

# **BOP : BRAIN ORIENTATION PROFILE**

DR LOUIS FICK OF INTEG ©2011

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## **LEFT BRAIN/RIGHT BRAIN ORIENTATION & COGNITION**

### **1. INTRODUCTION**

The brain, cognition and cognitive functioning are clearly closely related – so is the understanding, evaluation and prediction of brain functioning and the result (typically) produced by the cognition function, of significant importance in understanding the human being, its mind and its behaviour. It is particularly relevant regarding the field specialized in by the COPAS (Cognitive & Potential Assessment) as far as the World of Work is concerned, e.g., career planning, development, selection, promotion, level and quality of performance, etc.

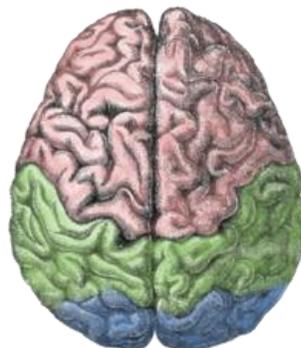
With reference to the above, it is logical to bring the concept of ‘**Left/Right Brain**’ in play regarding understanding, interpretation and prediction of behaviour. This concept of the structure and functions of the mind suggests that the two sides of the brain control two different “modes” of thinking and that each individual prefers one mode over the other.

### **2. THE BRAIN**

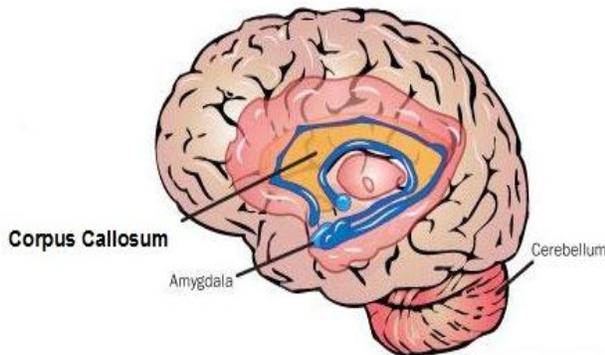
The human brain resembles an English walnut of which the shell is removed. It has a deeply wrinkled surface with a clearly marked fold dividing it into a left and a right half. In addition to the *two halves* the brain consists of, there are various other known attributes that have important roles to play in the further discussion of this subject, e.g., the corpus callosum, the language centres, the memory structures and the reticular activity system.

#### **Graphic 1**

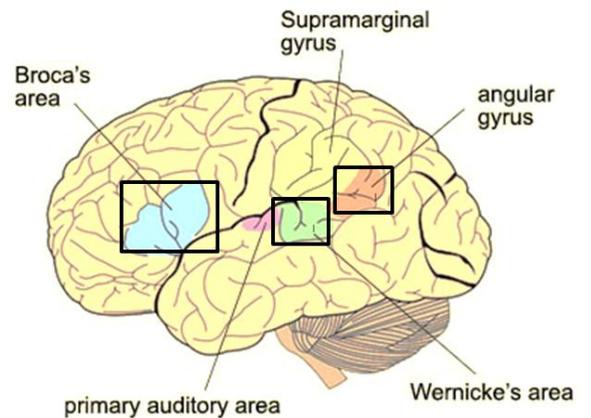
##### **Two Halves of the Brain**



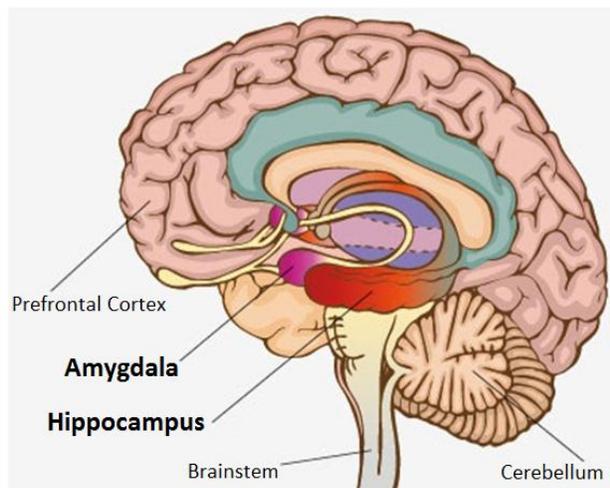
The walnut shaped two halves the brain consists of.

**Graphic 2****Corpus Callosum**

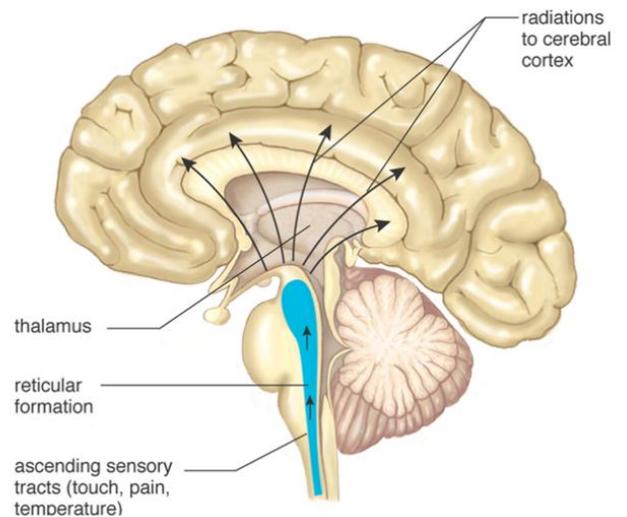
The corpus callosum is the bundle of fibers that connects the two hemispheres.

**Graphic 3****Language Centers**

The language centers (Broca's area, Wernicke's area and angular gyrus) are usually in the left hemisphere.

**Graphic 4****Memory Structures**

The amygdala and hippocampus located in the midbrain are responsible for transforming short-term memory into long-term memory.

**Graphic 5****Reticular Activating System**

The reticular formation (or reticular activating system) is the seat of consciousness that is responsible for mental alertness, and it connects the conscious and subconscious mind.

