p>Naturalistic Intelligence</p>	<p>Learners who are high in this type of intelligence are more in tune with nature and are often interested in nurturing, exploring the environment and learning about other species. Picture a landscaper who is highly aware of even subtle changes to the environment and enjoys learning topics that have a connection to nature.</p>	<p>These students are good at categorizing and cataloguing information easily and enjoy learning through outdoor activities and exploring the outdoors. Information makes more sense to them when input is of a sensory origin.</p>	
<p>Source: http://psychology.about.com/od/educationalpsychology/ss/multiple-intell_9.htm</p>			

It should also be noted that Gardner’s theory of multiple intelligences has been critically received by many respected psychologists for the pedigree of its verified data. In addition, subjective judgements may also come into play which can be affected by the individual, the wider environment, the conditions of testing and other factors which may be discriminatory. Any one of these could affect an aspect of performance such as the client’s focus or memory. This point was well made by Fuster in The Cortical Substrate of General Intelligence (2005):

“Intelligence is the most complex of all cognitive functions. One reason for its complexity is its close dependency on other functions – namely, perception, attention, memory and language. The degree of contribution of any one of those other functions to intelligence varies greatly with the individual and, at any given time, with the environmental demands.”



If Marjorie, at the age of six years old, had been assessed in a wider sense, using the model of intelligence developed by Gardner, her admission to mainstream school may not have been questionable as everyone has both strengths as well as weaknesses. The fact that she did attend mainstream school attests to the fact that she probably demonstrated enough ability in some area to warrant admission as Gardner’s MI theory would suggest. However, using Gardner’s model would have more precisely identified the areas of her strengths and weaknesses.

The combination of delayed physical development, poorly developed social skills and a stressful home life would have been firstly, considered as indications of other factors and secondly, would have been identified within the test as relevant to a result or results. The conclusions which the test administrator would have drawn could have provided an insight to her teachers which could have led to the facilitation of a more productive learning environment for her. Identified strengths could have been nourished and identified weaknesses could have been more considerately addressed. At the very least, should Marjorie have been tested using Gardner’s MI model, imprecise assumptions would not have been made.

The second theory of intelligence to be discussed is that of Robert Sternberg.

Robert Sternberg – Triarchic Theory of Intelligence




“Intelligence is the ability to learn, exercise judgment, and be imaginative.”

J. Huarte, 1575

Robert Sternberg’s theory is closely linked to that of Gardner’s as both saw intelligence as being far more complex than an independent general ability. The factor which Sternberg saw as integral to individual intelligence was how that individual coped with a change in or a changing environment throughout his or her life. So Sternberg proposed a triarchic theory to include analytical, creative and practical intelligence. The nature in which it was groundbreaking was that this theory was the first to approach intelligence cognitively rather than psychometrically. Sternberg defined human intelligence as,“(a) mental activity directed toward purposive adaptation to, selection and shaping of, real-world environments relevant to one’s life”(1985).

If it is accepted that individuals possess varying degrees of analytical, creative and practical intelligence, it can be assumed that these work together, with unique variations, in the tasks which are being performed. It can also be inferred that over time, and with appropriate input and support, the less dominant intelligences can be developed further. This is illustrated below in Table 5.

Table 5: Sternberg’s Triartic Theory of Intelligence

Analytical or Academic Problem-Solving Intelligence	Creative Intelligence	Practical Intelligence
This relates to examining information, deconstructing a problem to achieve a singular solution and discerning the quality of ideas which will contribute to an acceptable conclusion.	This involves resourceful interpretation and successful reaction to new situations and producing applicable ideas, even when there is some level of automaticity in performing the task.	This involves a pragmatic, and/or common-sense approach to daily tasks and the subsequent steps which would manage them effectively in a real-world environment.
		

Like Gardner, Sternberg’s theory on intelligence has helped teachers differentiate for the full range of intellects and abilities which they encounter in the classroom. In daily life, intellect, talent and skills overlap to a considerable degree and the question begs: are they universally shared or individually constructed? However, both theories make assessment of creative or practical intelligences difficult as these have more to do with aptitude than intelligence.



