

# **Personality vs. Intelligence:**

## A literature review and future study proposal

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Joyceline Chow

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Indraneel Sircar

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Professor John Wilkes, Project Advisor

# Table of Contents

I.	Abstract.....	Pg 2
II.	Literature Review.....	Pg 4
	a. Intelligence .....	Pg 5
	b. Personality and the MBTI .....	Pg 16
	i. Personality Traits vs. Personality Types .....	Pg 17
	c. Woodcock Johnson III .....	Pg 23
	i. Thorough Descriptions of the WJ III Tests.....	Pg 25
	d. The MBTI, SAT and WJ III .....	Pg 30
III.	Appendix A .....	I
IV.	Appendix B .....	V
V.	Bibliography .....	VIII

## **Abstract**

The possibility of a relationship between intelligence and personality has generated great controversy in psychology. This study involves the very specific question of the relationship between the Myers Briggs Type Indicator version of Jungian Personality and the Woodcock Johnson III test of Cognitive abilities as the Intelligence test. Myers posited that there would be a relationship but the cluster of intelligence experts working for the Educational Testing Service (on the SAT) strongly disagreed. Our contribution to the empirical study of this question was to review the literature on measures of these concepts, place the indicators to be used in context, gather data on about a quarter of the 60 cases needed to test the question empirically, and propose a future study which could be based on a larger data set. This involved a search for an IQ test that was credible but took 20 minutes rather than 2–3 hours (as the WJ–II did) to administer.



# Literature Review

Interest in the study of a relationship between personality and intelligence is a very recent development in the field of psychology, a science that is still trying to establish a firm theoretical grounding. It is a multi-paradigm field. The formal study of intelligence is approximately hundred-fifty years old and the study of personality by Jungians developing the MBTI can be traced back to the 1940s. However, full-scale studies do not emerge about until 1960 when Isabel Myers was at the Educational Testing Service and thinking about the IQ-MBTI relationship. She was in conflict with Princeton based psychologists developing the SAT out of the IQ tradition when she posited that there would be a predictable order in the average scores of the sixteen different types.

The emergence of a new field of study is likely to provoke controversy in a scientific community, and Isabel was an uncredentialed outsider. Isabel Myers started a school of thought that believed that a relationship exists between personality and intelligence in the context of a field that believed in the latter and doubted that personality was stable enough to be measured accurately, much less, that it was stable over time.

Thus, the goals of this paper are to systematically study the development of the intelligence testing, personality profiling, and empirically discover the relationship between intelligence and personality using the Woodcock Johnson III cognitive assessment battery, the SAT (a common proxy measure for IQ), and the Myers-Briggs Type Indicator.

# ***Intelligence***

*Term usually referring to a general mental capability to reason, solve problems, think abstractly, learn and understand new material, and profit from past experience. Intelligence can be measured by many different kinds of tasks. Likewise, this ability is expressed in many aspects of a person's life. Intelligence draws on a variety of mental processes, including memory, learning, perception, decision-making, thinking, and reasoning.<sup>1</sup>*

The first recorded attempt to measure intelligence was conducted in 1869 by Sir Francis Galton. His studies, which were a comparison of accomplishments of different generations from prominent English families, were published in his book, *Hereditary Genius*. His studies concluded that intelligence was a hereditary trait. Some of his followers would found a eugenics movement in a misguided effort to improve the race over time, making him a controversial figure as well as a pioneer in psychology. In the 1890s, James McKeen Cattell, who developed the first formal test consisting of 50 batteries, joined Sir Galton. Like Sir Galton's, Cattell's tests were designed to measure sensory perception and reaction times and thus to determine intelligence indirectly. However, his claim to validity for this test was unsupported, as it did not correlate with college academic performance, which was the key cross validating variable, given that the test population contained only students from Columbia University.

Shortly following Cattell's work, Charles Spearman, a British psychologist made an important discovery that "all tests of mental abilities were positively correlated."<sup>2</sup> In other words, if a person were to score high one of the sub tests, they would score high on the other existing cognitive ability tests and the inverse. Therefore, in an article in 1904, Spearman stated that this "positive correlation must be due to a common factor."<sup>3</sup>

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<sup>1</sup> (Microsoft Encarta, 2006)

<sup>2</sup> (Kamphaus, R. W., 1997)

<sup>3</sup> (Microsoft Encarta, 2006)

It was from this intellectual base that psychologists began the process of factor analyzing multiple test batteries.

Spearman elaborated that there must be two factors that affect mental processes. The first one, named the *g* factor, represented general intelligence, which affects all “intellectual tasks and mental abilities.” The second factor, the *s* factor, was a specific factor that determined a person’s ability on a particular test. He later argued that the *g* factor determined intelligence, as it was a measure of some type of a person’s “mental power or energy.” However, something so subjective and intangible (impossible to measure at the time) could hardly hold sway as a definitive theory. Thus, others hypothesized that the *g* factor was a correlate of neural efficiency, neural speed of some other property of the brain<sup>4</sup>.

Spearman’s work opened the path for a new method of understanding intelligence. Some believed that intelligence does not depend on just one general factor, as Spearman had concluded, but on several small factors. So using the statistical analysis method of factor analysis, psychologists learned how to group the various cognitive factors. These “group factors” were basically “specific abilities” required for performing well on particular collections of test items. This kind of research started a debate about whether there was only one *g* factor, which would be elaborated a little later in time by the American psychologist Louis L. Thurnstone<sup>5</sup>.

Returning to the development of intelligence tests, it was in 1901, that the French psychologist Alfred Binet with his colleague Simon started work on the Simon-Binet testing method. Originally, the project was assigned to Binet and Simon by the French government to create a means of measuring intelligence to distinguish the

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<sup>4</sup> (Microsoft Encarta, 2006)

<sup>5</sup> (Kamphaus, R. W., 1997)

mental abilities of children and assign them the appropriate grade levels, supporting the government's new compulsory education policy. Binet and Simon's first test was published in 1905, and it is very similar to today's tests. After conducting studies, Binet found that "children follow the same course of intellectual development but develop at different rates."<sup>6</sup>

Ironically, the test gained more popularity in the US than it did in France. It was first introduced to the US by Henry Goddard to test for people with mental retardations. However, it was quickly revised by Henry Terman to be appropriate for "normal" adults. Terman further created a scale that defined average performance at each age level. Since the revisions were made at Stanford, the test is more commonly known today as the Stanford-Binet test. The Stanford-Binet was also the first test that quantified intelligence using an absolute numerical value known as the *Intelligence quotient*. Terman followed a simple formula to calculate the numerical value using the following simple formula.

$$IQ = [ (tested\ mental\ age) / (actual\ age) ] * 100$$

During World War I, the US Army needed a means of distinguishing recruits suitable for officer training. It employed the services of the American Psychologist Robert M. Yerkes to create a test that could be administered in large groups to screen recruits. Two different tests were developed for the occasion. The first one, called the Army ALPHA Exam, was created for literate recruits who would be more likely to become officers and take higher positions of power. The second test, called the Army BETA Exam, was for non-English language speakers and illiterate recruits.

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<sup>6</sup> (Microsoft Encarta, 2006)



Based on the success of the Army's group based testing in rapidly identifying "officer" material in a way considered objective, Yerkes, with the collaboration of Terman, went on to develop a group based testing instrument for schoolchildren in 1920. Shortly following their work, in 1926, the *Scholastic Aptitude Test* or SAT was developed. Its initial purpose was to identify exceptional working class students in the broader society and award them a full tuition scholarship, essentially an expense free college education. The initial application was to open up higher education, not exclude people, far different from its use today. The inspiration for the SAT was the I.Q. movement measures as what was to be predicted was "aptitude" not achievement. Academic promise among poorer students, who had not gone to the best high schools, was what they were trying to identify<sup>7</sup>.

Today, the most common intelligence measures are the Stanford-Binet, Wechsler Intelligence Scale for Children (WISC), Wechsler Adult Intelligence Scale (WAIS), and the Kaufman Assessment Battery for Children (Kaufman-ABC). All of the afore mentioned measures contain ten or more different tests, each meant to test a certain area of one's intelligence through testing for vocabulary, recognizing similarities, digit span, general knowledge, object assembly, negotiating mazes, and arithmetic. Each of the tests gives numerical values, which collectively give an "absolute" composite measure of intelligence and allow intra-comparison of the test scores<sup>8</sup>.