A few general remarks about the brain is fitting at this stage.

The study of the brain is generally known as *neurology* and of course the people specializing in this field, as neurologists. Neurons, synapses and chemical processes are playing an important role in the structure and functioning of the brain. The basic building blocks of the brain, the *neurons*, die off as the person gets older. The *synapses* are responsible for carrying over the ‘messages’ in the brain. Historically, there was a concept that the larger the number of synapses the brain has, the cleverer the person is. *Chemical processes* are responsible for the activities associated with the brain’s functions. *Plasticity* is the adaptability of the brain in general – e.g. for one part of the brain to take over the functions of another if the latter is damaged in an accident. *Addiction* is an important aspect in the practical presentation of the brain’s functioning – and/or malfunctioning.

The question for the purpose of this paper is, however, why is the brain divided into a left and right side? For hundreds of years, scientists believed that the two sides were mirror images of each other. Since nature equips the human with two eyes, ears, and kidneys that perform the same function, why not both sides of the brain?

Only within the last forty years has science shown that the left and right-brain **hemispheres** have unique and specific functions. Before this breakthrough, brain function was a mystery. More than ninety percent of all science known about the brain is directly or indirectly related to left-brain/right-brain research, which scientists also refer to as split brain or hemisphere specialization research.

### 3. HEMISPHERIC BRAIN RESEARCH

In the 1950s and early 1960s, neuro-surgeons who were treating patients with uncontrollable epileptic seizures decided to perform a radical type of brain surgery. They completely separated the two halves of the brain, creating a split brain, by cutting through the **corpus callosum**, the bundle of fibers that connects these halves. It turned out that these patients suffered no change in intelligence, personality, or daily function, and their seizures stopped.

However, split-brain patients did report oddities and curiosities (such as, one patient had difficulty learning to associate names with faces, many patients had subtle memory difficulties, and most patients complained that they no longer dreamed). These reports initiated a tremendous interest in research, thus creating a rapid buildup of knowledge about the brain.

Research in sleep labs proved that split-brain patients do indeed dream, indicated by a special brain wave pattern and rapid eye movement below the closed eyelid. These patients could not remember their dreams because one side of the brain is responsible for dream activity and the other side records the dream into words. Because the doctors had disconnected the two sides, the brain could not share this information between the two hemispheres.

Other research suggested that the two sides of the brain have a specific set of functions. Victims of automobile accidents with injuries to the left side of the head lost the ability to speak, but they could still sing. Persons with right-brain damage lost memory of faces and an orientation to their surroundings, even their home (referred to as spatial orientation). These early findings illustrated that speech and language functions are on the left side of the brain and facial recognition, spatial orientation, and music functions are on the right side. Both hemispheres of the brain are involved in higher **cognitive** functioning; with each half of the brain **specializing** in **complimentary** fashion.

#### 4. HEMISPHERIC SPECIALIZATION

The expression left-brain/right brain refers to specialized functions of the two hemispheres. Scientific research with healthy human subjects used a new brain scan (PET) scan to confirm these findings.

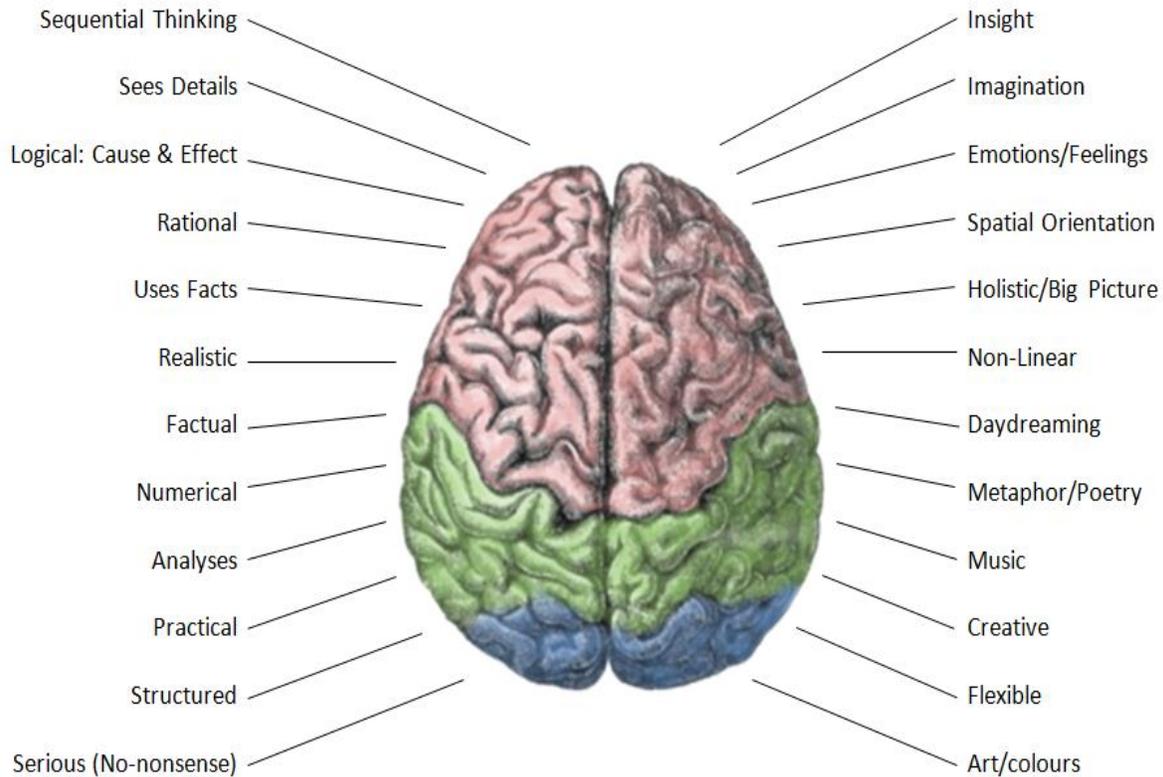
Individuals were connected to a machine that mapped brain activity by lighting up to show which part of the brain was active. In a typical experiment, the researcher gave each subject a series of tasks to perform, and then recorded which side of the brain was most active. Results indicated that activities involving numbers, logic, word puzzles, sequential tasks and **analysis** were more active on the left side of the brain; whereas activities involving music, imagination, colours, or creative expression were more active in the right hemisphere. Evidence suggests that the right-brain has a **global** bias while the left-brain has a **local** bias. In other words, the right hemisphere sees the picture and the left hemisphere sees the components of the picture.