Sternberg’s model would have provided extremely interesting feedback on Marjorie’s intelligence through analysing the differences in her academic, creative and practical abilities. In contrast, Spearman’s theory would have identified her intellectual ability in very global terms using his ‘g’ factor and by extension denoted her general intelligence, which would almost certainly have compromised her access to mainstream education. Sternberg’s approach would have identified some, although not all, of Marjorie’s strengths and weaknesses but it would

have not have discriminated to the degree that mainstream school might seriously not have been a viable option. As Marjorie has stated that she has achieved a considerable degree of success in a number of areas' later in life, Sternberg would have probably felt validated as this statement of his would indicate, " success requires not simply applying acquired knowledge, but also coping with novelty and transforming novel experiences into automatic information processing". (Cianciolo and Sternberg, 2004)

The third theory of intelligence to be discussed is that of Cattell, Horn and Carroll.

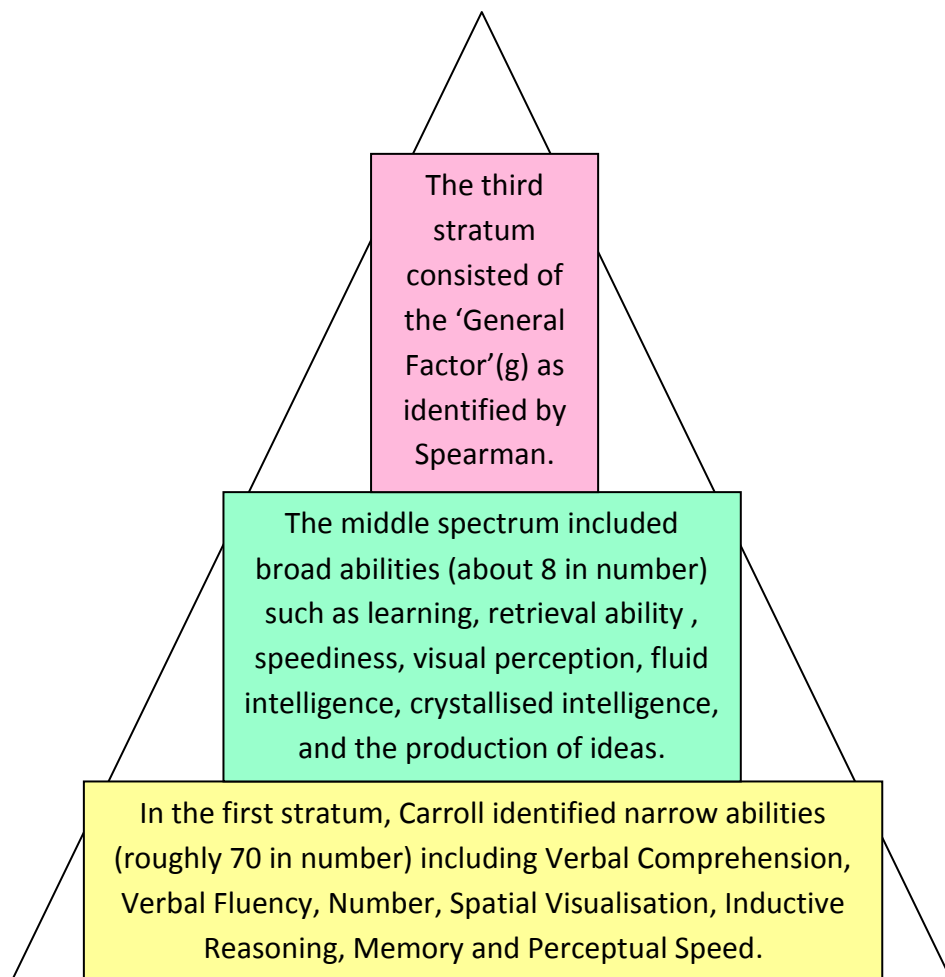
The Cattell-Horn-Carroll (CHC) Theory of Cognitive Abilitites

“... doing well at a broad range of tasks is an empirical definition of ‘intelligence’ ”

H. Masum, S. Christensen, F. Oppacher, 2002

In Human Cognitive Abilities (1993), Carroll, an American psychologist, constructed a “three stratum”, or three tiered hierarchical psychometric model of intelligence, as shown in Figure 2 below, which is highly regarded by many psychologists as a definitive model largely due to the comprehensive analysis of a considerable amount of collected data.



