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# The Test Room to Measure the Cognitive Functions of the Brain

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***Abstract:*** **This paper shows the diagnostic benefits of using the Test Room to Measure the Cognitive Functions of the Brain (TRMCFB). This patent was obtained on 31 Aug 2015; number 4304, from King Abdulaziz City for Science and Technology (KACST) in Riyadh, Saudi Arabia. This patent is an evaluation mechanic-technology to assess certain brain functions and psychological conditions and disorders through a number of different tests; e.g. mathematics, geometric shapes, discrimination dimensions, logical thinking, visual IQ, imagination test through images, forms arrangement, colour, fine motor skills, motor balance, motor coordination, visual-motor integration, wording, literature, art, recalling, short-term memory, long-term memory, comprehension, perception, ordering, analysis, composition, emotion, response speed, identify tones and, finally, a sounds test. The inventor, who is also a psychotherapist, did not find a single tool that was able to test a large number of brain functions and psychological disorders simultaneously and in a single mechanism. Most of the existing tests examine the brain functions and the cognitive abilities orally, whereas the existing medical devices such as the Magnetic Resonance Imaging (MRI) or the functional Magnetic Resonance Imaging (fMRI) examine a limited number of brain functions. The current patent (TRMCFB) would solve such problems by displaying a number of tests and questions that measure a large number of brain functions, cognitive abilities, and psychological conditions and disorders. In addition, the results of the tests displayed by the TRMCFB can be used for different purposes such as in selection for a certain educational field or professional position, to diagnose a psychological disorder, or simply to evaluate the brain abilities and capabilities.**

***Keywords:*** **Patent, Invention, TRMCFB, Brain Functions, Mental Abilities, Cognitive Abilities, IQ Tests, Psychological Disorders, Psychometric, Client, Observer.**

## 1. INTRODUCTION

Psychometric is one of the psychology sub-fields, which is essentially "the construction and application of psychological tests; mental measurement" (Colman, 2015, p. 617). These tests can be used to measure the mental functions, cognitive functions, and the psychological conditions and/or disorders. The results of these tests can be used for a number of purposes such as deciding which field a person should study at university (Di Leo, Alivernini & Lucidi, 2015), deciding which professional area they should pursue (Nasab et al., 2015), deciding which applicants should be accepted or selected for a certain educational field or professional position (Miller, 1999; Beller, 2001; Lievens, Reeve & Heggestad, 2007; Furnham, 2008; Zysberg, Levy & Zisberg, 2011), or simply to check a person's mental and cognitive abilities and capabilities (Rasmussen, Jeppesen & Sabroe, 1993; Deary, 2000). Although there are medical technologies and devices that target the measurement of the brain functions such as the Magnetic Resonance Imaging (MRI) – a medical imaging technique that is used to capture the anatomy and the physiological processes of the body and brain (Glassman, 2010; Malattia, 2014); and the functional Magnetic Resonance Imaging (fMRI) – an advanced medical imaging technique that measures brain activity and functioning (Huettel, Song & McCarthy, 2009; Shah et al., 2010; Voos & Pelphrey, 2013) – these technologies do not measure all brain functions or IQ like the mathematics and visual IQ tests. What's more, the MRI and fMRI are also expensive to use (Kim & Ugurbil, 1997; Barbé, Van Moer & Lauwers, 2011). As a result, an average person will not be able to test his/her brain functions, nor will an organisation be able use these devices with a large number of candidates for selection purposes.

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Therefore, in recent years, the need to use medical technology – specifically in the field of psychometrics – has emerged and increased (Cipresso et al., 2015). Historically, the German psychologist Wilhelm Wundt (1832-1920) – considered the pioneer of the experimental psychology (a psychology sub-field that links to developing interventions and measuring and evaluating the effect of these interventions) and who wrote one of the most important books in the field 'Principles of Physiological Psychology' in 1874 – established the first laboratory ever to be exclusively devoted to psychological studies at the University of Leipzig, Germany (Rappard, Sanders & De Swart, 1980; Nicolas & Ferrand, 1999; Schacter, Gilbert & Wegner, 2008; Wassmann, 2009). Since then, a number of psychologists and technological experts have conducted a number of psychological experiments and developed a number of inventions for human and animal psychology (Greenwood, 2003). Nevertheless, there are still many gaps in the body of knowledge specifically in the field of psychometrics and especially in the Arab world where a lot of psychometric measures and scales were, and still are, based on the traditional process of pen-and-paper tests (Aroian et al., 2008). Highlighting that the main purpose of psychometrics is to diagnosis, besides the brain functions and cognitive abilities, psychological disorders - and any mistake in this diagnosis will certainly lead to choosing the wrong treatment(s) and/or medication(s) (Crinella & Yu, 1999; Furr & Bacharach, 2014). Measuring the brain functions and/or psychological disorders is not an easy task because of the possible high relativity in decision-making when measuring the human abilities, and because of the large measurement margin error of such a process. As a result of this, an inventor – also a psychotherapist – decided to create an invention that would fill in this gap within the field of psychometrics and produced a Test Room to Measure the Cognitive Functions of the Brain (TRMCFB). The TRMCFB can be used to measure the brain functions, cognitive abilities, and psychological conditions for many purposes including medical investigations (possible brain damages after a head injury), psychological disorders and selection purposes for both education or professional positions. Testing the mental abilities by the TRMCFB is also cheaper than using the MRI or the fMRI.