The distinctiveness of the left and right-brain functions has led to the notion that humans have two brains. Although research shows that each hemisphere may be in charge of a specific set of functions, neither side has exclusive control of those functions. Both sides can interchange roles.

Graphic '6' displays a summary of those functions for both sides of the brain.

## Graphic 6

### Left-Brain/Right-Brain Functions



## 5. BRAIN HEMISPHERE LEARNING

Research identifies the left-brain as the Academic Brain because educators generally emphasize its processes in the traditional classroom, resulting in certain groups using hemisphere specialization to explain limitations of traditional learning. On the other hand, research identifies the right-brain as the Artistic Brain because it is in charge of creative talents.

Although fields such as science and medicine now pay more attention to these brain processes, education has traditionally neglected the right side, leaving half of a student's brain potential undereducated. However, more and more school systems are using whole-brain learning techniques. Recently, educational researchers have shown that a balanced involvement of both sides of the brain in the classroom can create surprising learning gains in

many types of students: children, adult learners, the so-called “mentally dull,” and the genius. Thus, these studies conclude that learning can proceed at astounding rates when teachers have students integrate both sides of their brain in a lesson. For example, kindergarten teachers who use music, dance, storytelling, drama, or numerous other right-brain activities as part of their routine teaching strategy not only aids the left brain learning of their students, their students also learn at incredible rates. After the junior grade, when the use of these aids typically diminishes, learning rates drop significantly as well.

## 6. BRAIN HEMISPHERES

The brain splits up functioning and then coordinates and **synchronizes** information processing from the two hemispheres. Split-brain research back in the 1960s resulted in some early views of a logical-creative functional split. This simplistic understanding has evolved to a more complex view.

Brain scanning technology has been instrumental in furthering our knowledge-base in the area of brain function, specialization, and synchronization. The brain devotes areas to specialized tasks. For example, there are clearly areas in the cortex devoted to visual and auditory data, as well as areas that deal specifically with language, memory, and so on.

Different, specialized brain areas process related information at the same time (such as visual data, sound, and smells). These associations enhance long-term memory storage. These “initial,” or “level one” processing areas then transfer (hence the term **bi-lateral transfer**) processed data onto another area for higher level thinking skills and further processing. Distinct data is then integrated.

**Bi-lateral** transfer refers to the ability of the brain to transmit data processed in one hemisphere and coordinate and integrate it with data processed in other areas. The processing appears to take place in levels. That is, initial processing seems to focus on the sensory input. Integration occurs between areas. Higher-level thinking skills get involved to make sense of the data.

This all happens very quickly, but there is both a sequential nature and a spiraling nature to the increasingly complex processing that occurs. That is, the brain has the ability to apply increasingly sophisticated analytical and evaluative thinking and it does so progressively. The brain also **synthesizes** new information and experiences with existing knowledge, memories, beliefs, values, and emotions.

## 7. THE DOMINANT SIDE OF THE BRAIN

This section introduces the reader to the concept of brain preference, or brain hemisphere dominance, and explains brain preference from a personal, cultural, and career perspective. It might benefit the reader to complete a brain preference assessment to determine which part of his or her brain is dominant.

As more knowledge about the brain became available, professionals in fields such as science, medicine, and education asked more questions. One interesting line of research explored the question of whether people rely on one side of the brain more than the other. Is one side of the brain **dominant**?

Researchers believe that brain dominance determines a person's preferences, problem-solving style, personality characteristics, and even career choices. For example, a right-brain individual will quickly get a feeling for a situation, while a left-brain person will usually ask a lot of questions first. The following chart reflects additional differences between left and right-brain dominance.

<b>PERSONAL PREFERENCE</b>	
<b>LEFT DOMINANCE</b>	<b>RIGHT DOMINANCE</b>
<b>Detail</b>	<b>Holistic</b>
<b>Realistic</b>	<b>Imagining</b>
<b>Careful planning</b>	<b>To visualize the outcome</b>
<b>To consider alternatives</b>	<b>To go with the first idea</b>
<b>Being thoughtful</b>	<b>Being active</b>
<b>Monopoly, scrabble or chess</b>	<b>Athletics, art, or music</b>

There is nothing good or bad about either preference. Both orientations can be equally successful in accomplishing a single task; however, one may be more appropriate over the other depending on the situation.

## 8. HOW BRAIN PREFERENCE DEVELOPS

Researchers have determined that brain preference does not come from a person's conscious choice about which side of the brain to use. However, what they want to know more about is whether children inherit their brain preference from their parents (obtained from nature), is it socialized from early childhood experiences (obtained from nurture), or a combination of both. Different studies on how brain preference develops suggest that:

- Dominance is present at birth, but that children may not be able to establish it well until they are *five years old* — while other studies suggest that children continue to develop their brain preference until they reach *puberty*.
- The brain is not completely developed before two years of age and ‘changes’ can best be brought about in this period/phase.
- A strong relationship exists between the brain preference of infants and their parents, suggesting that *genetics* has a major influence on brain preference.
- Early childhood experiences, or nurturing, can play a major part in brain preference *development*.

## 9. DOMINANCE AND CAREER CHOICE

As children grow, they will continue to prefer activity on one side of the brain, which eventually can reflect in their choice of a major at tertiary level or a career preference. Students at tertiary level, who major in literature and the humanities, show a greater degree of right brain activity, compared to those majoring in science and engineering, who show high left-brain activity.