Figure 2: The CHC Theory of Intelligence



The CHC theory of cognitive abilities is a comparatively recent psychometric model based on extensive research gathered over decades in thousands of practical investigations, so it is indisputably data-driven. In the 1990's two separate psychometric theories were merged into a single model. "Cattell was developing a model of intelligence and Horn was continually working to expand and refine the theory into an evolving model of cognitive abilities. Carroll, in contrast, was conducting an extensive factor-analytic survey, which he correctly perceived to be of great value to the field of cognitive abilities." (<http://ego.thechicagoschool.edu/s/843/index.aspx?pgid=2173&gid=63>) Therefore this model assumes that tasks may require both fluid and crystallised intelligence to be successfully completed.

The CHC model examines the interactive relationship between Fluid and Crystallised Intelligence is shown in Table 6 below.

Table 6: CHC Theory of Fluid and Crystallised Intelligence

	<p>Fluid Intelligence (Gf)</p>	<ul style="list-style-type: none"> • the ability to reason through unfamiliar problems • abstract thinking independent of instruction which can be flexible and inventive • impacted by biological and neurological factors • the aging process can affect this
	<p>Crystallised Intelligence (Gc).</p>	<ul style="list-style-type: none"> • Cumulative learning from experiences • ability which is also knowledge-driven • functioning capability within cultural environments also impact • the aging process is unlikely to affect this

It is interesting to note that both the Cattell-Horn and Carroll models (CHC) fundamentally originated from Spearman's 1904 'g-factor' theory and offered independent and reliable conclusions relating to a spectrum of broad cognitive abilities. It was therefore pragmatic and fortuitous, that a single, combined model built on a unified theory did emerge. Research still

continues to identify broad and narrow abilities which may yet be added to the CHC model as investigation continues.

It is the CHC model which is the basis for the intelligence tests administered at this point in time. The theory behind the CHC model has been at the core of the design and construct of many intelligence assessments, such as the Kaufman Assessment Battery for Children-2nd Edition (KABC-II) and the Wechsler Intelligence Triad of Tests (WPPSI-III, WISC-IV and WAIS-IV).



We do not know how, or with what test, Marjorie was assessed. However, the CHC model would have provided the most comprehensive representation of her intelligence, in terms of her broad ability, had it been available to her at the age of six. As an adult, tests based on this model would highlight specific, extensive and detailed information as to the strengths Marjorie has in relation to her creative ability to deal with new ideas or situations (Fluid Intelligence) or those she acquired over time from past experiences and formal learning (Crystallised Intelligence). Marjorie will also discover the specific areas where weaknesses still exist which still impact on her life, and which she seeks to identify as an adult.

Having explored the differences between the three theories of intelligence in relation to Marjorie, it is perhaps a good point to look at discrimination in testing intelligence.







Discrimination in Testing Intelligence

It's not that I'm so smart; it's just that I stay with problems longer.

Albert Einstein

The very nature of testing intelligence is itself a contentious concept, due to the multitude of variables which may be unknown or unforeseen and therefore may present an aspect of discrimination. Thorndike (1949) carried out an important piece of research aimed at confirming the principle that intelligence testing includes relative variables which are not linked to the way the test is constructed. Thorndike grouped these variables into six categories as shown in Table 7 below.

Table 7: Thorndike's Variables to Test Construction

<p>General Individual Characteristics</p>	<ul style="list-style-type: none"> • The ability to actually take the test • The ability to perform well under certain test conditions • The ability to understand and decode instructions 	
<p>Specific Individual Characteristics</p>	<ul style="list-style-type: none"> • Including stable responses • The factor of chance 	
<p>Performance Affecting factors</p>	<ul style="list-style-type: none"> • The individual's motivation • Physical conditions like stress, hunger and tiredness • Environmental conditions like temperature and lighting 	
<p>Comprehension</p>	<ul style="list-style-type: none"> • Understanding the specific task in the test • Prior knowledge • Previously acquired techniques or practice • Levels of attention or memory 	
<p>Test Conditions</p>	<ul style="list-style-type: none"> • Time limits • Personal interaction with the test administrator • Any bias in rating or grading the test • Freedom from distractions 	
<p>Variance</p>	<ul style="list-style-type: none"> • Elements of luck • Distractions 	

In the following paragraphs, there is further discussion on some of the above variables, as they may have related to Marjorie.

