ABSTRACT

TITLE – Development of varied durational reaction time board – a pilot study. **AIM:** To develop varied durational reaction time board to measure and train for reaction time. **OBJECTIVES**: 1) To measure the reaction time of individual at varied reaction time intervals. 2) To compute a normative data for the new reaction time board to support assessment and management as reference values. **METHODOLOGY -** Purpose of the study was explained to the subject. Written consent was taken. subject were prepared psychologically and was told to be in comfortable clothes and to take meal before 2 hours. The room was of 15 by 15 feet with sufficient light, kept quite with only examiner and subjects were allowed inside. The board was of 4 ft by 3 ft made of wooden material. It had computerised chip board which was capable of randomly glowing the bulbs. 12 bulbs of even size and material glowed randomly after every 1 sec for one minute. The duration between two stimuli was adjusted according to the sequence. Switches were placed beside the bulbs. After 1 minute, the circuit switched off automatically. Execution - Subject sat on adjustable stool such that he was able to touch the board on both corners. Board was wall-mounted which 2 feet from ground and adjustable. The individual used dominant hand and the other hand was kept behind the back. The centre of the board was decided by simple intersection method. The person had to press the switch placed beside the bulbs, which glowed randomly. As soon as the switch of respective bulb was pressed, it was counted by the digital counter. The bulb would glow for 1 second. The person had to press switch before the bulb went off. Digital counter recorded the number of switches that were struck and it gave the reaction score of that particular individual. The new reaction time board, also has an option of decreasing the time between two stimulus by 100milliseconds thus 900, 800 stimuli depending on required assessment and training. **RESULTS -** descriptive statistics was done. The mean value for 1000 msec. is 52 and median of it is 53. For 900 msec. the mean value is 50 and median is 50.however, mean value for 800 msec. is 54 and median is 56.

CONCLUSION - The normative data for 3 sequences is: for 1000 milliseconds, 46 – 53 is good, 54 – 58 is very good, below 46 up to 44 is fair,

43 and below is poor and 59 and above is excellent. For 900 milliseconds, 47 to 53 is considered as good, 44 – 46 is fair, blow 44 it is poor. 54 – 57 is very good and 58 and above is excellent. For 800 milliseconds, 52 to 56 is good, 57 – 58 is very good, below 52 up to 46 it is fair, 45 and below is poor and 59 and above it is considered as excellent.

Key words – new reaction time board, reaction time, normative data.

MANUSCRIPT

INTRODUCTION

Reaction is a purposeful voluntary as well as involuntary response to stimulus. There is certain time period between application of stimulus and appropriate motor response. Reaction time is the ability of person to respond quickly to a stimulus. During 19th century, psychologists and physiologists had interest in measuring reaction time. In 1865, Dutch physiologist, F. C. Donders had Interest in measurement of human reaction time (the time elapsing between the onset of a stimulus and the onset of a response to that stimulus) studied whether the time taken to perform basic mental processes could be measured or not. Until that time, mental processes had been thought to be too fast to be measurable. It concerned the decision in a choice and an action of the will in response to that decision[1].

When a person wanted to respond to stimulus, the reaction occurs in a sequence. Time will be taken to perceive the stimulus, identifying, analyzing of stimulus and to respond. It is composed of three stages: stimulus, recognition and response. Information flow can be represented as stimulus, sensory neuron, spinal cord, motor neuron, response.

The information flow can be represented as [2]:

Stimulus ⇨ Receptor ⇨ Integrator ⇨ Effector ⇨ Response

There are different kinds of reaction time, such as simple, recognition, choice. (Luce, 1986; Welford, 1980).

In **simple** reaction time experiments, there is only one stimulus and one response. 'X at a known location,' 'spot the dot,' and 'reaction to sound' all measure simple reaction time.