Studies have also indicated that brain dominance can be inferred from a person’s occupation. Typically, lawyers, chemists, mathematicians, and accountants are left brain dominant because these occupations require logical, sequential, and analytical skills. Characteristically, musicians, actors, athletes, and artists are right-brain dominant because they rely on right-brain functions such as body sensing, rhythm, color imagery, and spatial-orientation.

Distinctions in brain preference also exist in the same occupation. Corporate and contract lawyers are often more left-brain oriented than domestic and criminal lawyers. Rock musicians and recording artists are often more right-brain dominant than classical musicians. Successful managers and administrators in the same field may have a different brain dominances. The manager who works well with people most likely has a right-brain tendency, while administrators who do a lot of planning will tend have a left-brain dominance. Careers in the military follow this same pattern — some are more left-brain oriented while others are more right-brain oriented.

## 10. YOUR OWN BRAIN PREFERENCE

Knowing your brain preference is important because it determines certain likes, dislikes, skills, and weaknesses. These preferences may develop very early in life and may become more extreme as you develop and grow older. For instance, if you are good at tennis, but not at reading, you would most likely spend more time playing tennis than reading. Thus, your abilities and personality may become one-sided. To become a well-rounded, actualized person, you need to consciously develop the less preferred side of your brain. My wife, who is a teacher per excellence by heart and career facilitated our kids at a young age to perform certain activities to stimulate both sides of the brain (even mine) with significant results!

## 11. THINKING BETTER

In today's society, a crisis exists in how people think — that is, oftentimes people do not think independently or creatively. It is important to examine how you think, how you can improve your thinking process, your problem-solving style, and how to balance brain functions to obtain better results. Successful people know how to use their *whole-brain* functions in order to solve their problems more successfully.

## 12. VERBAL AND VISUAL THINKING

Each side of the brain has its own thought process, which appears in our conscious mind as voices or pictures. The left-brain produces verbal thought while the right-brain creates pictures or visualizations (known as visual thought). Researchers also believe that emotional feelings, hunches, gut reactions, etc. — which people attach to voices and pictures — represent a third brain input called kinesthetic thought. The combination of these three processes is the way people program their brains to accomplish their life goals.

### 12.1 VERBAL THOUGHT

People experience verbal thought through *self-talk*. Psychologists use *self-talk* extensively today to help individuals with many of their life problems by giving them “thought-stopping” techniques to break the habit of negative thinking. For example, star athletes go to sport psychologists to learn how to apply positive self-talk to improve their game. Statements used to condition positive self-talk are *affirmations* — high quality statements that *promote* successful thinking and feeling. People who make the most of affirmations like them so much that they

adopt them as personal slogans. Additionally, thinking about an affirmation and repeating it over and over will make it a part of an individual's self-talk, programming the brain to bring about the desired end result. The affirmations listed below are examples that one can use to promote success in *learning*:

- Learning is something I enjoy immensely.
- Learning is inside me just waiting to happen.
- My memory is sharp; my mind is powerful.
- I recognize the right answers at the right time.
- I acquire new knowledge without much effort.
- I succeed applying new skills effectively.

The following affirmatives can be used to promote success in *life in general*:

- I am kind, patient, and compassionate within myself.
- I stand tall inside myself.
- I have the energy and determination to tackle and solve my toughest problems.
- I have everything it takes to achieve my goals, beginning now.
- I am as good, if not better, than the next person.
- I am a natural winner.

## 12.2 VISUAL THOUGHT

The *visual pictures* that you form in your mind may be crystal clear and in full color or they may be fuzzy, fragmented, and unstable. Some people visualize only in black and white; others do not make pictures at all. People also experience visual thought while they are daydreaming. As a child, visual thinking is prevalent, but by fourth or fifth grade, outside influences can discourage children from daydreaming. Many adults consider it to be a waste of time. However, visual thought is very important and is the beginning point of anything new in one's life. Everything created by humans once existed as a picture in somebody's mind. I spend hours at night, while I am supposed to sleep, daydreaming and surprise myself time and time again of these visualized thoughts realizing themselves in my life.

The old expression — “*a picture is worth a thousand words*” — means that visual pictures impress the memory better than verbal thoughts. For example, students who routinely visualize what they read in books perform better on tests and most people remember faces longer than names. Our society may give verbal thinking more importance, but it appears that visual thinking has more brainpower. There are various technical ways you can develop your visual thought power to bring about

desired outcomes, e.g., *flashback* and *flash forward* in daydreaming and visualization.

### 13. PROBLEM-SOLVING STYLE

It proved to be more effective for individuals and/or groups to obtain an understanding of their own (unique) brain preference and cognitive functioning as well as to derive a process or style of problem-solving that would enhance this process in terms of effort, integratedness, depth, creativity, quality and reliability. For best results, learn how to combine the left and the right sides of the brain to solve problems, especially the more complex ones.

Although each hemisphere is in charge of a specific set of functions, both sides can interchange roles. Both halves of the brain are necessary for optimal brain functioning – they complement each other. Both hemispheres of the brain are involved in higher cognitive functioning; with each half of the brain specializing in complimentary fashion. It is thus clear that a *balanced and integrated* involvement of both sides of the brain can enhance the process of learning, the meaningful collection and comprehensive integration of data and problem solving, to a significant extent.

### 14. PUTTING IT IN PERSPECTIVE

Knowing about the functions of the brain is good, but knowing something definite about your own brain is better. So far you know that the left and right-brain hemispheres have specialized functions and, in many instances, educators emphasize the left-brain and neglect the right-brain.

During your stages of learning, growth, and personal development, the world can and will present different types of challenges that will place complex demands on your brain. Know how to use your brain efficiently. Know your individual brain preference and your problem-solving style, and then use both sides of your brain to set and accomplish goals and to tackle those difficult challenges.