- The actual test selected
- The way in which the test is designed or constructed and standardised
- The circumstances (personal, situational and/or environmental) on the day of the test
- The interpretation of the responses or results

TEST SELECTION

Testing as a procedure based on a model of intelligence, designed on the basis of a specific theory and constructed for a specific outcome, still cannot be accepted as either complete or infallible. However, psychological tests, which have been standardised (like those intended for educational purposes), have value and are one (and only one) of the important ways information can be obtained.

The selection of a test should be linked to the purpose of testing and therefore integral to the results which are, in turn, highly relevant to the interpretation. Therefore it could be suggested that testing forms part of a process which begins with a consultation with the parties involved, but most importantly with the individual who is being tested. The more holistic information which can be obtained prior to testing provides the test administrator with a stronger basis for selection of the correct test to use. It should also be carefully noted that any test has been developed to measure only a specific aspect of ability or attainment. Therefore, the test administrator cognisant of what specifically needs to be ascertained through testing, carefully considers and selects the 'battery' or compilation of assessments for the individual.

While attainment tests measure accumulated knowledge, from education, experience, background, or even, intuition, ability tests are constructed to measure what an individual is able to do rather than what they have learned. As abilities are specific, it is common practice to use several ability tests to obtain a fuller picture. Gardner, Sternberg and Cattell, Horn and Carroll have all revealed how full, this 'fuller picture' can be. When all of the selected assessments are considered as a whole, one aim is to ascertain a collective result and the other is to interpret the individual's performance on each specific test.



Had Marjorie, or her family, been afforded the opportunity of a consultation with an educational practitioner, such as an Educational Psychologist, when it was realised that cognitive issues existed which were discriminating against her access to mainstream education, the fact that she was delayed in her physical development, had poorly developed social skills, and she was experiencing significant stress at home, may have been taken into account. It can therefore be assumed that the conditions under which Marjorie's low intellectual functioning was questioned, and by extension her potential to learn and achieve through similar access to the type of education offered to her peer group, did in all likelihood, discriminate against her.

As a six year old child, the tests available today would not have been available to Marjorie then and therefore the added discrimination of appropriate test selection would have impacted on the situation in which she was placed. If Marjorie's intelligence was solely being considered in terms of Spearman's 'g-factor', there is little doubt that attending mainstream school would have been a close call, as indeed it was.

DESIGN AND CONSTRUCTION

Reputable and well-critiqued tests have been specially constructed to measure a particular aspect of ability or attainment. Some tests investigate specific functions and others are composites where independent results are united. Tests are heavily scrutinised to ensure that they can be reliably used with confidence and several forms of evidence should also be provided to assure the validity of the test. Well constructed tests should be non-biased in regard to gender, race and ethnicity, among other factors, and if these tests are unsuitable for individuals with certain differences (eg. speech articulation problems), this should be clearly stated as a different test may be more suitable. Not all tests offer options for individuals presenting with issues which would impact on the test being carried out accurately and without any discrimination in the process of administration, as the construct would demand.

Standardisation of a test is also integral to the individuals who will be given it to measure their competencies. When a test is developed in a particular country, a large enough random sample, or 'normative' group, relevant in age and representative of a substantial regional population should be used, taking into consideration gender, geographic region, race, cultural status, exceptionality status, family income, social background, educational attainment of parents and age. The percentages of these characteristics should also be compared with official demographic statistics for the age of the population within the sample. A comparison of the

percentage can then demonstrate that the normative sample is representative of the country's population.



Apart from not knowing Marjorie's current age, there is no background information on the test conducted when she was six years old to ascertain her ability to enter mainstream school. Therefore, it is unclear as to what assessment of her intelligence took place. We can postulate that the 1960 or the 1973 version of the Stanford-Binet Test (originally created in French in 1905 and in English in 1916 by Lewis Turman) may have been used. We can equally hypothesise that only an informal comparison was made between her achievement and that of her peer group level took place. We have no idea as to the depth of consideration which was granted to her as a six year old child. Assuming the latter to be the case, it could be deduced that both bias and unfairness at the most basic level took place where Marjorie was probably being compared with a non-standardised sample.