In **recognition** reaction time experiments, there are some stimuli that should be responded to (the 'memory set'), and others that should get no response (the 'distractor set'). There is still only one correct response.eg. 'Symbol recognition'

In **choice** reaction time experiments, the user must give a response that corresponds to the stimulus, such as pressing a key corresponding to a letter if the letter appears on the screen. The *Reaction Time* program does not use this type of experiment because the response is always pressing the spacebar[3].

Reaction time can be measured by different ways, such as **RULER TEST**, developed by Davis in 2000 to measure athletes reaction time. In this test, The ruler is held by the assistant between the outstretched index finger and thumb of the athlete's dominant hand, so that the top of the athlete's thumb is level with the zero centimetre line on the ruler. The assistant instructs the athlete to catch the ruler as soon as possible after it has been released. The assistant releases the ruler and the athlete catches the ruler between their index finger and thumb as quick as possible. The assistant is to record distance between the bottom of the ruler and the top of the athlete's thumb where the ruler has been caught. The test is repeated 2 more times and the average value used in the assessment. This test can be done using various ways of distraction like Reading a text silently, aloud. Naming letters in direct order in the text, in reverse order, on a drum, seen one at a time; the fixation of one letter seen through a slit. Multiplication, e. g., 6 x 19, etc. By a fall apparatus and consisted of: letters, colours, diagrams, factors to be multiplied, numbers from one to ten. Orally by factors to be multitude, numbers from one to ten[4]. Ruler test is easy to understand, perform and is feasible, so it is been used in previous researches to measure reaction time.

LIGHT BOARD REACTION TEST, in which the board displays a target light that moves to different cells across the board. The lights are located a different distances on lines radiating out from the centre of the board. The person has to stands upon a Bosu(swiss) ball and facing the light board. The light board is positioned so that the centre is directly in front of the face. The person tries to press as many active lights as possible. In this test, performer gets visual feedback which will be helpful for subject while performing the test.

GRONINGEN REACTION TIME TEST, in this test, the participant holds the module in the preferred hand and when the red light comes on must respond as quickly as possible by pushing the button. The reaction time (in milliseconds) is displayed on the timer. The time between the visual signals ranges between 4 and 9 seconds. After three practice trials, 15 trials are recorded, usually does for old age patients. It is useful for old people as they get visual feedback through red light, so it will be easy to perform the test[5]. **BATAK instrument**, person stands comfortably in front of the BATAK board. Light buttons are lit randomly, and the subject must strike out as many as possible in the allocated time. As soon as one target is struck the next target will lights up. Previously some studies have been performed to see the reaction time in normal individuals by BATAK instrument and they found that it is useful to measure reaction time.

Though reaction time is not often measured, It is important in day to day activities. While driving a car if driver has slow reaction time then person might experience grave consequences. Reaction time is important in many sports like while saving a blistering soccer ball from entering the goal. Slow reaction time may come with goal.

Reaction time can be varied because of age, gender, hand dominance, type of vision, fatigue, personality type, exercise, stress, if any medication is going on, intelligence, learning disorders, due to any illness, sleep deprivation, mood changes.

Study design-

The instrument is newly developed and all the subjects are performing it for the first time. So, it is Experimental study. It was a onetime study where subject had to perform test on reaction time board were observed for each individual. The research protocol was approved by guide, institution. Ethical clearance was taken from the committee.

PARTICIPANTS –

Total 620 consent forms were given in both the hostels 300 consent forms were given in girls hostel and 320 Consent forms were given in boys hostel

and those who were fitting into inclusion criteria were informed to come to Physiotherapy OPD on scheduled date and time. Some of them did not come to OPD to perform the test so, again they have given date and time according to their convenience through phone calls which was mentioned on consent forms.

PROCEDURE –

All the necessary permissions were taken from Principal of Physiotherapy College and rectors of boys and girls hostel for sample collection and those who were fitting into inclusion criteria were informed to come to Physiotherapy OPD on scheduled date and time.