As mentioned earlier, people are born with a Left/Right Brain dominance and that it can thus be classified as a genetic phenomenon. It may, however, only establish itself in practice at around five years of age and children continue to develop their brain-preference to a significant degree until they reach puberty. It should never be perceived in absolute terms – in essence it remains a preference; a dominance, with a strong under current of

‘relativity’ to it. It has a dividing-line of virtually 50% and is a living entity with an ever changing character – it is a leaning, rather than being absolutely cast in stone.

***In essence the typical dividing characteristic between the two sides can be described as:***

The ‘**left brainers**’ are more structured, rational, analytical, logical, objective, factual, practical, realistic, ordered, detailed (seeing parts/components of the picture), sequential, deductive, scientific, numerical, and serious in their natural and typical orientation.

The ‘**left brainers**’ are typically the more rational, analytical, structured, factual, detailed, down-to-earth, realistic and practical types who like order and are guided by proven principles.

The ‘**right brainers**’ are more emotional, creative, ideas-orientated, open-minded, fluid, random, non-linear, flexible, subjective, imaginative, fantasy, metaphoric, synthesizing, intuitive, gut, hunches, insight, contextual, holistic (see big pictures), spatial, art, drama, storytelling, music, meditation, rhyme, colours, dance and playful in their natural and typical orientation.

The ‘**right brainers**’ are typically the more creative, open-minded, flexible, unstructured, ‘free-floating – intuitive types who see the ‘big picture’ and are more emotional, artistic and lighthearted (playful) in their orientation.

In Addendum A a random list is provided of some of the typical functions related to the Left and Right brain hemisphere to demonstrate the kind and variety of these functions.

In some cases the brain dominance may be vary pertinent and strong – where the person ‘scores’ high on virtual all typical brain-qualities on the particular side he/she demonstrates a dominance in (e.g. the left brain) and lesser on the attributes typifying the other side. In some other cases the person may demonstrate a virtual even spread on all qualities – being a well-balanced whole brain user, where it is difficult to categorize the person in any particular side.

In perhaps the majority of cases, the person ‘scores’ strongly on most of the functions typifying the relevant side of his dominance, but on some/one of the counter functions (he/she is for example a typical ‘right brainer’), he is for example running a *well-organized* ship in the workplace. This ability to *structure*, he developed through need/experience. Another typical example is the well-developed ability of *discipline*, while the person (right brainer) is rather *disorganized* in his office layout/utilization.

## 15. DEVISING A MEASURING INSTRUMENT

In order to develop an instrument to assess the particular brain dominance of a person and all the other requirements of the development of such an instrument, the following **seven steps** must be observed (Moerdyk, 2009):

- **Conceptualizing** : What are we looking for?
- **Operationalizing** : How would this show itself?
- **Quantifying** : How can we attach a value to what we have observed?
- **Pilot testing** : How does the measure behave in practice?
- **Item analysis** : Does each item contribute properly to the total score?
- **Norm *development and interpretation*** : What does this score mean? (Develop and maintain norms).
- **Evaluation of the technique** : Is the assessment process consistent and accurate? (Is it reliable and valid).

Considering the above, the material covered in this document makes much sense – especially regarding the first two steps.

In order to proceed to the remaining five steps and to establish a meaningful and comprehensive content-basis on which to found the first two steps, the following **Categorized List** of Left/Right Brain functions is provided relative to the following six descriptive characteristics which were generated through the process of *Factor-Analysis (FA)*:

<b>Critical Descriptive Characteristics (CDC)</b>	<i>Number of items</i>
* <i>Logical/Rational vs. Creative/Open-minded</i>	20
* <i>Analytical/Detailed vs. Holistic/Big Picture</i>	10
* <i>Practical/Conservative vs. Artistic/Music</i>	14
* <i>Structured/Organized vs. Random/Unstructured</i>	14
* <i>Independent/Solitary vs. Emotional/Social</i>	14
* <i>Verbal Thought vs. Visual Thought</i>	14
* <i>General</i>	14
<b><i>Total</i></b>	100

Please note, the number of test-items used to collect relevant data per CDC is also reflected in the above list – a total of 100 test-items are used.

**BRAIN ORIENTATION PROFILE (BOP)  
LEFT/RIGHT BRAIN DOMINANCE**

**Categorized Functions per CDC**

<b>1. Logical/Rational</b>	<b>Creative/Open-minded</b>
1.1 Logical : Cause & Effect	1.2 Abstract/Open to expression
1.3 Sequential/Ordered patterns	1.4 Haphazard/Non-linear
1.5 Objective/Clinical	1.6 Subjective/Not Mindful
1.7 Controlled/Does to act without thinking	1.8 Risk taking/Open-minded
1.9 Numeric/Mathematical	1.10 Unstructured/Free floating thinking
1.11 Factual/Realistic	1.12 Intuitive/Gut feeling or instinct
1.13 Rational/Basic	1.14 Creative/Finding new ways to do things
1.15 Scientific/Thinks in step-by-step approach	1.16 Flexible/Adaptive
1.17 Technical/Systematic order of thinking	1.18 Fantasy/Daydreaming
1.19 Higher order thinking skills	1.20 Insight/Jumping to conclusions

<b>2. Analytical/Detailed</b>	<b>Holistic/Big Picture</b>
2.1 Analytical/Breaking down and analyze	2.2 Holistic/Seeing the Big Picture
2.3 Detailed/Prefers dealing with individual parts	2.4 Synthesizing/Bringing parts into the whole.
2.5 'Alienating' Parts/Taking part out of context	2.6 Contextualize/Placing in context.
2.7 Dissertation with scientific intent.	2.8 Conceptualize/Generalize ideas
2.9 Focused/Pinpoint facts	2.10 Broad-based thought process/Integration

<b>3. Practical/Conservative</b>	<b>Artistic/Music</b>
3.1 Practical/Guide by proven principles.	3.2 Artistic/Art, Dance, Drama
3.3 Realistic/Material existence.	3.4 Spiritual/Non practical value
3.5 Consistent/Stick to ways	3.6 Varies/Prepared to experiment with different ways.
3.7 Conservative/Adhering to tradition	3.8 Progressive/Forward dynamic.
3.9 Serious/No-nonsense approach	3.10 Playful/A good time.