CIRCUMSTANCES

It is widely understood now that whether tests are of attainment or ability, these can only estimate an individual's performance at the time of testing. A low score can be obtained, without definitively indicating low ability. Emotions, illness, opportunities to develop abilities, social backgrounds, living conditions, situations which impact personal development and so on, can and do impact on test results. Sometimes tests only sample a limited range of abilities and miss out on many that are important for success in life and can seem unfair for individuals whose talents do not match the abilities included in the tests. The test, therefore, only represents a snapshot of strengths and weaknesses, selected by the test, and gives estimates, rather than exact measures. Tests should always take into account and be looked at in conjunction with the wider environment, including society, home and school.



In retrospect, while giving a history of her childhood assessment, Marjorie indicated, what would now be considered three environmental factors, which were present and pertinent when she was being considered for mainstream placement. Delayed physical development could have indicated prematurity, malnutrition or poverty. Poorly developed social skills could have indicated an environment where verbal communication was weak, access to information was

scarce and/or emotional connection was absent or discouraged. Significant stress at home, while non-specific, probably indicated social or emotional issues within the home environment which were a cause of distress, severely impacting her ability to function 'normally'. With this in mind, accepting that all is speculative, including the environmental conditions and how Marjorie present on the day of the test, it is still reasonable to infer that the question of Marjorie's cognitive ability was severely biased, unfair and discriminatory and that whatever means was used to test her intelligence, would have taken no environmental factors into account and therefore, be invalid.

INTERPRETATION

The impact and outcome of a test should benefit the individual to whom it is being administered. While testing is intended to discern differences in individuals, this should never be used to discriminate against them. Closely following the instructions in the testing manual is integral to both administering the test and interpreting the results, after all, it is in the interpretation that the test is of greatest value. When all intrinsic and extrinsic factors are considered together with the scores of the test, a fuller picture emerges and a worthwhile outcome, with relevant proposals for intervention can be recommended.

Testing is only one 'tool in the kit' available to us to discern a true picture of the problem which needs investigating. Therefore there should be a multi-faceted approach to ascertaining as true a result as possible. Consultation with the individual being assessed is invaluable as are interviews with people who are significant in the wider environment in which they live. Reports from previous tests can also help suggest a bigger picture and the professional judgement of the test administrator should take all of these into consideration before making diagnosis or recommendations for intervention.



Firstly, Marjorie's less than average cognitive ability as a six year old was somehow assumed before it was investigated. Whatever method of assessment was used to establish a result, obviously did place her with her peers in mainstream school. For all we know, her eventual admission could have been purely pragmatic: there may have been nowhere else she could have been placed or been able to travel to. Perhaps the assessor was known to her and by extension was simply sympathetic and felt that it would do neither her, nor her more advanced classmates, any harm to have them learn together.

However there is no doubt that whether or not Marjorie was formally tested previously, there now exists more advanced tests based on the work of Gardner, Sternberg and Cattell-Horn and Carroll which will take the myriad of personal and environmental factors into account before a result was interpreted. Therefore a more accurate and meaningful outcome can be assumed. Marjorie's request for re-testing as an adult will surely provide a more in depth, detailed and accurate snapshot of her intelligence, strengths and weaknesses.

Relative to the scenario, it becomes imperative to discuss bias and discrimination in relation to testing intelligence.

Bias and Suitability of Tests

“Despite the best intentions to develop tests that are low or reduced in bias, human error—stereotypes and prejudice—undermine test administration, interpretation, and use. More often than not, African American and other culturally diverse students are the recipients of this inequity.”

Gilman Whiting, Donna Ford, 2009

Test designers and constructors use complicated procedures to scientifically analyse tests for bias because tests are intended to be a fair assessment of ability within a specific group, regardless of sex, race, socio-economic status and so on. If a test is biased in its fundamental construct, it will predict outcomes with irregularity across different individuals and groups tested.

However, the debate still continues as to whether intelligence is inherited genetically, acquired through learning, experience and time, as a result of exposure to environmental factors, or a combination of some or all of these. With these unanswered questions in mind, test bias is almost certainly likely to give a test result a negative outcome should a test not make any allowances or reasonable adjustments or treat less favourably minority groups, those with disabilities or environmental factors which are of significance.

