Business Comprehension Test

Introduction

Intelligence, the concept of intelligence and the effectiveness of intelligence measures have been at the center of psychological and other debates for decades. Over the past 20 years there has been a proliferation of intelligence measures, for the most part applicable and valid in their use.

In this regard OMT developed the Business Comprehension Test towards the latter part of the 1990s. Since then thousands of candidates have completed the assessment with great success. This document aims to provide more information on the rationale for development of the BCT, the approaches followed in the development and the different sub-scales. Please note that in this document we will refer to intelligence, mental, reasoning, cognition and other terms interchangeably for ease of use.

Why is Cognitive Functioning Important

It is widely accepted that the work employees perform within an organization requires a mental process. All work, particularly from work levels 2 to 7 involves some form of problem solving. The complexity of the problem solving increases with each successive work level. Considering the economic landscape of modern business, over the last century, the dynamic has shifted from essentially manufacturing and agriculture driven to mainly service driven. The major shift from blue collar to white-collar worker or knowledge workers, led to cognition becoming more critical in successful work performance. Yet, even manufacturing processes became far more complex, requiring higher levels of cognition. This in turn stimulated the need for effective cognitive tests.

The first form of psychological testing was in the arena of cognitive functioning: The Frenchman, Alfred Binet, was the first in 1905, developing the concepts of assessing cognition. Later, in 1916 Lewis Terman developed the Stanford-Binet IQ test for the USA. We can therefor argue that 1905 marked the birth of the concept of cognition and intelligence (some 100 years ago) and since then a number of other tests have been designed. Most of these tests can be classified as general intelligence test, applied to a wide range of applications. It is however in the last 10 to 20 years, that cognitive tests specific to the Industrial, Business and Organisational context were designed.

Intelligence and the concept of G

Intelligence tests are designed to measure different aspects of cognition. Specific domains assessed by tests

include mathematical skill, verbal fluency, spatial visualization and memory, among others. As an example a very common and widely used intelligence test, the Wechsler Intelligence Scale includes the following elements: Information Comprehension, Arithmetic, Similarities, Vocabulary, Letter-Number Sequencing, Coding-Digit Symbol, Picture Completion, Block Design, Picture Arrangement, Matrix Reasoning, Object Assembly, Symbol Search. Other intelligence tests like the SAT possess similar types of dimensions.

Intelligence consists of a number of constructs and the sub-tests measuring these can generally be divided into two categories: Verbal and non-verbal tests. Verbal tests use text and descriptions as the stimulus to problem solving, while non-verbal tests use non-verbal stimulus such as diagrams and pictures. Verbal reasoning will include constructs such as abstract reasoning, deductive reasoning, and memory, whilst non-verbal tests will measure constructs such as reaction speed, hand-eye coordination, two dimensional visual reasoning, three dimensional visual reasoning. Clearly, for a business environment, verbal reasoning tests are more applicable.

What is interesting is that research has found that individuals who excel at one type of test, tend to excel at other kinds of tests too, while those who do poorly on one type of test, tend to do so on all tests, regardless of the test's contents (Gottfredson 1998).

A lot of research has been done correlating the scores an individual achieved on the various sub-sets of Intelligence. For instance, correlating scores between deductive reasoning, special visual reasoning, memory, abstract reasoning and so forth. The findings were a very strong positive correlation between sub-tests.

When all correlations in a matrix are positive, as they are in the case of IQ, factor analysis will yield a general factor common to all tests. The general factor of IQ tests is referred to as the G factor, and it typically accounts for 40 to 50 percent of the variance in IQ test batteries (Mackintosh 2011). The G factor therefor refers to the mental process common in all sub-tests or sub components of IQ. When the scores of sub tests, for example, numerical reasoning, abstract reasoning, deductive reasoning are correlated, generally very high inter-dimension scores are obtained, indicating that all these different test in some way measure the same thing. This elusive "thing" is G or General Intelligence.

These findings have been replicated numerous times. The consistent finding of universally positive correlation matrices of mental test results (or the "positive manifold"), despite large differences in tests' contents, has been described as "arguably the most replicated result in all psychology" (Deary 2000).