<b>4. Structured/Organized</b>	<b>Random/Unstructured</b>
4.1 Ordered/Predetermine fixed order.	4.2 Random/Without pattern or order.
4.3 Structured/Physically	4.4 Unstructured/Disarray without order.
4.5 Organized.	4.6 Disorganized in behaviour.
4.7 Categorized/Grouping things together.	4.8 Chaotic/Uncontrolled.
4.9 Planned/Plan future events.	4.10 Spontaneous/Act on spur of moment.

<b>5. Independent/Solitary</b>	<b>Emotional/Social</b>
5.1 Independent/Perform better alone.	5.2 Corporate preference.
5.3 Solitary/Working or existing alone.	5.4 Team/Group Orientated.
5.5 Asocial Tendencies/Not part of society.	5.6 Social/Interpersonal relationships.
5.7 Distant/Strong control of feelings & emotions	5.8 Emotional/Shows strong feelings/Emotionally
5.9 Closed – not prepared to be emotionally evaluated by others.	5.10 Open for Evaluation by others – emotionally

<b>Kinesthetic Thought Process</b>	
<b>6. Verbal (Words) Thought</b>	<b>Visual (Picture) Thought</b>
6.1 Language Functions/Grammar Rules.	6.2 Poor in Spelling.
6.3 Speaks Well.	6.4 No speaker.
6.5 Thinks in ‘words’.	6.6 Thinks in ‘pictures’.
6.7 Poor Spatial ability/Poor spatial perception.	6.8 Spatial Orientation/Concept Formation.
6.9 Poor 3D insight/perception.	6.10 3D form/Sees three Dimensionally.

<b>7. General</b>
A variety of uncategorized specific functions are covered under this heading.

## 16. THE TEST-ITEMS

The test-items the measuring instrument (**BOP** – Brain Orientation Profile) consists of, are derived from the above list of Critical Descriptive Characteristics (CDCs). The items represent Left/Right-Brain **functions** and the number of items included in the test are determined by the number of functions to be covered in order to make the **BOP** a fully representative instrument in the field it covers – with special reference to step ‘2’ in the test-development process, i.e., to effectively ‘Operationalizing’ the instrument in psychometric and practical terms.

The *categories* the functions are grouped in, are rather unique to the **BOP** and represent a professional/expert interpretive function rather than an absolute scientifically prescribed principle, although it was objectively based on a Factor Analyses conducted on ‘all’ known differential factors in the field of left/right brain studies. The majority of instruments available in the market have as sole objective to only determine the Left/Right-Brain *dominance* of the testee. The mere fact that the **BOP** identifies more descriptive and functional detail, makes it a more flexible instrument; allowing its user more opportunity for a wider and more in-depth interpretation and

application of the instrument and the results it generates. In the final analysis, the **BOP** also provides the brain dominance of the testee – based on sound coverage of the known functions related to the Left/Right-Brain preference of the human being. It was the latter functions/factors that formed the basis of the Factor Analyses that was mentioned above.

## 17. QUANTIFYING

As is clear from the Categorized List of functions, each Critical Descriptive Characteristic is sufficiently covered by items included in the 100 items the test consists of.

The *second phase* in the Quantification-Step was to introduce a *three-phased response scale* according to which the testee must ‘rank’ his/her response on each test-item, namely:

Mostly	Sometimes	Seldom
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The use of this scale is providing the basic quantification of the testee’s response of the test-items.

The *third phase* in the Quantification step is embodied in how the items are presented in the instrument and the clear set of instructions to guide the testee in completing the test.

## 18. PILOT TESTING

The *Test Booklet* and *Answer Sheet* were devised and the test was applied on 812 candidates to determine how the instrument behaves in practice and to gather sufficient data to conduct an Item Analysis. The size of the group is very much in line with the recommendation of four- to five hundred participants by Foxcroft & Roodt (2005, p.51).

## 19. ITEM ANALYSIS

Although it was found necessary, as a result of the Item-Remainder Correlation process used during the Item Analysis, to formulate/rewrite some test-items because a correlation coefficient of below 0,4 were obtained between their ‘scores’ and the total score obtained by administering the **BOP** and, finally, to re-pilot these items on a somewhat smaller population of 386, the refined instrument, proved to be a structured and well-designed success.

## 20. NORM DEVELOPMENT AND INTERPRETATION

In the case of the **BOP** the entire concept of the ‘norm’ is reduced to the testee’s degree of Left/Right-Brain Dominance – and by implication the extent to which the candidate is able to use his/her entire brain – the so-called ‘Whole-Brain’-user (Jaques & Carson, 1994).

## 21. EVALUATION OF THE BOP

The question in this final test-development step is, whether the **BOP** is rendering consistent and accurate results – in other words, is it reliable and valid?

Although the statistical research and analysis in this regard, is an on-going one, the results obtained with the re-pilot population of 386 are rather convincing on both fronts, i.e. its reliability and validity (McIntire & Miller, 2000, p.118).

### 21.1 Reliability

Reliability is a measure of the consistency with which a measuring instrument measures. Reliability is thus the consistency with which a measure/test achieves the same results under different conditions. If a low degree of consistency is achieved by a measure, it is uncertain whether anything of substance is really measured by the particular instrument. This is the first, primary and acid ‘test’ an instrument must pass in terms of the successive hurdles of psychometric properties which an accurate, successful and effective psychometric test must adhere to in a statistical and practical sense.

With this as a general background, the following reliability models were applied in the development of the **BOP**:

21.1.1 **Coefficient of Internal Consistency** where a *split-half* approach of the test’s items were used to determine how consistent the instrument is in an internal sense.