Though not as accurate as individual testing, group testing has become popular because of its efficiency. The previously mentioned army tests have evolved into the Armed Forces Vocational Achievement Battery, which is in daily use. Colleges, other academic institutions, and employment firms have also used intelligence tests to pick worthy candidates for employment, promotion and top leadership. Though not

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<sup>7</sup> (Anderson, Etienne, 2003)

<sup>8</sup> (Microsoft Encarta, 2006)

explicitly called intelligence tests, various achievement and aptitude tests are identical to the earlier “IQ” tests. The main difference is that achievement tests are designed to assess what a candidate has learned while aptitude tests are designed to assess one’s potential to learn. The educational, business and governmental institutions using these assessments refrain from using the word intelligence, as it can be a labeling and frightening word or even cause discord and objection among the test-takers. The College Board has even dropped the word “aptitude” from the title of the SAT, now calling it the Scholastic Assessment Test. However, the most common “aptitude” style tests in the IQ tradition are the SAT, CAT, GRE, LSAT, and the MCAT. The ACT, which is the main competitor to the SAT, is from the Achievement Test Tradition. However, in practice the two sets of scores (SAT and ACT) are highly correlated. Though most institutions and figures in the field of psychology agree that these tests cannot accurately measure aptitude or even less nebulous mental abilities (such as achievement), as there are too many variable factors. The tests still provide an objective base of comparison of mental abilities of people of similar ages from diverse social backgrounds. In the end, choices have to be made and some students turned away, preferably on fair and “objective” grounds<sup>9</sup>.

Even though commonly used, there are still numerous criticisms of widely practiced methods of intelligence testing. Many believe that the available measures do not actually test overall intelligence, but just some of the mental processes of a person. According to the supporters of this criticism, intelligence is constituted of many other abilities such as “wisdom, creativity, common sense, social skills, and practical knowledge.<sup>10</sup>” However, other psychologists either believe that these are derivative from, or a consequence of, the basic processes that the intelligence tests measure. It is also possible that these abilities are immeasurable because they are intuitive and too

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<sup>9</sup> (Microsoft Encarta, 2006)

<sup>10</sup> (Microsoft Encarta, 2006)

subjective to be tested for using an objective measure. Others looking at the same pattern of findings have concluded that the degree of development in the areas that are tapped depends largely on the environment that the subject has been exposed to which creates a large number of variable factors. The complexes are great and there is still no consensus in this field of study.

Returning to the historical developments of the field, the idea of there being more than one *g* factor was becoming evident and it was in 1938, that the American psychologist Louis L. Thurnstone hypothesized that intelligence is not just one “general” factor. Thurnstone believed that intelligence is a small set of independent and equally important factors, which he called the primary mental abilities. To prove this hypothesis, Thurnstone, with the help of his wife, constructed a test of 56 batteries and administered it to 240 college students. From the results, he decided that there were seven primary mental abilities, which were verbal comprehension, verbal fluency, number or arithmetic ability, memory, perceptual speed, inductive reasoning, and spatial visualization<sup>11</sup>.

This claim would soon fuel a lot of speculation about whether that was all and controversy about whether “*g*” was all these in combination. Were there other important unmeasured aspects of “*g*”? Critics reported that his test and study had two major faults. Firstly, it was administered to a very homogenous group and did not represent the larger population. This criticism led Thurnstone to re-administer the test to a larger population, which only produced a larger correlation among the factors. Secondly, since Thurnstone’s method of factor-analysis was so complex, when the data were evaluated by other psychologists in other ways, they concluded that Spearman’s original idea of

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<sup>11</sup> (McGrew, K.S., 1998)

the one factor intelligence was true, and the “G” vs. Multiple Intelligence” debate was joined

In the 1960s, American psychologists Raymond Cattell and John Horn, using the then new method of factor analysis, revisited the theory of intelligence. They concluded that there are two types of intelligence;  $g_f$  (fluid intelligence) and  $g_c$  (crystallized intelligence). Fluid intelligence is the mental ability of a person that develops and which deteriorates with biological processes such as age. Crystallized intelligence, on the other hand, is knowledge or skill acquired in the course of learning and experience. Cattell elaborated that there is no limit to the development of crystallized intelligence as long as resources are available. He also theorized that fluid intelligence aids in the development of crystallized intelligence and called it *investment theory*<sup>12</sup>. This theory led to the idea that intelligence tests could reflect and tap both types of intelligences. Many psychologists did not see Cattell and Horn’s work as new but simply looked at their work as an elaborate or consolidation of Spearman’s original hypothesis.

In 1983, the American psychologist Howard Gardener again tried to broaden the popular one factor intelligence theory by introducing the idea of multiple intelligences that each work separately. To prove this, he examined subjects with brain damage, who, even when they had suffered a loss of spatial determination, still had strong memory and linguistic abilities. Thus, he believed that a person has multiple intelligences that work independently but can be called upon all at the same time, if needed, to perform a task. He produced more evidence when examining prodigies, individuals who demonstrate extraordinary ability in a specific area at an early age but are average in the others, and savants, “individuals who score well on IQ tests and show

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<sup>12</sup> (Microsoft Encarta, 2006)

limited social or language skills but may have an extraordinary ability like drawing or memory.<sup>13</sup>”

Through his work, Gardner discovered what he considered to be the eight basic intelligences; linguistic intelligence, logical–mathematical intelligence, spatial intelligence, musical intelligence, bodily kinesthetic intelligence, interpersonal intelligence, intrapersonal intelligence, and naturalistic intelligence. He even proceeded to propose a prominent historic figure that displayed extraordinary ability in each of the eight areas of intelligence<sup>14</sup>.

Gardner’s point of view on intelligence was widely accepted among educators, as it served to explain how students could have specific areas of learning that generalized over several subjects, and be coupled with a gift, say for music, art or the dance. However, most of the scientific community in psychology rejected his claims on methodological grounds. The theory was arrived at through deductive reasoning and intuition, and was therefore lacking in the kind of solid empirical data of the mental testing movement. Some claimed that the eight intelligence types stated by Gardner were simply talents. Besides, since Gardner’s different intelligence types could not be objectively measured, it did little to dissuade followers of Spearman’s one factor intelligence theory.

Another American psychologist, Robert Sternberg of Yale, proposed the *triarchic theory of intelligence*<sup>15</sup> in the 1980’s as well. He recognized that mental tests were poor predictors of performance in the real world. Thus, people who performed well on the tests did not necessarily do well in real world situations. Therefore, his *triarchic* theory

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<sup>13</sup> (Microsoft Encarta, 2006)

<sup>14</sup> (Microsoft Encarta, 2006)

<sup>15</sup> (McGrew, K.S., 1998)

claimed that intelligence could be divided into three separate parts, analytic, creative and practical. Together, the three components created one system the enabled a person to perform regular tasks, which was fairly similar to Spearman's one *g* intelligence theory. His work gained a lot of praise since it managed to broaden the realm of intelligence, however, it also attracted criticism. Once again, scientists claimed that Sternberg's theory could not be empirically proven and that analytic intelligence, practical intelligence, and creative intelligence were not separate types of intelligence but an extension of Spearman's *g* factor theory.

Further controversy and speculation arose when scientists tried to determine how differences in intelligence originate. This question has generated two opposing schools of thought. The first school of thought is similar to Sir Galton's views and claims that intelligence has a large hereditary (or genetic) component. All persons are born with a definite amount of intelligence, and that "native" intelligence cannot be increased by any means. The opposing school of thought held that intelligence is determined by one's interaction with their environment. They believe that equal opportunities and access to information will result equal development of intelligence of people who seemed different early in life. Thus, one could intervene at an early age and theoretically can build an egalitarian society in terms of intelligence. Today's cognitive psychologists generally agree that intelligence is affected by genetics and environmental factors, but their relative importance has spawned a continuing Nature versus Nurture debate.

There are worries that intelligence testing and Galton's line of thought, giving primary importance to genetics, can lead to discrimination among societies and races. (This fear is based on ideology of the use of eugenics in World War II by the Nazi regime to justify anti-Semitism.) For instance, the 1927-Buck V. Bell case ended up in the US Supreme Court, which upheld the right of states to sterilize those who score at the

“idiot” level in intelligence tests. Since the African American community consistently scores several points percent lower on average than the White American population on the IQ tests, African-Americans were more likely to have their right to procreate withdrawn than whites. Those from the school of thought that the environment develops intelligence believe that this is discrimination. They further claim that the score differences are due to the culturally based content, which was heavily biased towards the white population. Even when the cultural content was eliminated from the tests, the relative IQ scores did not change greatly. It is also found that another minority, the Asian-American populations, score the highest average on the IQ tests in the US. Explanations of this phenomenon are rarely genetic.

The prevailing theory is that Asian-American populations score higher due to a higher rate of learning, a stronger work ethic and a culture that supported dedicated application to master the more difficult subjects such as mathematics. This line of reasoning supports the environmental school of thoughts' efforts to challenge heredity as a main determinant of intelligence. However, that explanation still fails to explain why Asian Americans perform some tasks (math aptitude tests) better than the rest of the population. To explain the gap, some psychologists such as Arthur Jensen (1969) and Richard Herrnstein and Murray (1994), claimed that intelligence is dependent on genetic differences. However, the subject is (wisely) avoided by most in the scientific community, due to the politically correct movement which attacks such theories as racist and a justification for inequality in a nation committed to equal opportunity.