Similar to Spearman, Arthur Jensen has maintained that all mental tasks tap into G to some degree. Jensen has argued that G cannot be described in terms of the item characteristics or information content of tests, pointing out that very dissimilar mental tasks may have nearly equal G loadings. He has hypothesized that G corresponds to individual differences in the speed or efficiency of the neural processes associated with mental abilities (Jensen 1998).

Rationale for the Business Comprehension Test

The BCT has been designed to take into account the modern world of work; IQ, intelligence or G are multi-facetted concepts. Typical intelligence measures like the SAT and Wechsler would include various forms of intelligence. As mentioned earlier, these may include verbal, numeric, deductive, fine motor, visual/spacial, memory, mechanical, hand-eye coordination etc. There are also "newer" forms of intelligence that have been identified and have emerged over the last decade. These include EQ, and more recently, concepts like spiritual intelligence.

But does that mean that these types of intelligence are equally important in the new world of work? Eye-hand coordination may be important for roles on the factory floor, or they may be important to a pilot or a truck driver, but to an individual in a white-collar environment, these intelligence constructs, while needed at a minimum level, are generally less important. Ponder for a moment the relative importance of a key concept of intelligence like memory. When was the last time you needed to remember 3 telephone numbers? When was the last time you needed to remember an address? With the proliferation of the Internet, cellphones, GPS devices, computers etc. the need to remember has become less important. You do not need to

remember a telephone number; you punch it into your phone. You do not need to remember when a meeting is taking place, because you can consult your Outlook Calendar. When is the last time that you calculated a complex numerical problem on a piece of paper? You use a calculator.

The requirement was to contextualize cognitive functioning or intelligence for the modern world of work.

Taking this into account we looked at all the types of intelligence and asked the following questions:

- Which of these forms of intelligence are most prevalent in the workplace?
- Which of these forms of intelligence would contribute the most to the concept of G?
- Which of these forms of intelligence would correlate with performance in the workplace? For example, having superior hand-eye coordination will not help me very much as a middle manager.
- Which of these forms of intelligence would correlate with job level? For example, visual-spacial or mechanical intelligence will not make me perform better at senior management level relative to junior management level.

Obviously, the more constructs of cognition are measured the better. However, which ones are the most critical for success in a business organization, or which ones can be combined in one test battery requiring completion time that will realistically be accepted within the commercial realities of a business organization?

To this end EvaleX identified 5 types of intelligence that match these criteria the best. They are Inductive/Abstract reasoning, Deductive Reasoning, Numeric Reasoning, Maturity, and Judgment.

More detail on these will be provided further on in this document.

The Issue of Context

The next question we posed ourselves was whether we need to develop an intelligence measure that is devoid of context, or should we develop a measure that is anchored in the business environment? An example of a measure devoid of context is typically a set of figures, that repeat, but each with a different angle, or applying a new rule. Please consider the following example below:

Which figure completes the series?

A   B   C   D
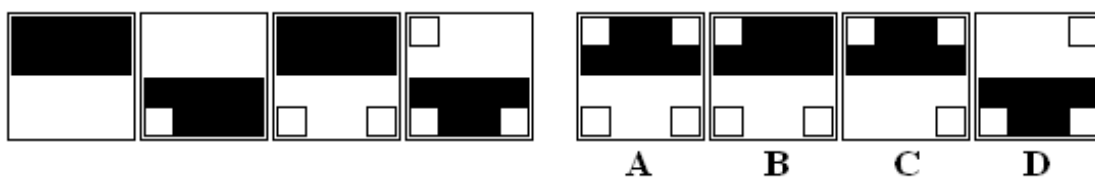
It was decided not to use this type of question, but rather use questions that are of a verbal nature and anchored in the business environment. There are a few reasons for this:

- Most people in the business world work with words and sentences. Problem presentation in a verbal form requiring them to deduct or induct or abstract an answer is more relevant and a better simulation of what they really do. Human rights oriented individuals may argue that a test using diagrams etc. as in visual reasoning, have no relationship to the job content and therefor invalid, unless it is a specific technical position requiring such a skill.
- When the candidate is doing the assessment you have very little face validity. She/he will struggle to understand what you are trying to test or the relevance of the questions.
- It is unclear what you are trying to assess in the example above. Is it inductive reasoning, is it deductive reasoning, is it pattern completion or is it visual-spatial reasoning?
- Ideally the test should be anchored in the context within which the person will be functioning. For example, if we were to assess your memory, does it not make sense to give you terms to remember

that are anchored in the business environment, rather than to give you a test to remember engineering formulas? You are assessing the person and their reasoning in the business environment, so why not anchor it in the business environment, as it will be more relevant?

You do find some proponents in the field that argue against this way of thinking. They propose that one should rather measure the ability to reason with "clean" data, devoid of context.

Their hypothesis is that if you can reason, you can learn, and if you can learn, then you have potential to fulfill the job. We actually agree with this hypothesis, but it is sometimes devoid of the context in the new world of work. Consider the following thoughts:

- You have the option of two candidates; both have a degree in business. Both have 3 years' experience. Which one would you choose? The one that can assimilate and reason with information anchored in the business environment, or the one that can reason in the graphical example above? You would probably go for the one anchored in the business environment for the simple reason that this candidate will hit the road running. They have already proven and already exhibited the behavior required to succeed within the business environment.

- Until the 90's, most intelligence or reasoning tests were developed for a clinical, academic or educational environment and businesses did not yet use them in large scale. What is clear when you look at the tests of cognition of that time, is that they tended to either assess intelligence in a broader context (e.g. SAT) or they focused on specific elements (like School Readiness). Over the past two decades, assessment providers have been developing intelligence measures specifically for the work environment. If you actually do the reasoning tests of the world's largest assessment providers you will notice that every single one anchors their assessment in the business environment (save for their abstract reasoning construct). One provider actually calls their measure of cognition a Business Inventory.

- Research by Hattrup et al. (1992), analyzing the equivalence of constructs in job specific versus non-job specific tests made the following comment: "nearly any randomly chosen pair of tests might exhibit some degree of parallelism." They found that from a structural perspective there is no significant difference between job specific and traditional measures of intelligence.

The principles according to which the BCT was designed had two major implications:

- The first, that the forms of cognition to be assessed must be those critical in job performance within a business organization. Five specific reasoning processes were identified and included in the test.

- The second was that each question within each sub-test must tap a reasoning process that is important for functioning in a business organisation, but not dependent on experience or knowledge there-of.

Based on the above arguments and research EICM set about developing the BCT.

Elements of the Business Comprehension Test.

In developing the BCT we considered which elements of intelligence would support the following criteria:

- High loadings on the G factor. Research has indicated that the highest loadings are acquired from inductive, deductive and numeric reasoning.
- Elements that have applicability to the world of work and would correlate with performance and job level.
- Elements that require the individual to apply judgment to situations.

Based on these criteria EICM identified 5 elements:

Deductive reasoning

Deductive reasoning is the ability to form logical conclusions from a set of facts. It is the ability to look at a set of data, deduct or conclude a rule, pattern or trend and then to apply that rule. Studying a set of data or circumstances or events, discerning the underlying pattern and extrapolating that pattern into the future, predicting future results is an inherent process in most positions in a business organisation. almost all positions require some level of this cognitive process.

Those that measure high on this construct will exhibit a sound ability to reduce data to deductions and conclusions for problem solving. Those measuring low on this construct will find it difficult deducting a pattern in a sequence of events for problem solving.

In its most basic form it would conclude the following: If A=B and B=C, then A=C. Deductive Reasoning is very important in learning, planning and critical analysis. Most intelligence tests call this type of reasoning critical thinking.

