

## The Intelligence Reflex

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### Abstract

The human brain has been studied extensively for over centuries to ascertain the source of functioning of the body besides understanding psychological aspects of the mind. Even though technological applications have enabled analysing brain functions to a certain extent, the mechanisms are unclear and research continues to reach definitions where more hypotheses form. This paper attempts to define intelligence as a basic reflex mechanism to explain the changes that we experience while we orient ourselves to our surroundings. The components that are being explored here are the orienting reflex, desynchronisation of the alpha rhythm and correlating these to establish a change in intelligence.

**Keywords:** Intelligence, Orienting Reflex, Desynchronisation, Alpha Rhythm, Habituation.

### Introduction

The intrinsic mechanisms of our body response to the surroundings manifests as orienting responses which are reactions to a stimulus through which an individual becomes more sensitive to the stimulus. This is important for information processing. Reactions such as dilatation of the pupil in response to dim light are a type of physiological orienting responses. Other measurable responses include phasic and tonic skin conductance responses, electroencephalographic changes such as desynchronisation, electrocardiogram changes following a novel stimulus all occurring within seconds of the stimulus. Response to a threat stimulus manifesting as an inhibition of a conditioned state leads to preparedness towards that threat, all manifesting as components of the orienting response. One of the components is being explored here in a novice attempt by a direct correlation of the cognitive change and as intelligence is basically the ability to perform better in cognitive tasks, this response makes it dynamic which is changing as the body orients itself to the surroundings.

Before the correlation is made a brief history of the alpha waves and intelligence quotient can be listed in a chronological order.

### History of Alpha waves in

#### Electroencephalography

1. Hans Berger (21 May 1873 – 1 June 1941) was a German psychiatrist, best known as the inventor of electroencephalograph, EEG in 1924 and naming the alpha rhythm known as "Berger's wave". He also used the term alpha blockage for the change in rhythm to increase in beta waves on eye opening.
2. In 1929, he published his first findings on alpha waves in the journal *Archiv für Psychiatrie*.
3. Alpha waves have been used in biofeedback and treatment of depression.

### History of Intelligent Quotient

1. Francis Galton, related to Charles Darwin hypothesized that there should exist a correlation between intelligence and other observable traits such as reflexes, muscle grip, head size and statistically tried to correlate the inheritance of intelligence as early as in 1883.
2. Alfred Binet (July 8, 1857 – October 18, 1911) a French Psychologist invented the first practical IQ Test and with Victor Henri and Theodore Simon he published the Binet-Simon test in 1905. American psychologist Henry H. Goddard published a translation of it in 1910.
3. Charles Spearman in 1904 made the first formal factor analysis of correlations between the tests. Spearman named it *g* for "general factor" and labelled the specific factors or abilities for specific tasks *s*.

The abbreviation "IQ" was coined by the psychologist William Stern for the German term *Intelligenzquotient*, his term for a scoring method for intelligence tests at University of Breslau he advocated in 1912.

1. American psychologist Lewis Terman at Stanford University revised the Binet-Simon scale, which resulted in the Stanford-Binet Intelligence Scales (1916).
2. Raymond Cattell (1941) proposed two types of cognitive abilities, fluid and crystalline intelligence.

John B. Carroll (1993), after a comprehensive reanalysis of earlier data, proposed the three stratum theory, which is a hierarchical model with three levels. Numerous others tests have been used.

The most commonly used individual IQ test series is the Wechsler Adult Intelligence Scale for adults and children for school-age test-takers. Other commonly

used individual IQ include the current versions of the Stanford-Binet, Woodcock-Johnson Tests of Cognitive Abilities, the Kaufman Assessment Battery for Children, the Cognitive Assessment System, and the Differential Ability Scales.

Hence, much work has been performed over the century since the discovery of the electroencephalograph and the use of tests to measure Intelligent Quotients.

This parallel work involving the brain needs an interdynamic correlation that can elicit a quantified biological response to stimuli as our body orients to surroundings called the Intelligence Reflex.

The methodology includes the components such as orienting reflexes, desynchronisation of the alpha rhythm and the intelligence.