The argument continues between those who believe in the one *g* factor of intelligence and those who believe in a multifaceted model with important elements of learning. In the recent years, instead of focusing on aptitude and achievement tests, alternate methods of testing to explain intelligence have been developed. The scientific reductionist community has tried to explain intelligence through studies conducted in

the neurological, behavioral and cognitive sciences. Intelligence has also been approximated in the area of the computer sciences through the development of artificial intelligence programs. Amidst all the controversy, a new theory of intelligence has arisen that tries to explain the emotional abilities and processes of a person, explicitly called emotional intelligence.

Meanwhile, the ongoing debate of what creates intelligence; are we born with it or do we develop it through our interactions with our environment has spread to cover each new intelligence posited and documented. If intelligence is genetic, does it imply that some ethnicities or races are superior in terms of mental power? Such controversial and racially charged debates complicate the matter and make the arguments more tangled and finessed than before, while discouraging research into the relevant questions. Therefore, it is evident that the area of intelligence is a subject which is very complex and still in its pre-paradigm phase – though there have been periods with a dominant school of thought, it will take more time before a single accepted theory about the factors shaping and constituting intelligence emerges and claims paradigm status in psychology. However, a synthesis attempt is underway.



## ***Personality and the MBTI***

Although currently there isn't a universal definition to describe personality, in psychology, personality is generally viewed as a pattern of behavioral, temperamental, emotional, and mental traits of a person. It is what collectively comprises a unique individual.

In today's world, due to a high number of profit losses due to employee theft, many companies have created a variety of tests designed to find out if the applicants are likely to steal or exhibit dishonest behavior. The most commonly used type is the personality test. Only applicants with certain characteristics and traits considered as those of an honest person will be hired as employees. Are these results reliable? To a certain extent, they are. For example, scores on the Reliability Scale (citing) – which includes questions about impulse control and disruptive behavior during school years – were found to be significantly correlated with a broad range of undesirable employee behaviors (Hogan & Ones, 1997).

Although the use of personality tests to help select reliable employees is gaining popularity, it is still a relatively new concept and far from perfect. In general, these tests are not 100% fool-proof however it can still be very beneficial. The goal is to help finding the overall mean of one's personality to reduce the chances of hiring dishonest people.

To gain an accurate understanding of a person's personality, one needs to put other things into context, such as personal habits, development process, cultural influences, social skills...etc. Personality tests are designed to measure aspect of a person's character that remains stable throughout a person's lifetime, not just how the person feels or act on a certain day. They are usually series of standardized questions or

tasks that are used to describe the subject's unique characteristics since a person's character does not change significantly across the life span. (citing)

In order to understand personalities' factors a bit more, here, we're looking at how personalities are formed by traits. There are three basic assumptions that can be made by using the trait approach to find one's personality. (Carver & Scheier, 1996)

- 1) Personality traits are comparatively stable; therefore, it is predictable over a period of time. Hence, a gentle person tends to stay that way day after day, year after year (Costa & McCrae, 1997)
- 2) Personality traits are relatively stable when it comes to situations, thus, another reason why a person's action can be predictable under different settings. For example, a person who's generally very quiet and does not have a lot of friends in school will probably act the same way when he's at work, not very social.
- 3) No two people have the same personality, even if two people have very similar personality traits.

Concisely, the trait approach views personality as the combination of stable internal characteristics that people display consistently over time and across situation (Carver & Scheier, 1996)

### **Personality Traits vs. Personality Types**

Theories on the development of personality have been developed for over thousands of years. One of the very first personality descriptions was founded by Greek philosopher, Hippocrates (400 BC). He suggested that 4 different types of "humors" in people. Each type is associated to one of four bodily fluids, or so-called "humors - phlegm, blood, black and yellow bile. Each of these fluids corresponds to their

character or personality. According to Hippocrates, personalities are based on the amount of humors each person has. He labeled each type of personality as: phlegmatic (slow, lethargic), sanguine (optimistic), melancholic (sad, depressive) and choleric (angry, irritable). (Bernstein, 1999)

Keep in mind that Hippocrates describes personalities as types, not traits. A type is a category, a classification. You can categorize a certain type of personality and put them as a group. Whereas trait is a genetically determined characteristic, a distinguishing features.

Two of the better known personality-categorized systems are the Carl Jung's Theory and the Myers-Briggs personality test. Carl Jung, a Swiss psychiatrist, an early follower of Sigmund Freud, was the first to develop the theory that individuals each had their own psychological type. Jung believed there are two kinds of behaviors which humans contain, obtaining information and making decisions. Within these two categories, there are two corresponding ways of functioning. We can perceive information via 1) our senses, or 2) our intuition. We can make decisions based on 1) objective logic, or 2) subjective feelings. (BSM Consulting, 1998) According to Jung, we all use these functions in our everyday lives, however, the results may vary from individual to individual. Jung identified 8 different types of personality, and they are:

<b>1. Extraverted Sensing</b>	<b>5. Extraverted Thinking</b>
<b>2. Introverted Sensing</b>	<b>6. Introverted Thinking</b>
<b>3. Extraverted Intuition</b>	<b>7. Extraverted Feeling</b>
<b>4. Introverted Intuition</b>	<b>8. Introverted Feeling</b>

The Myers-Briggs personality test, the most widely used psychological instrument

for categorizing personality types, was developed based on Carl Jung's theory on personality classifications.

The Myers-Briggs is a model to help identifies your most frequently used function, your personality preferences. Everyone uses all eight functionalities however, each person also choose to use one preference more than another. This test is a model based on four major preferences:

1. <b>E</b> xtraversion	<b>I</b> ntroversion
2. <b>S</b> ensing Perception	<b>I</b> ntuitive Perception
3. <b>T</b> hinking Judgment	<b>F</b> eeling Judgment
4. <b>J</b> udging	<b>P</b> erceiving

According to Myers-Briggs Theory, while both types and traits are both inborn, traits is like a skill, it can be improved, whereas types is based on how a person was raised and under what he environment that a person was grown to, it can changed over a period of time. This indicator is a tool to help tackle a person's preferences of types that's based on their personal change and growth. (citing)

The MBTI (Myers-Briggs Type Indicator©) divides one's personality into 16 types, each with a four-letter abbreviation that represents each personality preference such as the following:

	<b>S</b> ensing		<b>i</b> Ntuition		
<b>I</b> ntroversion	<b>I</b> STJ	<b>I</b> SFJ	<b>I</b> NFJ	<b>I</b> NTJ	<b>J</b> udgment
	IS <b>T</b> P	IS <b>F</b> P	IN <b>F</b> P	IN <b>T</b> P	<b>P</b> erception
<b>E</b> xtraversion	<b>E</b> STP	<b>E</b> SFP	<b>E</b> NFP	<b>E</b> ntp	
	ES <b>T</b> J	ES <b>F</b> J	EN <b>F</b> J	EN <b>T</b> J	<b>J</b> udgment
	<b>T</b> hinking	<b>F</b> eeling		<b>T</b> hinking	

The goal of MBTI is to find out about one's personality type, to learn, to understand and to appreciate differences between people since as all types are equal, there is no type better over another. The MBTI instrument sorts for preferences, it neither measure a person's trait, ability, nor character.

Recently, researchers believe that personality is organized around five basic factor and these five factors is known is the "five factor" theory. (Wiggins and Trapnell, 1997) Here, the traits of personality are divided into 5 different kinds; in psychology they are called the Big Five. Big Five is the classification of a person's personality into these five categories:

1) *Neuroticism*– People who have an easier tendency to experience feelings such as anger, guilt, anxiety and depression. (Mathews & Dear, 1998) Subject respond poorly under stressful environment, have controlling urges and hopeless frustrations.

2) *Extraversion* – Also known as introvert and extrovert traits.

- Introverts tend to be very quiet, rather low-key and conscientious. They often prefer

solitary activities (such as reading and writing) rather than social activities (such as parties). Although introverts found more pleasurable to spend time alone, they do enjoy interactions with very small group of friends.

- Extroverts tend to enjoy human interaction. They are often very enthusiastic, outgoing, assertive and talkative. They take pleasure in social gathering and group activities.

3) *Agreeableness* – This trait is typically considered as super-ordinate, meaning this is a group of people with specific personality traits that are statistically cluster together. Agreeable individuals tend to be very optimistic and get along well with others. They are often friendly, considerate, generous and willing to compromise their interests for others.

4) *Conscientiousness* – People who have this trait are more likely to have the quality of being very cautious and careful. They are generally very and they have the tendency to think carefully before acting.

5) *Openness to experience* – Sometime is called Intellect/Imagination. This dimension includes having wide interests, and being imaginative and insightful. Their traits are usually tough-minded, open to new ideas, curious, creative and have great imaginations.