An example of Deductive reasoning in the BCT:

Africa's biggest generic drug maker ABC Pharmaceuticals has clinched a licensing and distribution deal with pharmaceutical giant PharmaAf that will see its products enter a host of new markets. The venture builds on ABCs strategy to expand its international interests. You can conclude that:

a.   ABC currently has no international interests;
b.   ABCs main operation is manufacturing and not distribution;
c.   ABC currently does not distribute its own products;
d.   PharmaAf also produces generic drugs;
e.   ABC bought PharmaAf.

Inductive / Abstract reasoning

Inductive reasoning is the ability to think in parallel, see relationships, generalize data, make associations and abstract information. It is often closely linked to abstract reasoning, strategic thinking and a person's ability to learn.

In a business organisation one of the most critical situations for any staff member to deal with is "problem solving". The ability to register issues and events, discern their relationships and intersections and to conclude an underlying cause. Similarity, or dynamic is deemed to be critical in most positions as determinants of work performance and success.

The nature of the questions asked assesses the ability to study three or four objects or constructs and to conclude a common denominator at the next level of abstraction; from concrete/object to concept/universe. It requires an ability to abstract rules, principles and solutions from the relationship observed between objects and events.

Those that measure high on this construct will exhibit a sound ability to conceptualise new rules and approaches from problems and experiences. Those measuring low will find it difficult to abstract rules and learning from problems and situations.

An example Abstract Reasoning question in the BCT is:

Protective clothing is to health, as insurance is to:

a. Receiving a payout;
b. Managing risk;
c. Insurance policy;
d. Car and home;
e. Factory and office.

Please note that in the BCT we are assessing inductive reasoning, which is the twin of deductive reasoning. They use the same reasoning process, just in a different direction. We interpret abstraction to be the ability to abstract data, see relationships and generalize. We **do not** use the term abstract in the context of dealing with something being new, or unknown.

Many reasoning tests equate Inductive Reasoning to Abstract Reasoning. Furthermore they equate the concept of abstraction to dealing with uncommon concepts. Let us consider the following abstract reasoning example for a different intelligence measure.
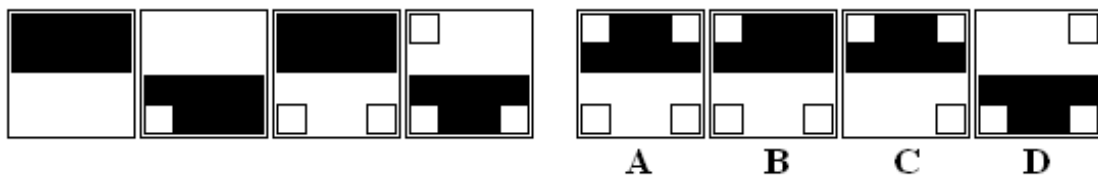
The thinking in the example above is that if you can reason with the pattern in the figures then you should be able to think abstractly. In other words you can deal with unfamiliar information or data. Furthermore, the thinking is that as you are not dealing with words but with figures, then you have the ability to deal with abstract concepts.

If however you consider the above example, you will notice that you are not tapping into the construct of abstract/inductive reasoning. What you are doing is tapping into the construct of visual/spatial reasoning. Combined with deductive reasoning, you are not abstracting, you are actually deducing or concluding. In other such items the test developer also adds additional complexity by using three-dimensional figures. If this is the case you also start measuring visual/spatial and depth reasoning. It is interesting that research has actually proven that men have better depth perception than women. If you are using a 3-D model in your question then you will be introducing bias.

Furthermore, if you are familiar with SST theory, then it is clear that a figure like the example above is tapping into accumulative and serial processing. It is not tapping into parallel processing, therefore the reasoning process one is using is actually not as abstract as we think it is and we are actually dealing with deduction.

Numeric Reasoning:

Numeric reasoning is the ability to reason with numerical data. Many theorists believe that numeric reasoning is the purest form of intelligence. In fact research indicates that it often accounts for one of the highest loadings on G. Numeric reasoning is used in almost all walks of life.

Those that measure high on this construct will exhibit a sound ability to do basic calculations and reason with numerical data. Those measuring low will find it difficult to do basic arithmetic or to think critically where numbers and figures are involved.