This patent, Test Room to Measure the Cognitive Functions of the Brain (TRMCFB), number 4304, was obtained from King Abdulaziz City for Science and Technology (KACST) on 31 Aug 2015 in Riyadh, Saudi Arabia. KACST is the most well known institution in Saudi Arabia and the Middle East for innovation, research and science. The TRMCFB patent was obtained after negotiations and discussions with the KACST over nearly four years based on the KACST organisational procedures. The following figure shows all the parts and details of the TRMCFB.

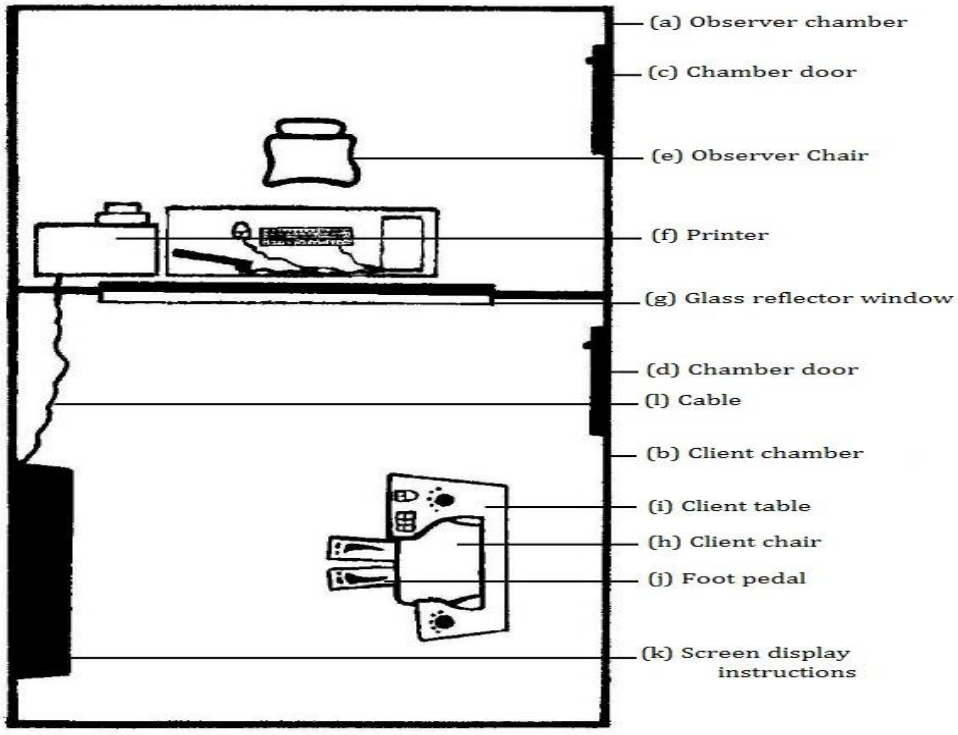


**Figure 1 shows the patent, the Test Room to Measure the Cognitive Functions of the Brain (TRMCFB), with all its parts and elements**

As can be seen in Figure 1, the TRMCFB is a regular room that is divided into two separate small chambers – one for the client, and the other for the observer (e.g. psychotherapist). These are separated by a glass reflector window. The following section will describe the TRMCFB invention and discuss its mechanism in more detail.

## 2. THE WORKING MECHANISM OF THE TRMCFB

To understand the working mechanism of the TRMCFB, it is important to understand every part and element of it. Figure 1 and the defined parts in it (based on letters) will be discussed in the following two sub-sections which express the two chambers (the client's and the observer's):

**First: The client chamber:**

As can be seen in Figure 1, this chamber is a regular room that has its own door (d). It has elements that help in testing a client's brain functions and psychological conditions and disorders by displaying to him/her a number of instructions and questions and getting his/her answers. These elements are:

***a) The TRMCFB screen displays the instructions and questions:***

Explanation: A client will watch a number of instructions and questions on the TRMCFB screen (k) in front of him/her. The instructions will show him/her how to use the keyboard, hand-and-fingers keyboard, mouse, foot pedal, how to answer the different questions, and how to communicate with the observer (which will not be present in the client chamber). After reading and understanding the instructions, the questions will be displayed based on the test. For example, if the first test is about colours, the questions of this test will be about colours; if the second test is about the short and long-term memory skills, the questions of this test will be about memory. This means that the tests and their questions will be displayed in sequence based on the purpose of the test; e.g. educational or professional selections, or for investigating certain psychological disorders. The observer can change and modify the content of the tests and the questions displayed in the TRMCFB screen. In addition, the TRMCFB is designed to contain a large number of different tests including mathematics, geometric shapes, discrimination dimensions, logical thinking, visual IQ, imagination test through images, forms arrangement, colour, fine motor skills, motor balance, motor coordination, visual-motor integration, wording, literature, art, recalling, short-term memory, long-term memory, comprehension, perception, ordering , analysis, composition, emotion, response speed and the identification of tones and sounds. However, not all these tests will be used for a client. The number and types of tests will be decided in advance based on the purpose of the TRMCFB test. When a client finishes a question, he/she clicks on the 'continue' button in order to move to the next question; and when they finish a test, they can move to another test until they complete the whole TRMCFB test. This highlights that the client will not be able to see the result of each question or each test when they finish it, nor the total result of the TRMCFB test on the screen. The observer is the only person who can track the progress of the client in the test during the whole process by his/her computer from his/her chamber (the observer chamber).

***b) The TRMCFB client's chair.***

Explanation: The TRMCFB client's chair is attached with a table (i) and a foot pedal (j). When a client sits on this chair, he/she will see the instructions and questions on the TRMCFB screen. They are required to agree to the instructions and respond to the questions by using the keyboard, hand-and-fingers keyboard, the mouse in the table (i) or by using the foot pedal (j). The use of one of these tools will be based on the instruction and the question. At various points, the client may be asked to use two or more tools at the same time. For example, using both the hand-and fingers keyboard in the table and the foot pedal concurrently when the test is about visual-motor integration.

**Second: The Observer chamber:**

Similar to that of the client chamber and as can be seen in Figure 1, this chamber is also a regular room that has its own door (c). It has elements that help in observing, measuring and evaluating a client's brain functions, cognitive abilities and psychological conditions. These elements are:

***c) The TRMCFB computer and printer:***

Explanation: When the observer sits in his/her chair (e), they evaluate the client's response to the instructions and answers to the questions by his/her (the observer) computer. At the end of the test, the result of each test – including the total TRMCFB test – will be printed directly from the printer (f) which will show which questions were answered correctly, the

length of time the client took to answer each of them, the time it took to complete the entire test, and which tests he/she received the highest scores in. The printed copies of the results will also include a number of graphs, tables and figures based on the type of tests that were used. This will help in the decision-making after the test is completed; and highlighting that the TRMCFB screen in the client chamber is linked with the observer computer and printer by a cable (l).

***d) The TRMCFB glass reflector window:***

Explanation: Besides observing the client responses and answers in the computer, the observer also watches the client through the TRMCFB glass reflector window which separates the two chambers and allows the observer to keep an eye on the client without distracting him/her during the test; i.e. the observer can see the client, but the client cannot see the observer (although the client knows the observer is behind the window). This will help also in case the client needs something during the test. It is essential that the client is alone in their room (the client chamber) during the test.

## 3. CONCLUSION

This paper discusses the benefits of using a patent called the Test Room to Measure the Cognitive Functions of the Brain (TRMCFB). This patent – which is number 4304 and was obtained from King Abdulaziz City for Science and Technology (KACST) on 31 Aug 2015 in Riyadh, Saudi Arabia – is an evaluation mechanic-technology to measure the functions of the brain, cognitive abilities, and psychological disorders and conditions. The TRMCFB is a room that has two chambers – one for the client and one for the observer – that are separated by a glass reflector window. Each chamber has its own tools; e.g. the client chamber includes the TRMCFB screen where all the instructions and questions are displayed, whereas the observer chamber includes the computer to track the client's responses and the printer to print the final result after the test is completed. The TRMCFB has a number of benefits that help in decision-making. For example, the results of the TRMCFB test can be used in deciding which field of study is appropriate for a person, or which professional position or career they should pursue; or selection purposes as in education, military, or for a certain job; or it could also be used to measure the brain functioning and cognitive abilities to evaluate psychological disorders. What makes this patent beneficial is that the existing medical technology and devices that measure the brain functioning (e.g. MRI and fMRI) do not test a large number of the brain functions or cognitive abilities that the TRMCFB is able to. They are also expensive to use. Therefore, the TRMCFB would add to the body of knowledge in psychology in general and, specifically, in the field of psychometrics.

## 4. RECOMMENDATION

This paper recommends the use of a technology in the field of psychometrics to evaluate the brain functions, cognitive abilities, and the psychological disorders and conditions such as the current patent, the Test Room to Measure the Cognitive Functions of the Brain (TRMCFB), rather than using medical technology such as Magnetic Resonance Imaging (MRI) or the functional Magnetic Resonance Imaging (fMRI) which are expensive and do not test all the cognitive abilities.

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