Although the trait approach has gained wide acceptance, even at times, dominate contemporary research in personality. There are several problems and weakness associates with this approach. (Bernstein, 1999) The traits approach seems to be aiming at describing a person instead of understanding them. For instance, a person is hostile towards other people because of her natural aggressive traits, but other factors, such as her reaction towards an offensive person, could be just a cause and effect. In short, trait

theories say a lot about *how* people behave, but they don't always explain *why* they behave the way they do. (Pervin, 1996) This is a flaw in trait approach for it doesn't put a person's thoughts and feelings into account when a person behaves in certain way. Therefore, even if the Big Five is a correct universal classification of one's personality, its factors are not always accurate since situations affect behavior.

## ***Woodcock–Johnson III***

This entire project examining the intelligence–personality relationship would be impossible without the access to the training and material necessary to administer the Woodcock Johnson III cognitive assessment battery as a definitive measure of intelligence. The Woodcock Johnson III is considered one of the most detailed and accurate batteries for assessing an individual’s cognitive abilities available today. Some of its advocates call it the most advanced method of cognitive assessment available in the area of intelligence testing available today. The Woodcock Johnson III batteries are based upon the CHC or Cattell–Horn–Carroll theory of cognitive abilities.

The CHC theory is a fusion of two separate bodies of research. The first of the two grounded theories is based upon the “psychometric factor–analytic studies” conducted by Raymond Cattell and John Horn. The Cattell and Horn theory is generally known as the Gf–Gc theory or fluid intelligence and crystallized intelligence mentioned previously. While Cattell is responsible for the study of the fluid and crystallized intelligences, John Horn’s research discovered that there are other broad cognitive abilities termed short–term memory (Gsm), long–term retrieval (Glr), processing speed (Gs), and visual spatial thinking (Gv). With the help of Lazar Stankov, a fifth ability, that of auditory processing (Ga), joined the group. The discovery of these seven cognitive abilities led to the development of the WJ–R *Test of Cognitive Abilities* in 1989. Soon afterwards, two additional abilities called quantitative ability (Gq) and reading–writing ability or (Grw) joined the group completing the Cattell and Horn theory (Fig 1. Appendix A)<sup>16</sup>.

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<sup>16</sup> (Flanagan, Dawn, 2001)



The second of the two theories is established on the basis of “extant factor-analytic research” by John Carroll and is called Carroll’s three-stratum theory of cognitive abilities. Analyzing data recovered from the 1920s and data collected using the first Woodcock–Johnson Psycho–Educational Battery released in 1977, Carroll concluded that human cognitive abilities could be explained hierarchically. Carroll discovered that there are actually sixty-nine specific human cognitive abilities. He categorized these sixty-nine narrow abilities as Stratum I. The narrow abilities in Stratum I are branches from broader categories of cognitive abilities categorized as Stratum II. Finally, the broader cognitive abilities are branches of the General factor of General Intelligence discussed several times previously (*g*), which he called Stratum III (Fig. 2 Appendix A)<sup>17</sup>.

The combination of the two theories into the CHC theory of cognitive abilities is justified due to the great similarities between them. For instance it is evident that the Stratum II abilities identified by Carroll are analogous to the Gf–Gc factors of Cattell and Horn.

“The Cattell–Horn model, as summarized by Horn (1985, 1988), is a true hierarchical model covering all major domains of intellectual functioning. Numerous details remain to be filled in through further research, but among available models it appears to offer the most well–founded and reasonable approach to an acceptable theory of the structure of cognitive abilities.”<sup>18</sup>

The latest WJ III battery is designed to assess an individual’s abilities as conceptualized by the CHC model (Fig. 3 Appendix A). The WJ III is exceptionally good and is designed for assessing the Stratum II category of the CHC model, as it gives a more general assessment thus providing greater stability and validity. The WJ III assesses seven of the nine CHC factors (Fig. 4 Appendix A).

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<sup>17</sup> (Flanagan, Dawn, 2001)

<sup>18</sup> (Flanagan, Dawn, 2001)

## ***Thorough Descriptions of the WJ III Tests***

The following are the descriptions (as stated by Nancy Mather and Richard W. Woodcock) from the Woodcock–Johnson III Tests of Cognitive Abilities Examiner’s Manual on the individual WJ III battery tests performed for the research project.

**Test 1: Verbal Comprehension** includes four subtests: Picture vocabulary, Synonyms, Antonyms, and Verbal Analogies. Each subset measures a different aspect of language development in spoken English language, such as knowledge of vocabulary or the ability to reason using lexical (word) knowledge.

Picture Vocabulary measures aspects of lexical knowledge. The task requires the person to identify pictures of familiar and unfamiliar objects. The beginning items require only a pointing response to pictures of common objects. For the remaining items, the subject names the pictures orally. The items become increasingly difficult as the selected pictures appear less frequently in the environment or represent less familiar concepts.

Synonyms measure an aspect of vocabulary knowledge. The task requires hearing a word and then providing a synonym.

Antonyms measure a counterpart aspect of vocabulary knowledge. The task requires hearing a word and then providing an antonym.

Verbal Analogies measure the subject’s ability to reason using lexical knowledge. The task requires listening to three words of an analogy and then completing the analogy with an appropriate fourth word.

Verbal Comprehension is a measure of acquired knowledge (*Gc*).

**Test 2: Visual–Auditory Learning** is a test of long–term storage and retrieval (*Glr*). This thinking ability test requires the subject to learn, store, and retrieve a series of

visual–auditory associations. On this test of associative and meaningful memory, the subject is asked to learn and recall rebuses (pictographic representations of words).

**Test 3: Spatial Relations** is a test of visual–spatial thinking (*Gv*). This visualization–of–spatial relationships task requires the subject to identify the two or three pieces that form a complete target shape. The difficulty increases as the drawings of the pieces are flipped, rotated, and become more similar in appearance.

**Test 4: Sound Blending** is an auditory processing test (*Ga*). This test of phonetic coding measures skill in synthesizing language sounds (phonemes). The subject listens to a series of syllables or phonemes and then is asked to blend the sounds into a word.

**Test 5: Concept Formation** is a test of fluid reasoning (*Gf*). This controlled–learning task involves categorical reasoning based on principles of inductive logic. This test also measures an aspect of executive processing–flexibility in thinking when required to shift one’s mental set frequently.

Unlike some concept formation tasks that require a subject to remember what has happened over a series of items, this test does not include a memory component. The subject is presented with a complete stimulus set from which to derive the rule for each item. With the exception of the last items, the subject is given immediate feedback regarding the correctness of each response before a new item is presented.

**Test 6: Visual Matching** is a test of processing speed (*Gs*). More specifically, it is a measure of perceptual speed. This task measures an aspect of cognitive efficiency–the speed at which an individual can make visual symbol discriminations.

There are two different versions of this test. The first version, Visual Matching 1, is designed for use with preschool children and individual who have developmental delays or reduced functioning. The second version, Visual Matching 2, is designed for

individuals above the developmental level of an average 5-year-old. On this section, the subject is asked to locate and circle the two identical numbers in a row of six numbers. This task proceeds in difficulty from single-digit numbers to triple-digit numbers and has a 3-minute time limit.

**Test 7: Numbers Reversed** is a test of short-term memory (*Gsm*). Although this test primarily measures short-term memory span, it can also be classified as a measure of working memory or attentional capacity. The test requires the individual to hold a span of numbers in immediate awareness (memory) while performing a mental operation on it (reversing the sequence).

**Test 11: General Information** measures an aspect of comprehension-knowledge (*Gc*). Specifically the test measures the depth of one's general verbal knowledge. This test consists of two subtests. In the first subtest, the subject is asked, "Where would you find ... (an object)?" In the second subtest, the subject is asked, "What would you do with ... (an object)?" The initial items involve objects that appear commonly in a person's environment. The items become increasingly difficult as the selected objects become more unusual.

**Test 12: Retrieval Fluency** measures an aspect of long-term retrieval (*Glr*). This test measures fluency of retrieval from stored knowledge. The subject is required to name as many examples as possible from a given category within a 1-minute time period. The task consists of three different categories: things to eat or drink, first names of people, and animals. Carroll (1993) calls this ability ideational fluency.

**Test 13: Picture Recognition** measures the visual memory of objects or pictures, an aspect of visual-spatial thinking (*Gv*). The subject's task is to recognize a subset of previously presented pictures within a field of distracting pictures. To eliminate the

mediation as a memory strategy, varieties of the same type of object are used as the stimuli and distractors for each item (e.g., several different bowls or several different windows). The difficulty of the items increases as the number of pictures in the stimulus set increases.

**Test 14: Auditory Attention** measures an aspect of speech–sound discrimination—the ability to overcome the effects of auditory distortion or masking in understanding oral language. This is a narrow auditory processing (*Ga*) ability requiring selective attention. The subject listens to a word, while seeing four pictures, and is asked to point to the correct picture for the word. The task increases in difficulty in two ways: the sound discriminations become increasingly difficult and added background noise increases in intensity.