The questionnaire was divided in the middle, at 50 items aside, and rendered a correlation coefficient of 0.93 on the re-pilot population of 353 – significant at the 0.001 level.

21.1.2 **Coefficiency of Stability** where a *test-retest* approach was used to determine the reliability/consistency of the instrument when applied to the same group of people at two or more occasions – how stable is this test over time.

The re-pilot population was again submitted to the **BOP** after seven months and rendered a correlation coefficient of 0.90 – significant at the 0.001 level. The population shrunk to 312 over this period.

## 21.2 Validity

The validity of a measure is the extent to which the instrument measures what it claims, or is supposed to measure/test. In other words, validity is concerned with the extent to which the measure is free of irrelevant or contaminating influences. Validity is thus the ratio of the relevant score to the total or observed score. Therefore the larger the irrelevant component, the lower the validity. Another name for this irrelevant component is ‘bias’. Logically this leads to the conclusion that *the validity of an instrument cannot be greater than its reliability* – justifying the primary importance placed on the concept/property of reliability above.

With this as a general background, the following validity models were applied in the development of the **BOP** – all of which are important, although they apply differently in different contexts and therefore require different kinds of evidence:

### 21.2.1 Construct Validity

Determining the extent to which the instrument produces results that are in line with what is already known in the particular field of study. Strong evidence of **convergent validity** was found in the fact that the results obtained by the **BOP** correlate to a significant degree with those obtained by the well-known and proven Left Brain/Right Brain Preference Test distributed and used by Foundations of Success - i.e, a correlation coefficient of 0.56 on the total dominance Score for the population of 312 was found, which is significant on the 0.001 level. The research and data published by the Foundation of Success were used extensively in the development of the **BOP**.

### 21.2.2 Content Validity

Determining to what extent the context of the instrument accurately reflects the domain it assesses. If the data reported in the Categorized List is taken into account, the opinion of expert judgment is overwhelmingly in favour of the fact that **Content Validity** associated with the **BOP** is considered to be very sound. This conclusion is supported by the research conducted by Fick (1997 & 1999).

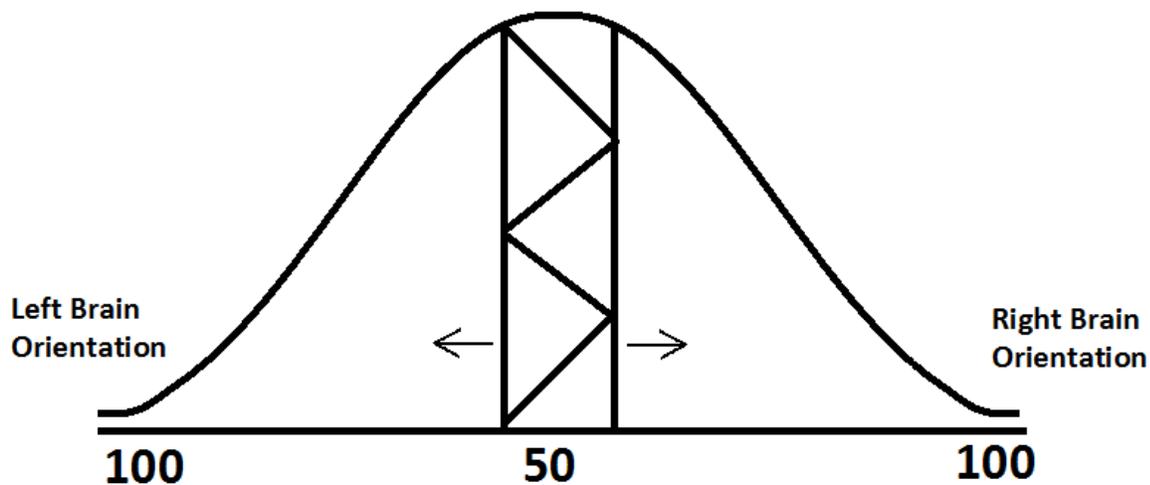
### 21.2.3 Face Validity

Part of Content Validity, is the notion of Face Validity. Determining the extent to which the instrument appears (especially to the uninformed) to be doing what it claims to be doing – i.e., does the instrument, and the items it consists of, seem to be appropriate? According to the results obtained during ‘post-mortem’-sessions, following the administration of the **BOP** in practice, the **BOP** is considered to have sound Face Validity.

### 21.2.4 Concurrent Validity

Concurrent Validity determines the extent to which the instrument successfully distinguishes between *known groups* relative to the criterion of success (Left/Right-Brain orientation).

Although subjective and somewhat uncommon, the ‘Categorized List’ was used as a ‘questionnaire’ by superiors to differentiate between employees in four organizations, twenty schools and two hospitals (amongst people well known to them) on a percentage scale regarding these people’s Left/Right-Brain preferential behaviour. The results obtained in this process were reflected in the following Normal Curve and the middle section eliminated to accentuate the more extreme participants and only they were included in the population used in performing the Concurrent Validity process:



A population of 1009, consisting of 528 Left & 481 Right Brain-orientated people was obtained through the above procedure, submitted to the **BOP** and the information used to calculate the Concurrent Validity – a coefficient of 0.48 was established which is significant at the 0.001 level.

### 21.3 Bias, Fairness & Discrimination

**Bias** can best be described as the systematic error in measurement or research that affects one group (e.g., race, age, gender, etc.), more than another. Unlike random error, bias can be controlled for.

**Fairness**, on the other hand, is the extent to which assessment outcomes are used in a way that does not discriminate against particular individuals or groups.

It is clear that a commonality exists between the above two and in the development of the BOP-test the so-called '**Norming Process**' was applied in a (statistical) practical approach where a wide variety of factors that are 'known' to be 'sensitive' to the concept of bias, fairness and/or discrimination (like age, gender, ethnicity, language, etc.) were sub-divided into two categories each (like young and old) and the results of the test correlated with a multi-dimensional (external) success-criterion.