As an example, “The test bias controversy and debate has its origins in the observed differences in average IQ scores between various racial groups (Blacks) and ethnic groups (immigrants) in the early 1900s”. (Cole & Zieky, 2001)

According to Flanagan & Ortiz, 2001, several studies indicated that white Americans scored on average 15 points higher than African Americans on traditional intelligence tests. The test components indicated that more emphasis was placed on high linguistic/verbal ability which would have been more suited to the culture of white Americans. Therefore intelligence testing in the U.S. suggested that African Americans were less intelligent than their white or Hispanic counterparts. The results of these tests, therefore, impacted the educational and occupational opportunities of African Americans. As already discussed in the Design and Construction section, there is now an increased sensitivity in test construction to the cultural differences between groups and tests are more rigorously 'normed'.

Legislation

There is also legislation which has been introduced, in countries like the United States and the United Kingdom, which seek to eliminate potential bias or discrimination in education in general which suggests that assessment of individuals is a part of this.



Although The Equality Act 2010 (U.K.) has superseded the Race Relations Act of 2000 (U.K.), Section 2 (c) of the latter, "Monitoring the Impact of Policies", is of relevance to this paper. "Under the duty, schools must monitor the impact of their policies on pupils, staff and parents from different racial groups. In particular, schools should monitor the impact of policies on pupils' attainment levels." To give an example of monitoring, schools are expected to monitor 'attainment and progress by racial group, analysing it and using it to examine trends' and one aspect of this is for the benefit of schools to 'decide what further action needs to be taken to improve the performance of pupils from different ethnic groups' and to 'review and set targets in relevant strategic plans'. However, bias is far more extensive than discrimination on racial terms.



Another example of bias is disability. In the United States, the Individuals with Disabilities Education Improvement Act of 2004 states, that after a referral process, an evaluation is the next step. It is interesting to note the aspects of this as it pertains to eliminating bias in testing procedures:

'The Evaluation

After the referral, the district will begin the evaluation usually beginning with a social history. The law requires a comprehensive school evaluation involving all areas of suspected disability. Testing must be in the native language of the child (if feasible) and must be administered by a team of professionals, (including at least one teacher and a specialist who is knowledgeable in the area of the child's disability). Testing must be administered one-to-one, not in a group. Any tests or other evaluation materials used must be administered by professionals trained and qualified to administer them — i.e. psychological testing must be conducted by a psychologist trained to administer the specific tests utilized.

In addition to testing, an observation of the child either in school or in a comparable situation is required for an initial evaluation. It is through the observation that the child can be assessed while interacting with his peers and teachers. To ensure objectivity and cross-referencing, this observation must be conducted by a person other than the child's classroom teacher. The observation need not be done exclusively in the child's classroom, especially when the child's suspected area of disability may become manifest in larger settings, such as the lunchroom, hallways or gym.

For children over twelve years of age, vocational testing is required. The 2004 amendments to IDEA strengthen the law's focus on transitioning to secondary education and vocational or other mainstream opportunity and recent case law has emphasized IDEA's focus on independence and self-sufficiency as fundamental goals for each student.

During the testing process, the parent is free to obtain privately obtained evaluative material and reports. Private evaluations can be very valuable in providing the Committee on Special Education with the expertise of specialists trained in the area of the child's disability who may have a different view or opinion than school personnel. Experts may include professionals such as neuropsychologists, psychotherapists, psychiatrists, neurologists, pediatricians, medical personnel, tutors and providers of specific reading/writing methodologies (such as Lindamood-Bell, Orton Gillingham and Wilson). Professionals who have been working with the child over time can often provide valuable depth of understanding the child's history with a long-term view of the child's needs.

A parent has the right to an independent educational evaluation at public expense if the parent disagrees with an evaluation obtained by the school district.'



Dr.Sharon-Nicole Gopaul-McNicol, from Trinidad and Tobago, has examined in depth the guidelines for culturally aware assessment and intervention. In 2002 her book, 'Psychological Tests with Minority Populations. Practical Resources for the Mental Health Professional' was published. It is of particular relevance in the Caribbean as it examines assessment and cultural challenges when minority populations are assessed using traditional models. She examines the deficits and proposes a bio-cultural model of assessment to more accurately assess individuals from various ethnic, cultural and linguistic backgrounds. The Caribbean has a rich diversity of cultural origins, and variations in the use, mechanical configuration and meaning of language, including dialects and patois, which are often linked to individuals within geographic, social and economical strata of native Caribbean societies. 'The culture-fair techniques and strategies of the book tap into a broad range of the abilities and aptitudes of the examinee. Assessment and Culture provides a cultural frame of reference which allows the examiner to take into account the individual's social and cultural factors in development, coping style and personal history. Individual chapters consider the practical aspects of assessing the intellectual, linguistic, academic, visual-motor, emotional and vocational functioning of culturally diverse children.' (Book description, www.amazon.com)