**Test 15: Analysis–Synthesis** is a test of fluid reasoning (*Gf*). Specifically, the test measures general sequential (deductive) reasoning, a thinking ability. The test is a controlled learning task and is designed to measure the ability to reason and draw conclusions from given conditions. The subject is given instructions on how to perform an increasingly complex procedure. With the exception of the last items, the subject is given immediate feedback regarding the correctness of each response before a new item is presented. Although this is not pointed out to the subject, the task involves learning a miniature system of mathematics. The test also contains some of the features involved in using symbolic formulations in other fields, such as chemistry and logic.

**Test 16: Decision Speed** measures an aspect of processing speed (*Gs*)—the ability to make correct conceptual decisions quickly. Decision Speed is a test of cognitive efficiency that measures the speed of processing simple concepts. In each row, the subject’s task is to locate quickly the two pictures that are most similar conceptually. This test has a 3–minute time limit.

**Test 17: Memory for Words** measures short-term auditory memory span (*Gsm*). In this test, the subject is asked to repeat lists of unrelated words in the correct sequence.

## ***The MBTI, SAT and WJ III***

Numerous prior studies have been conducted which suggestive about the likely relationship between intelligence and personality traits. The most common method of analysis has included the studies of the relationship between students' GPAs, High School Grade Percentiles, SAT scores and PSAT scores against the MBTI types. Of all the studies conducted, the long-term study by Gerald D. Tharp at the University of Nebraska (1992) presents the most definitive correlations between the MBTI types and achievement performances. Tharp's analysis supports the theory that the two main personality dimensions that affect achievement are the S-N and J-P variables of the MBTI<sup>19</sup>.

Gerald D. Tharp has found that students with higher grades were usually of the I and J types while student with lower grades were of the E and P types. This relation is not a new finding but additional support for Melear's earlier finding that, "the EP students not only achieve the lowest, but are twice as likely to be the lowest achievers."<sup>20</sup>

Tharp also found that the SJ types were the students who had the highest grades followed by the ST types. The last two types in terms of grade average were the IN and IS.

Yet, studies conducted by psychologists, K. T. Schurr and V. Ruble (1988) indicate that students of the IN personality type are usually better prepared for college than the ES types. According to their analysis, the combination of the E-I and S-N indicators were most significantly related to SAT scores and High School Grade Percentiles. By contrast, the combination of the E-I and J-P dimensions produced

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<sup>19</sup> (Tharp, Gerald D., 1992)

<sup>20</sup> (Tharp, Gerald D., 1992)

indicators were more significantly related to achievement by any measure other than the SAT. Moreover, the “J–P scale is indicative of the personality characteristic that is most uniquely associated with college instructor’s evaluation of achievement.<sup>21</sup>” Based on these three findings, they concluded that college is much better suited for students of the J, N and I preferences while the students with the P, S, and E preferences do significantly worse on the academic side of college life, though they may excel in non academic pursuits or have unusual success later in life<sup>22</sup>.

Another source, the 1985 MBTI Manual developed by Isabel Myers Briggs, states that the S–N dimension was most correlated with standardized testing scores. “The pattern was clear. Standardized tests, especially in verbal sections, tend to favor intuitive types.<sup>23</sup>” McCaulley reinforces the theory that the S–N dimension is an indicator correlated with objective achievements with her research, which revealed that among students studying the sciences, IN types outnumber ES types. In the physical sciences, T’s outnumber F’s while F’s outnumber T’s in the behavioral sciences<sup>24</sup>.

A study of the distribution of MBTI personality types in the WPI class of 2004 showed that the most prevalent of the sixteen personality types was the IN combination defining their learning styles (Appendix B Fig. 1). The IN types were significantly more common than the ES types, thus corroborating McCauley’s claim about physical scientists in the MBTI Manual. In fact, all the MBTI data collected from incoming WPI freshmen from 1997 – 2002 (in the classes 2001 to 2006) indicate a much higher proportion of IN types than ES types (Appendix B Fig. 2). So the class of 2004 was probably typical of the WPI population over time. That would not be the case for the general population. The estimated personality frequencies for the United States as a

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<sup>21</sup> (Tharp, Gerald D., 1992)

<sup>22</sup> (Tharp, Gerald D., 1992)

<sup>23</sup> (Mather, N., & Woodcock, R.W., 2001)

<sup>24</sup> (Mather, N., & Woodcock, R.W., 2001)



whole clearly show that the ES types greatly outnumber the IN types (Appendix B Fig. 3). Indeed there are twice as many sensing as intuitive types in the general population.

In 1988, Gallagher concluded that students of the Thinking type achieve higher average scores on the SAT math section than the Feeling types classmates. McCauley and Kainz replicated this finding in 1974. When time limits are introduced into achievement testing situations, it was found that the Intuitive types have greater success than the Sensing types, and McCauley explains that “Sensing types often operate slowly in order to be sure, and Intuition is by definition a kind of perception that involves flashes of insight, hunches and quick perception through impressions.”<sup>25</sup>

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<sup>25</sup> (Mather, N., & Woodcock, R.W., 2001)

## ***The Current Study and Proposal for Future Studies***

Past research conducted on Worcester Public School classes of 1996–1999 populations by WPI students in the late 1990’s have not changed this general pattern; but the size of the differences in score (a 146 pt. “intuitive advantage” on the combined verbal and math score) was still surprising. The MBTI literature had depended heavily on college population SAT studies in which the variance in scores was smaller among those admitted to a given college than in a general high school population. So the original claim that the S–N dimension and the J–P dimensions are the most significant indicators of achievement, was again replicated. These findings were most clearly presented and developed in the IQP report of Ben Dean–Kawamura called “Practicing and Re-taking the SAT by MBTI Type.” The INP to ESJ average difference was nearly 250 points in the combined verbal and math scale, with the verbal difference a bit larger than those in math.

Though several studies have been conducted correlating aptitude and achievement test data to the MBTI, very little has been done to try to establish a relation between personality and intelligence using an IQ measure that reflects the multiple intelligence school of thought. The “IQ” measures used tend to be those developed in the period when “G” reigned supreme and the SAT was created incorporating that concept of intelligence. A more diversified set of scales combining into a composite I.Q. indicator such as the Woodcock–Johnson III Test of Cognitive Abilities allows one to ask different questions than a study using an I.Q. proxy measure, like the SAT. The initiative to describe the correlation pattern between the MBTI personality and the various intelligence scales in the WJ–3 came from James Creed. He convinced Professor John Wilkes to recruit a team of WPI students to do such a study in 2003. This first WPI team of six students managed to secure five Woodcock Johnson III Test of Cognitive

Abilities batteries to collect data and was trained in their use by Jim Creed. A major role of this project has been played by Mr. Jim Creed, who is responsible for training and certifying the members of the project team who are actually administering the WJ-3 test. His contacts in the school systems regularly using these test batteries were also expected to be important sources of data, but that has not proven to be the case.

This project actually had three phases using different strategies. Phase I consisted of data collection from WPI students of known MBTI type. These students were members of the class of 2006 and people who took classes in which Professor Wilkes used the MBTI. There were a total of thirty cases from phase I.

Phase II, once again, involved data collection in Worcester-Fitchburg area High Schools administering the MBTI to students who had already taken the WJ-3. However, this plan was not successful though tried in Worcester, Fitchburg and West Boylston. Only West Boylston ultimately cooperated and supplied data on fifteen student cases. Unfortunately the data administrations were incomplete and could not be used. In the schools educational psychologists are trying to understand specific problem areas and rarely administer the entire two to three hour battery of assessments.

Phase III, again, involved data collection from WPI students and Trinity College students (and friends and family members) administering both the MBTI and WJ-3 to cooperative subjects. Each case took approximately three hours to administer and this round of data collection by four people in a total team of six finally resulted in a total of 29 cases. Mary Brock, from the first wave study, returned to gather more data while Joyceline and Indraneel were trained to do their own administration<sup>26</sup>. The other three students specialized, one to do data organization, entry, scoring and analysis, one to

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<sup>26</sup> View Mary Brock's report for description on the training to administer the WJ-III

write, and one to gather data at Trinity College in a circle of friends associated with his fiancé. Cumulatively, there are a now total of 63 complete cases that can be used for analysis<sup>27</sup>.

Ironically, returning to the original seemingly laborious and inefficient plan, to focus on WJ-3 data collection from college students, mostly at WPI, was the ultimate key to success. Data collection was the major contribution of this team. However, at various points, it did not look like the training and certification would be completed in time to do this—and indeed the data collection effort ran late.

Thus, two other plans were considered. One was to do a study using a different I.Q. measure and take advantage of about 125 cases of existing MBTI data. However, a suitable I.Q. alternative that was no more complicated than the MBTI and could be group administered was very difficult to find.