If the obtained set of correlations differ to a significant degree for a particular sub-divided group, the probability for the instrument to measure/predict unfairly on the specific factor (it is sub-divided on), is considered to be good/strong. The opposite is also true. The model used is commonly known as the '**Sub-Division Norming Process**'.

No significant differences were detected on applying the Subdivided ‘Norming Process’ on 1009 candidates regarding five critical ‘known sensitive’ factor, namely *race, language, gender, tertiary education* and *schooling* and by statistically relating it to a selected external multiple criterion of success. (N = 1009; Significant at the 0.001 level).

#### 21.4 Readability

Although language per sé is not categorized as a psychometric property (except for been known as a ‘sensitive factor’ in terms of the concept of fairness), it can play a determining role in test-administration and interpretation. Other than using *language experts* and doing practical trail-runs with the particular test with the purpose of minimizing the differential effect of the language used in the test, the *Fry Readability Graph* (Fry, 1977) was used in the development of the test to ensure that the language was at a low ‘complexity’ level – and of course to always include Language as a ‘known sensitive factor’ in the ‘*Sub-Division Norming Process*’ during the seventh and last step in the Test Development Model. Attention is given on a continuous basis to the language-issues in the BOP-test - statistically analysis of all items are performed and feedback is gathered from users of the test in different situations, to ensure that items, words and sentences in the test are properly comprehended and serve their intended purpose.

***Readability & Ease of Comprehension*** : ‘A Maximum of sixth grade on the Fry Readability Graph was observed as guide during the test development phase’. No time-restriction applies during the completion of the test and a training administrator is always present to deal with questions on the part of assessees.

In summary, the following seven actions are taken to ensure effective and optimal ‘Readability’ in the **BOP** test:

- Using *Language Experts* to formulate texts during test-development.
- Applying the *Fry Readability Graph* during test-development.
- Using ‘Language’ as a given ‘critical/sensitive’ factor in the ‘*Sub-Division Norming Process*’ during the Evaluation of the Test in the last (7<sup>th</sup>) step of the Test Development Model.
- Performing *continuous statistical analysis* on items used in text-based tests.
- Gathering and implementing ‘*post-mortem*’- information on tests used in practice – especially when tests are applied for the first time to particular groups and under specific circumstances or conditions.
- *Translating* the test when necessary.

As far as the final 7<sup>th</sup> step of **Evaluation** of the instrument is concerned, it is obvious from the above results, that the **BOP** is living up to expectations. The evaluation and upgrading process is, however, an ongoing one; and this results in an ever improved and effective instrument that can be relied on in practice.

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**LEFT BRAIN/RIGHT BRAIN HEMISPHERIC FUNCTIONS****Left Brain Qualities**

Rational

Logical : Cause and Effect

Sequential

Structure

Analytical

See Detail/Looks at Parts – the Components the picture consists of

Categorize

Order/pattern perception

Reflective

Numerical (Good with numbers)

Realistic

Precise

Factual

Practical

Serious

Language – Grammar/Rules

Speaks Well

Word Puzzles

Name Things

Forms Strategies

Know Object names

Memory

Remember Names – Recall people by their name

Relay on proven principles

Right hand control

Present and past

Daydreams are not vivid

Do not often remember dreams

Thinking often consists of words

Tend to avoid talking about emotional feelings/emotions

Suppress Emotions

Independent, hidden, private and indirect

Avoid seeking evaluation by others

Usually try to avoid taking the blame

Tend not to be very romantic or sentimental

Keep talk to a minimum

Do not read other people's mind very well

Often feel mate talks too much

Traditional

**Right Brain Qualities**

Emotional/Feelings

Creative (Expressions)

Present possibilities

Intuitive (Response)

Subjective

Holistic/Big Picture/Global Bias

Contextualize : Placing in context

Synthesize

Imagining

Metaphoric

Fantasy

Insight

Gut (Reactions)

Hunches

Non-linear

Open-minded

Flexible

Fluidity & Space

Random

Ask/Explore Questions

Awareness & Learning

Unorganized

Facial Recognition

Spatial Orientation/Perception

Playful (Love of Play)

Music

Colour

Dance

Storytelling

Drama

Metaphor/Poetry

Meditation

Rep/Rhyme

Art

Daydreaming

Left hand control

Present & Future

Philosophy & Religion

Belief

Appreciate

Risk Taking

Impetuous

Know object function

Remember Dreams

Symbols ad images

3-D Forms

This article was composed by Dr Louis Fick from Integrity International

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Recognition is given to researchers and publishers across the globe regarding the Left/Right Brain Concept – especially to the *Foundation of Success*.

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# \*BOP BRAIN ORIENTATION PROFILE

## SUMMARIZED REPORT

**A. IDENTIFICATION**

Surname : ..... Name : .....  
 I.D. : ..... Gender : .....  
 Organization/School : ..... Date : .....

**B. GENERAL BRAIN ORIENTATION**

%

- 1. Left-Brain Dominance (LBD)
- 2. Right-Brain Dominance (RBD)
- 3. Whole-Brain (WB) - Implied


**C. CRITICAL DESCRIPTIVE CHARACTERISTICS (CDC) PROFILE**

%

LEFT - BRAIN VS. RIGHT - BRAIN
1. Intellectual vs. Non-Intellectual Orientation
2. Logical/Rational vs. Creative/Open-minded
3. Analytical/Detailed vs. Holistic/Big Picture
4. Practical/Conservative vs. Artistic/Music
5. Structured/Organized vs. Random/Unstructured
6. Independent/Solidary vs. Emotional/Social
7. Verbal Thought vs. Visual Thought
8. General

	Left	Right
	Brain	
1		
2		
3		
4		
5		
6		
7		
8		

**D. MONITOR – CONSISTENCY**

%

DEVELOPER : DR. LOUIS FICK

\*REGISTERED TRADE MARK