### **Orienting Response**

The orienting response (OR), also called orienting reflex, is an organism's immediate response to a change in its environment, when that change is not sudden enough to elicit the startle reflex. The orienting response is a reaction to novel or significant stimuli. Ivan Sechenov described in his book *Reflexes of the Brain* in 1863 which was later described by Pavlov as 'What Is It' reflex. This was studied systematically by Evgeny Sokolov who documented the phenomenon called habituation referring to gradual familiarity effect and reduction of the response with repetition of stimuli.

Orienting response has been studied extensively over the decades since it was systematically described by Sokolov since 1950s. Numerous studies have been performed and the relationship of orienting with different aspects of human behaviour have been described such as differences in habituation time between intelligent from the average ones, emotions, preferences and the state of arousal. The intellectually gifted children differ from average ones in initial orienting reactivity to innocuous stimuli and in rapidity of habituation of orienting reflex.<sup>(3)</sup> While the former had larger orienting reactions and habituated more slowly than the average ones, this strength and persistence of the orienting had been shown to be positive and monotonic from IQs 30 through levels above 160 in their study. The results of such a study support the assumption that attention and cognitive performance involves orienting reactions and these primitive neurophysiological mechanisms such as ORs are involved in complex intellectual functioning.

The orienting response is also believed to play an integral role in preference formation.<sup>(10)</sup> In addition to novelty of the stimuli, studies have also demonstrated the role of emotions in orienting attention. Several recent studies have found that despite a decrease in overall amplitude of late positive potential with repeated presentation of the same picture, emotional pictures continue to elicit a larger positive potential.<sup>(2)</sup> Habituation is also related to the level of arousal in a

subject. EEG, a cerebral cortical activity and skin conductance level (SCL), sympathetic autonomic activity associated with arousal has been studied separately, despite their potential to reflect complementary dimensions of reticular-thalamo-hypothalamo-cortical activating networks and a substantial relationship between them has been demonstrated.<sup>(6)</sup>

### **Alpha Rhythm**

Numerous studies have been performed with the alpha wave. It is interesting to note that desynchronisation of this rhythm is a component of the orienting reflex. Studies have demonstrated that there is a direct correlation between alpha activity, intelligent quotients and the marks obtained at senior secondary school level which is self explanatory in explaining the relationship between IQ of a person and alpha activity.<sup>(9)</sup>

### **Correlation**

It is known that the habituation in orientation is inversely proportional to intelligence which means that subjects with less intelligence habituate faster and time taken to habituate can be measured, this gives us two parameters i.e. time and event related desynchronised wave that are directly related to the intelligence response at that moment while subsequent habituation stimuli and conditioning sets a pattern on pre-existing intelligent level. This would also explain differences in intelligent responses with emotions, arousal or preferences because these have been known to be directly related to the orienting response. The above can be correlated to measure the change in intelligence. Thus, intelligence should be measured as a reflex, even though intelligent quotients assess the intelligence level they are static levels and as noted often the performance of an individual based on their intellectual level are compromised when they are either not adequately aroused or emotional. Measuring intelligence as a real time assessment will provide an accurate state of the mind of an individual.

### **Discussion**

Intelligence is basically the ability to perform better in cognitive tasks. Alpha waves have been described best for learning. While experiments have also proved that alpha activity is more in gifted persons, a correlation has been made between an increase of alpha brain waves either through electrical stimulation, mindfulness or meditation and the ability to reduce depressive symptoms and increase creative thinking by facilitating relaxation of both mind and body. Measured IQ is also positively correlated with the strength and persistence of orienting reactions which may be strengthened by conditioning and that this may lead to improved performance in intellectual tasks. As the desynchronisation of EEG is a component of orienting

reflex and studies have demonstrated relationship of intelligence with alpha activity it becomes relevant to state that level of intelligence that can be improved by habituation in orientation can also be quantified and documented on a scale that can be interpreted to show whether the subject has improved.

The advantages of having an instrument that can display this change in intelligence would have immense application. Beginning from a child in school and when one needs to know the attention or improvement in the level of understanding, this test would help to know the improvement. With wireless sleek headphones with music replacing cumbersome conventional electrode caps in this generation, it would be subject compliant and an over-the-desk test. It could help assess neurological disorders of the brain. A patient on a ventilator in a hospital or comatose can be assessed to know whether there has been an improvement. This would take care of medico-legal aspects together with saving on expenses both in the government, private and insurance sectors and also give a new dimension to management protocols. Work potential for recruitment and Intellectual gain can be assessed in government or private sectors.

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