The most convenient I.Q. test found was a trial exam produced by the Mensa Organization to allow people a chance to decide if taking the Mensa admission test would be worthwhile for them. At the moment, the steps necessary to acquire the use of the test from the Mensa Organization have yet to be carried out. Since SAT data had already been used as a proxy, Joyceline and Indraneel did not want to just reanalyze existing data on WPI students to complement the studies already done with High School students – unless SAT data could be gathered on students who had already taken the WJ-3 and MBTI. Unfortunately, most of the thirty WPI students who had previously taken the WJ-3 two years before had already graduated. So, to get their SAT scores WPI would have to release them from confidential files, and then we would have to send them the new IQ test. Only then would we have MBTI, SAT, WJ-3 and the new test in the same

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<sup>27</sup> View the combined report by Christopher Thein, Eric Twark and Nathan Rosenblad for details

data set. Even a comparison of the SAT to the WJ-3 would have been a worth study goal, but the logistics were so daunting that administering the WJ-3 looked more promising when it became a possibility.

Hence, the other backup plan became a literature review to put the MBTI and WJ-3 in the context of other personality and I.Q. measures and plan what the next study should look like, if it is to take advantage of the one-hundred students who have already taken the MBTI and are expected to still be on campus next year. Ideally, one wants to be able to understand the relationships between several measures of I.Q., assess the adequacy of the SAT as an I.Q. indicator, and find out how much of what one can learn from the WJ-3 one can get from the much easier to use Mensa or SAT measure. If there is a major MBTI to WJ-3 correlation that would also be a way to proxy the WJ-3 with the MBTI which can be a mass administered indicator, but analysis based on the first thirty cases gathered made that seem unlikely.

Before continuing, one should recognize what resources are available to utilize for any future study. AS of right now, sixty-three cases of mainly WPI students are available who have taken the MBTI and the WJ-3 assessments. About 1800 cases of students from the WPI classes of 2001 to 2003 are available with MBTI, GSCI, and SAT data in a database. Furthermore, the freshman year performance data is also available term by term for these students.

The second source of data comes from the 1400 cases of students from the WPI classes of 2004 to 2006, who have taken the MBTI and for whom SAT data from WPI archives could be obtained alongside four years of WPI performance data, and their consent to use this data that has already been obtained. Approximately 500 cases of WPI class of 2002 data with high school transcripts, SAT data, MBTI data, and GCSI data as well as the self-reported SAT and High School performance data has been compiled.

The five hundred cases obtained from the class of 2002 would allow one to assess the accuracy of the self-reported high school and SAT data compared to that obtained during the WPI admissions process.

Finally, 129 cases of MBTI data collected from current WPI students who took a class in which Professor Wilkes administered the MBTI can be retrieved from the newly created database. Most of the students can be contacted and those who graduate this year will be replaced by data collected in the same courses next year. Thus, this is very reliable pool of about 160 WPI students, expected to be available for the next few years.

Since most of the recent WPI MBTI cases have been organized into a database by Indraneel Sircar and are easily accessible, in principle, the Mensa and SAT data could be added to the data set. It could also be augmented as more students take courses in which the MBTI is used. The GCSI can be administered and asking the student to release their SAT scores can also be included in the process of building the database. The result would be a very comprehensive database consisting of student I.Q., personality and creativity indicator information. A study of the relationship between intuition, creativity (Remote Association) and intelligence would be possible. This study should tell us if personality and intelligence are correlated, and if so what parts of it are most related. Finally, one can address the question of whether preferences are built upon abilities. Once again, to conduct an effective study, one needs to organize the MBTI, SAT, and WJ-3 data all in one data set. Currently, the missing portion from the 63 cases in our present data set is the SAT and the short IQ test (possibly the Mensa), that would also be administered to the 100 current students for whom MBTI data was recently gathered in Professor Wilkes' classes.

With all these data, our ultimate goal should be to see if one can use the easily mass administered MBTI and an equally easily administered IQ test to help diagnose the

problems of students at risk of failing at WPI in the freshman year. One wants to make predictions about what people will struggle on overall, or in particular key courses that may prove difficult. Then having identified the typical problems, when an unexpected case appears, the WJ-3 can be administered to that student who, based on learning style, should not be struggling but is for another reason.

Essentially, the ultimate goal is to create a new generation student information system that can be used more effectively for aiding individuals with learning disabilities. However, the goal of the study next year would be to set the stage for this new generation student information system. One would do that by answering the question of whether one can substitute for the important parts of the WJ-3 with a simple, short, and mass administered I.Q. measure. To answer that question, the following has to be performed, systematically divided into five tasks.

#### Task 1:

Add to the existing WJ-3/MBTI database of WPI students (approximately 50 cases, once the Trinity College and family member cases are removed) the following data:

- WPI archive on self-reported SAT data
- GCSI data
- Mensa IQ Results
- WPI transcripts of Freshman year – course by course
- Another promising eight minute Cognitive measure (which I found while looking for an IQ measure) should be administered too.

Using the afore mentioned data, the questions that need to be addressed are:

1. Which WJ-3 scales correlate with WPI success in the first year overall and key courses?

2. What is the WJ-3 relationship to the Mensa (new IQ) measure, and GCSI?
3. Does the WJ-3 add anything once one has the MBTI, GCSI, Mensa and other cognitive IQ indicator?

Task 2:

Once it is known what WJ-3 scales are covered by the SAT verbal, SAT math, Mensa and the alternate cognitive measure, it must be decided what to administer to the 100 students still at WPI who took the MBTI already. Assume that only half an hour is available with them in a room of 20 to 30 students and that they will be gathered in four administration sessions. One can probably complete the Mensa and the new cognitive measure during this time and ask the students for permission to access SAT data from WPI, or acquire a self-report of it.

Task 3:

A quantitative (statistical) analysis must be performed to ascertain how close to having administered the “important parts” of the WJ-3 to thousands of students are you once you have the MBTI, GCSI, and SAT data, along with a few self-reported high school records in a database.

Task 4:

Another crucial question to be answered is would you be closer if it was the MBTI, SAT, and Mensa or the alternate cognitive indicator rather than the GCSI?

Task 5:

Based on the answer of to the question in task 4, if it seems valuable, try to set up a mass administration of an IQ test that can be done in 20 to 30 minutes to an incoming class of WPI students along with the MBTI.



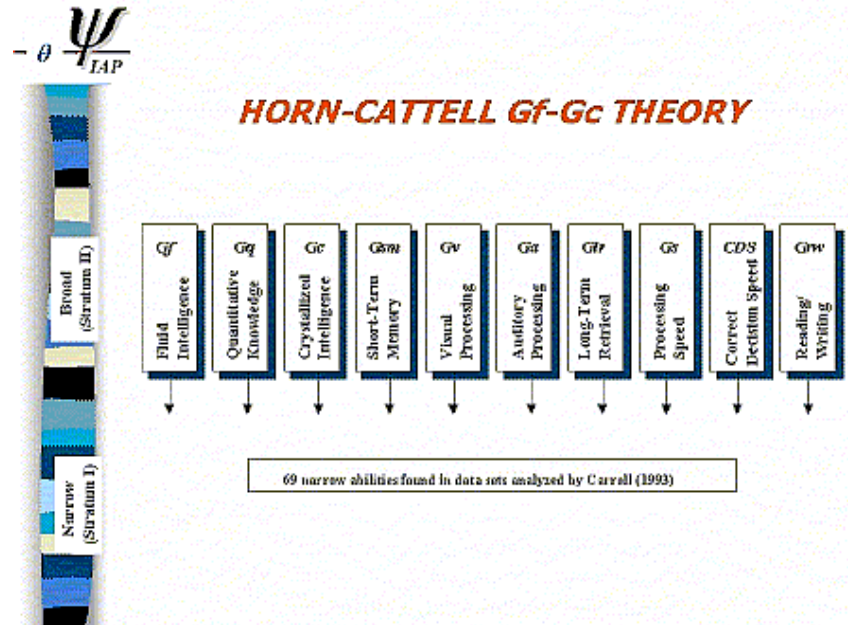
Otherwise, use the existing WPI archive of MBTI and SAT data to get an idea of the potential value of an ISIS system for a counselor such as Dale Snyder in the academic advising office who is working with a tough and unexpected case (not a motivation case or a typical struggle for a WPI student with the subject's learning style), and could refer them to the Counseling office for a psychologist to administer the WJ-3. The counselor would have the access to call up data on the SAT or go to the files and get a hardcopy of the high school records. She also has transcript access and can acquire NR grade patterns released by the registrar, which are not part of the online transcript (the online transcript includes only courses passed). The proposed study might lead to the development of one of the most advanced student disability guidance systems available today. The major flaw in the system is that it relies heavily on a very advanced student information database, so the logistics of setting it up are daunting.