In Barbados, The White Paper on Education (1995) states in relation to discrimination in the access to education for all students (although it should be noted that details on conducting tests or discrimination within tests) is not specifically outlined:

“Government’s commitment to equitable access to quality education for all persons ensures that all physically or mentally challenged children will receive educational instruction that is appropriate to their needs. In addition, The Ministry of Education, Youth Affairs and Culture plans to pursue vigourously the concept of ‘ least restrictive educational environment’ better known as mainstreaming...Currently the Education Act Cap. 41 makes provision for the education of this segment of our school population and defines Special Education as:

- '(i)...education suitable to the requirement of persons who are mute, deaf, blind or otherwise physically or psychologically disabled or mentally retarded; and
- (ii) includes education suitable to the requirements of pupils who are gifted or have exceptional ability.' "

Finally, it bears mention, that in a country like Barbados, which is a former British Caribbean colony, no statistical data based on population demographic is nationally available to correlate to the sample group of an American or British population, complex as they may be, for whom, an intelligence, ability, or attainment test is designed, constructed and standardised.

Complicating the issue of testing still further, is that the educational system in Barbados is different from that of the country of origin of any tests administered in Barbados. There are societal and cultural differences, curricula, syllabi and educational attainment targets which are different. Chronological ages as they relate to grade levels may differ to some extent; content of material is different, as is its level, depth and timing of presentation. Therefore the suitability of tests designed for a population outside of the unique cultural environment of the Caribbean, could be to some extent (and this is sometimes alluded to in the reports of Clinical Psychologists in Barbados) regarded as discriminatory.

The selection of tests of intelligence, attainment and ability will require careful and knowledgeable administration. For individuals who are at further risk of bias based on for example, disability, social or cultural variances from the Barbadian 'norm', gender or age, awareness of possible bias and shrewd, professional interpretation of the test conducted should be made. Reasonable adjustments to test administration and testing situations would be necessary to minimise bias and or discrimination. However, it is imperative that:

- (a) the validity and reliability of the test should not be threatened, and
- (b) any adjustments should be carefully noted and taken into account when the test results are being interpreted

Careful scrutiny of the assessment manual will (or should) indicate the compensations or amendments which can be made for individuals presenting with a disability which will negatively impact on the assessment's outcome and accuracy. These assessments are obviously

cognisant of the fact that test validity cannot be compromised and give clear instructions of what sub-tests may be eliminated without the assessment's results being any less reliable. Therefore having the most recent publication of a test is imperative. Amendments and improvements to the test construct constantly being considered by test publishers (very often through feedback from test administrators) are intended to minimise the effects of test bias. Test publishers seem aware that cultural demographics are altering and tests are reflecting these societal changes. Additionally, research in the area of intelligence is still underway and the construct of tests is also changing, even subtly, to reflect the new data being provided relative to intelligence, skills and abilities within the population.

Conclusion

Our understanding of the multi-faceted nature of intelligence has expanded considerably from Spearman's 1904 theory of there being two basic types of intelligence and research continues to ensure that all of the factors which constitute intelligence are considered. There are some professionals in the field who are unsure as to whether intelligence tests are accurate measures of ability, as while these may give valuable quantitative data, the results should be considered carefully along with qualitative data based on observation and investigation.

However, the fact remains; there is no realistic alternative to intelligence tests in the hands of competent professionals who use the scores but also go beyond them, integrating them with other information, to make relevant recommendations for the client.

Testing intelligence should be approached therefore, in a wider context and with a high degree of sensitivity. This should include access to far more information than merely that found in the questions provided in an intelligence test. The person being tested is not an object, the test is not infallible, the client's background is not inconsequential, the circumstances of the day are not universal, the scenario is not without specificity, the interpretations are not without a degree of subjectivity, the result is not without effect, and the impact on the life of the client, like Marjorie, is not insignificant.