An example of Numeric Reasoning in the BCT:

Motor vehicle sales of brand A were higher than for brand B during this year. Last year's figures were 200 units for brand A and 210 for brand B. Brand B sold 220 this year:

a. Brand A sold more than 220 units last year;
b. Brand B sold 200 units last year;

c. Brand A sold more than 220 units this year;
d. Brand B sold 210 units this year;
e. I do not know.

Contextual Reasoning

Contextual reasoning is a construct the BCT has been measuring for many years. Recently it has become popular under the term of Situational Judgment Tests (SJT). In essence what it assesses is the degree of judgment a person exhibits.

Contextual reasoning is a situational judgment test, where a specific problem scenario is described and the candidate needs to fashion an appropriate response to the situation. What it measures is whether the response is in relation to, or in context with the problem, hence the construct name Contextual reasoning.

Judgment, which means evaluating a situation and responding in context to the situation, is another key determinant of work success and effective integration within a business organisation.

Those that measure high on this construct will exhibit a sound ability to design and fashion solutions to problems that is in context with the dilemma presented. Their decisions will generally be evaluated as good judgment. Those measuring low will find it difficult to design appropriate solutions to problems and their decisions will generally be viewed as bad judgment, as the response does not appropriately address the problem. It is out of context to the problem.

An example of Contextual Reasoning in the BCT:

Sophia became one of two partners in a business with a good concept, but running at a loss. She invested a large sum of money to finance the business and received shareholding in return. After one year, the business still runs at a loss and all the funds she invested have been exhausted financing the losses. Sophia should:

a. Pull out of the business and demand her cash back;
b. Find more funds to put into the business;
c. Take legal action against her partner for fraud;
d. Ensure a proper business turnaround plan is in place;
e. Find additional shareholders to fund the business.

Assimilated Understanding

For an individual to successfully and effectively function within a business organisation one of the determinants is to understand what behaviours and values lead to success. In understanding this, the assumption is that the individual will exhibit these behaviours and live according to these values.

Assimilated understanding is a measure of maturity and emotional intelligence. Some people tend to look at the world with a higher sense of maturity and can judge which factors make people successful; which factors create success; which situations to avoid and which situations to take on. This part of the assessment measures this maturity.

To assess assimilated understanding, the questions asked require the candidate to evaluate possible drivers of work and organisational success and to indicate the correct ones. It therefore assesses a level of maturity in the assimilation or adoption of the correct understanding of what drives success.

Those that measure high on this construct will exhibit a level of maturity in terms of what is required to be successful. Those measuring low will find it difficult to engage in the behaviours that lead to success.

An example of a question assessing assimilated understanding:

Most clients who do not buy a company's services and products do so because the products and services:

    a.   Are of a lower quality;
    b.   Are not value for money;
    c.   Do not exactly satisfy their needs ;
    d.   Are not well advertised or marketed;
    e.   Are too expensive.

Conclusion

The Business Comprehension Test measures 5 constructs of cognition and intelligence that are critical to successful performance in a business organisation in one integrated assessment session, presented via the Internet, that takes approximately one hour to complete..

Research studies including just over 50 high/low studies (comparing high performers with low performers in 50 specific job types) confirm the BCT's ability to differentiate between low and high performers.

Research into the different levels of work yielded the following: Averaging the scores of employees functioning successfully at different levels of work (sustained high performance at that level over a period of time) indicated that each successive level of work, from levels 1 to 6, achieved an ever increasing score on the BCT. In other words, there exists a strong, significant correlation between position level and BCT score.

Benchmarks have been determined in this manner, so an individual's score on the BCT can be used to match him/her to a particular work level. This proves the BCT's ability to assess potential or talent in the sense of a prediction, at which level of work somebody can function.

The BCT measures constructs related to G, anchored in the business environment and have shown to have high levels of reliability and validity.

The BCT has over 30,000 individuals in the data base from more than 1,500 different organisations/companies, from more than 30 countries, covering work levels 1 to 6.

The BCT was developed by EvaleX Intellectual Capital Management and is distributed through Organisation and Management Technologies and Deloitte SA.