In conclusion, the next study to be conducted at WPI should be an effort to realize the above goals. Firstly, the future group should collect the database from our current study of student MBTI and WJ-3 data. Upon acquiring the database, SAT and GCSI scores should be collected from as many of the listed subjects as possible and added to that dataset. Thirdly, the group's efforts should be geared towards finding an efficient but informative measure of I.Q, which should then be administered on all the subjects for whom the MBTI, WJ-3, SAT, and the GCSI scores are available. The accumulation of all the data will approximate (be a prototype of) the next generation student information database. Cross-analysis should be conducted of each of the measures against one another and then a comprehensive report should be produced on any and all correlations contributing to an understanding of the WJ-3 or WPI grade data. The published data will be a very effective handbook for anyone interested in the general relationships between the five different types of data, and the relationship between personality and the different measures of I.Q. In the handbook, the new and effective method of cognitive disability assessment should be intricately outlined.

Therefore, the next study is to create an advanced psychological information database and start to learn how to use the information for the very effective and comprehensive assessment of cognitive disabilities and learning challenges.

Appendix A

Figure 1

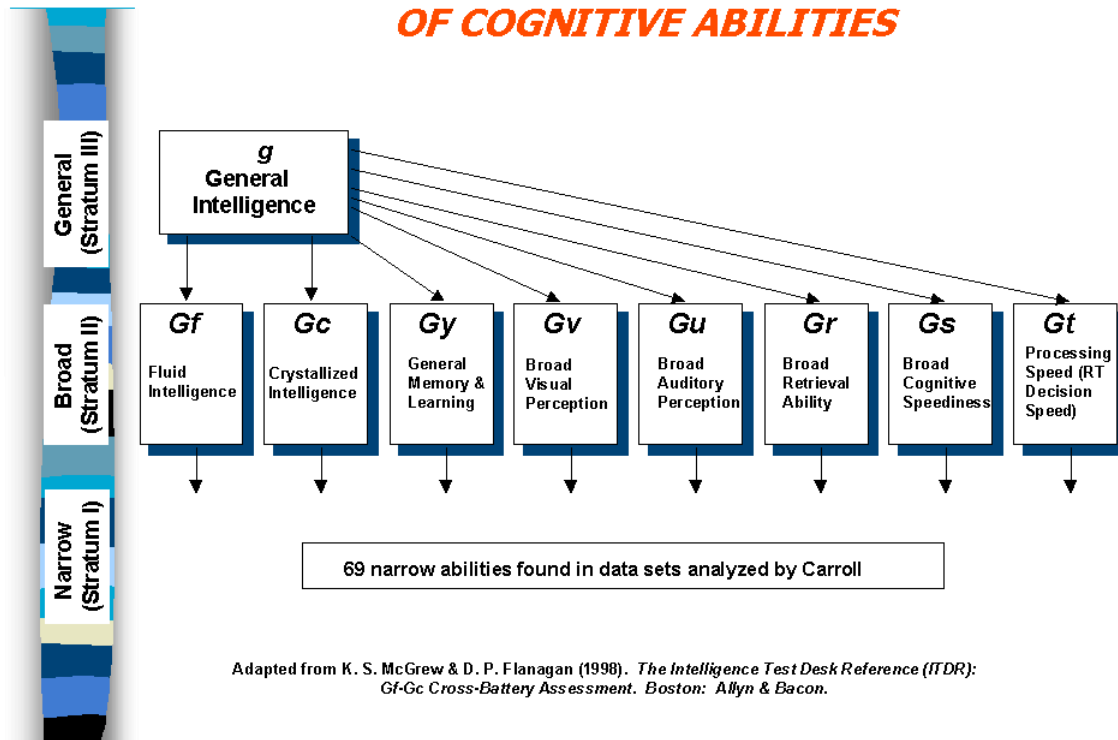


Courtesy of McGrew, K.S. and Flanagan, D.P.

Figure 2



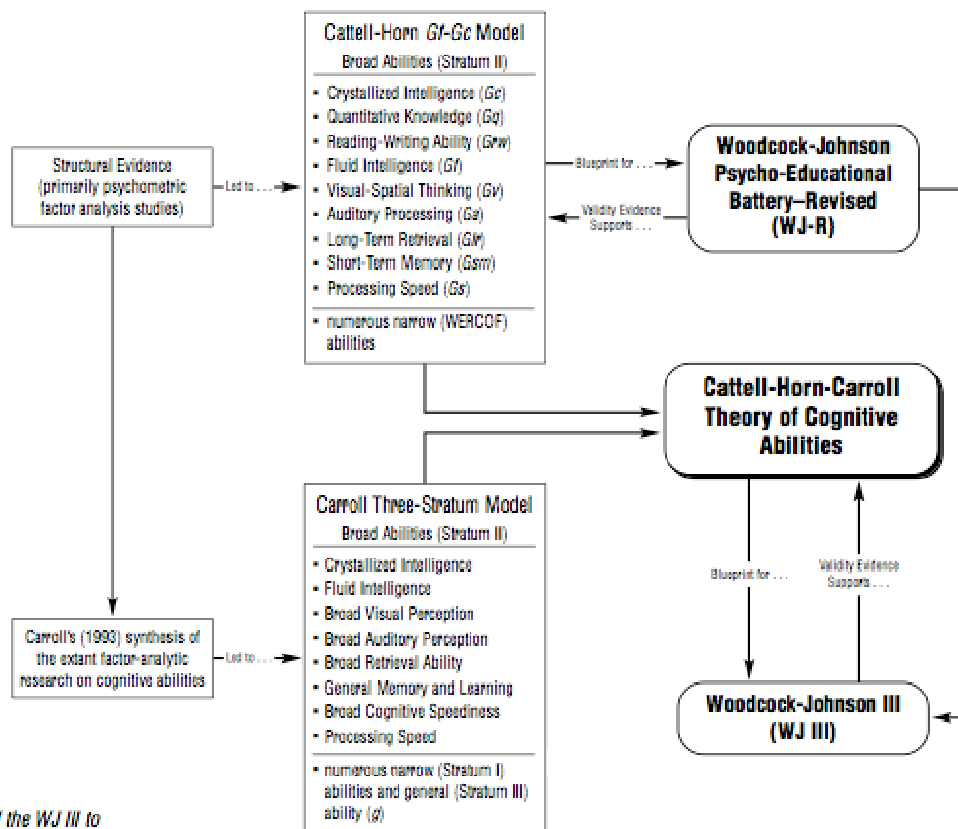
## CARROLL'S (1993) THREE-STRATUM THEORY OF COGNITIVE ABILITIES



Adapted from K. S. McGrew & D. P. Flanagan (1998). *The Intelligence Test Desk Reference (ITDR): Gf-Gc Cross-Battery Assessment*. Boston: Allyn & Bacon.

Courtesy of McGrew, K.S. and Flanagan, D.P.

**Figure 3**



*Relationship of the WJ III to CHC theory.*

Courtesy of McGrew, K.S. and Flanagan, D.P.

Figure 4

Selective Testing Table - Clusters

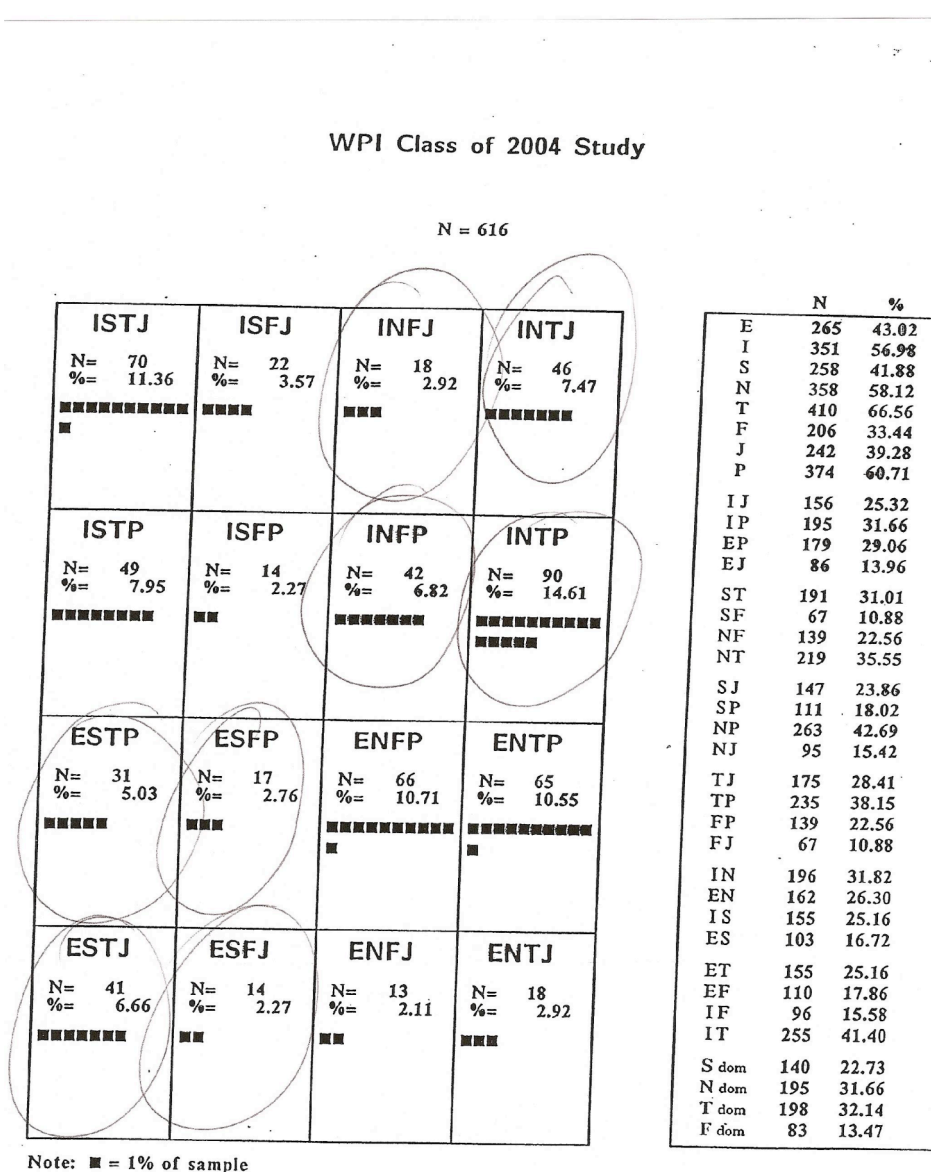
WJ III Tests of Cognitive Abilities

		Intellectual Ability		Cognitive Categories				CHC Factors				Clinical Clusters													
		Gen. Intell. Ability - Std	Gen. Intell. Ability - Ext	Brief Intellectual Ability	Verbal Ability - Std	Verbal Ability - Ext	Thinking Ability - Std	Thinking Ability - Ext	Cog. Efficiency - Std	Cog. Efficiency - Ext	Compreh. Knowl. (Gc)	Long-Term Retrieval (Glr)	Visual-Spatial Think (Gv)	Auditory Processing (Gp)	Fluid Reasoning (Gf)	Processing Speed (Gs)	Short-Term Mem. (Gsm)	Phonemic Awareness (Gsm)	Working Memory	Broad Attention	Cognitive Fluency	Executive Processes	Delayed Recall (note 1)	Knowledge (note 2)	
Standard Battery	1. Verbal Comprehension	◆	◆	◆	◆	◆				◆															
	2. Visual-Auditory Learning	◆	◆				◆	◆			◆														
	3. Spatial Relations	◆	◆				◆	◆			◆														
	4. Sound Blending	◆	◆				◆	◆				◆					◆								
	5. Concept Formation	◆	◆	◆			◆	◆					◆									◆			
	6. Visual Matching	◆	◆	◆					◆	◆					◆										
	7. Numbers Reversed	◆	◆						◆	◆						◆		◆	◆						
	8. Incomplete Words															◆									
	9. Auditory Working Mem.																◆	◆							
	10. Vis-Aud. Learn. - Delayed																						◆		
Extended Battery	11. General Information	◆		◆						◆														◆	
	12. Retrieval Fluency		◆				◆				◆										◆				
	13. Picture Recognition	◆					◆				◆														
	14. Auditory Attention	◆					◆					◆							◆						
	15. Analysis-Synthesis	◆					◆						◆												
	16. Decision Speed	◆							◆						◆						◆				
	17. Memory for Words	◆							◆							◆									
	18. Rapid Picture Naming																				◆				
	19. Planning																					◆			
	20. Pair Cancellation																		◆			◆			

Notes: (1) Also includes Test 12: Story Recall--Delayed from the WJ III Tests of Achievement; (2) Also includes Test 19: Academic Knowledge from the WJ III Tests of Achievement  
 © 2001, Riverside Publishing Company -- All Rights Reserved -- Source: WJ III Tests of Cognitive Abilities Examiner's Manual by N. Mather and R.W. Woodcock, code 9-23831, pg. 12

Courtesy of Mather, N. and Woodcock, R. W.

Figure 5



CAPT-MBTI Type Table - Group Code 7QI - Batch 9716 - j100269  
 Copyright 1987 Center for Applications of Psychological Type, Inc.

MBTI Distribution by Class Year (in Percents)  
Data Collected During Freshman Orientation

MBTI TYPE	CLASS OF 2001	CLASS OF 2002	CLASS OF 2003	CLASS OF 2004	CLASS OF 2005	CLASS OF 2006	6-YEAR MEAN
ISTJ	14	10	13	11	14	10	12
ISFJ	4	4	2	4	4	3	4
INFJ	3	4	2	3	3	1	3
INTJ	7	8	8	8	6	9	8
ISTP	8	8	7	8	9	8	8
ISFP	2	4	2	2	3	3	2
INFP	9	9	9	7	3	8	8
INTP	12	15	15	15	14	15	14
ESTP	5	5	5	5	5	6	5
ESFP	2	3	3	3	4	4	3
ENFP	7	8	9	11	7	12	10
ENTP	9	11	10	11	12	6	9
ESJT	6	5	5	7	5	6	6
ESFJ	3	2	2	2	2	2	2
ENFJ	3	2	3	2	2	3	2
ENTJ	5	3	4	3	5	4	4
TOTAL # OF CASES	545	602	625	616	404	470	3262

Figure 6



Estimated Frequencies of the Types in the United States Population

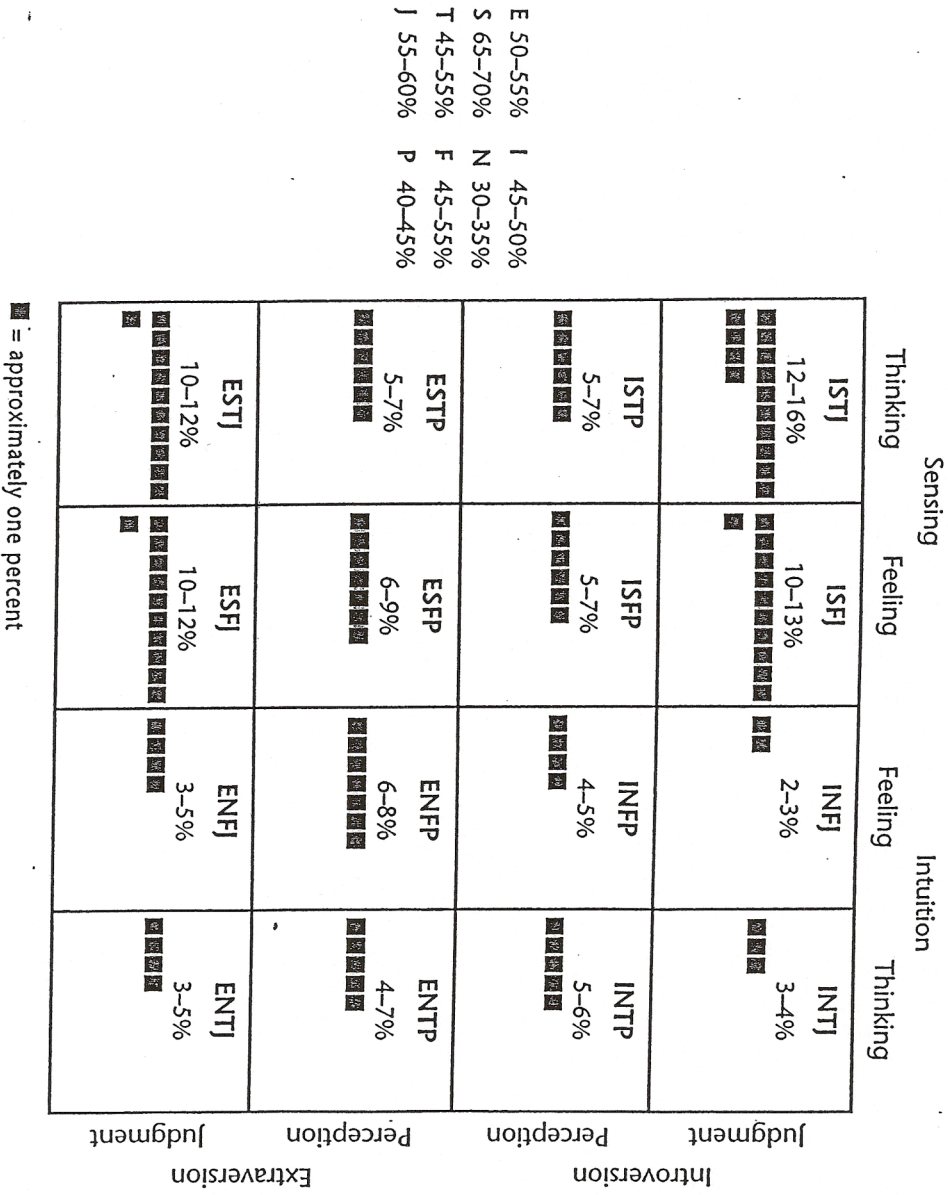


Figure 7

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