Subject is asked to wear comfortable clothes. Subject should take meal before 2 hours[2]. He/ she should not drink tea or coffee or any stimulant drugs just before the test [14,15]. Subject should not perform the test if he is feeling fatigue. Subject should not perform the test with empty stomach as it will increase the individual's reaction time[2]. Test should not be performed under stress, distraction because it will create false increase in reaction time[9]. Insulation of all the wires is done as it is a electrical instrument. Subject should not perspire while performing the test. Also, his hands should be dry completely for safety purpose.

Subject asked to select sequence chit to avoid the learning bias. He/she is asked to sit on adjustable stool in such a way that he/she is able to touch the board on both corners. Height of it is 2 feet and it can be adjust nearly 2 feet. The sitting surface of it is flat. Board is wall-mounted and is kept 2 feet above from ground. Board is of 4ft by 3 ft. The individual is asked to use his dominant hand and the other hand should be kept behind the back[16] because to avoid use of another hand unknowingly. The centre of the board is decided by simple intersection method. The axis of the dominant shoulder joint is in line with the centre of the board and this is decided by using a laser beam method in order to have equidistant reach. The shoulder acts as a pivot therefore at this position the shoulder joint would be the fixed point of the starting position for the initiation of the movement. The person has to press the switch buttons placed beside the bulbs, which is glowing. As soon as the

switch of respective bulb is pressed, it gets counted by digital counter. The LED will glow on for a sec (1000 millisecond) and the person has to press the switch before the LED goes off, if he presses after the blub goes off, it will not be registered in the counter. Digital counter will record the number of switches that are struck when the LED is ON and it gives the score of that particular individual. In new reaction time board, it also has an option of decreasing the time between two stimulus by 100 milliseconds i.e. 1 second = 1000 milliseconds, we can reduce it by 100 milliseconds such as 900, 800 depending on requirement of assessment and training. So, the number of LED's that will glow in 1000 milliseconds- 60 times,900 milliseconds – 64 times, 800 milliseconds – 70 times.

OUTCOME MEASURE – Normative data for 1000, 900, 800 milliseconds.

STATISTICAL ANALYSIS AND RESULTS:

Study was analysed by descriptive statistics which gives details about mean, median, maximum – minimum limit, skewness, kurtosis.

Table 1 :

Measures of association

	Eta	Eta Squared
1000_ best * sequence	.144	.021
900_ best * sequence	.134	.018
800 _best * sequence	.158	.025

Table 2 :

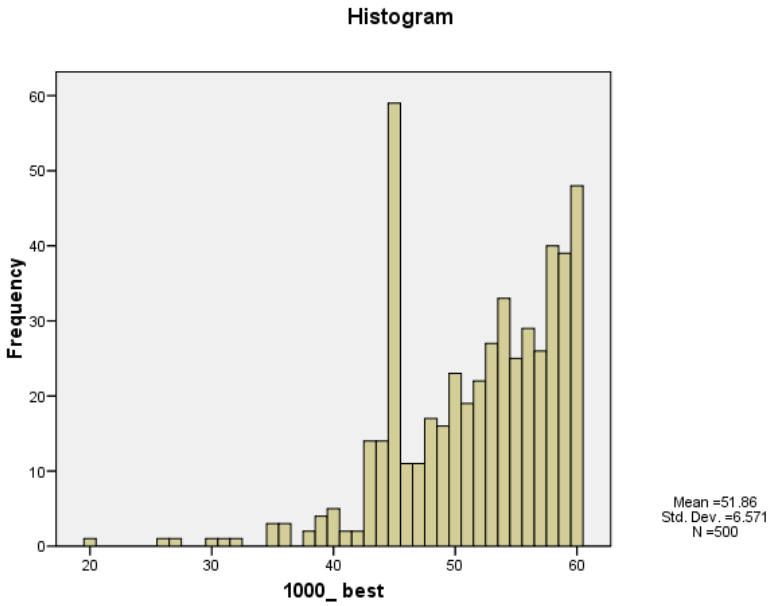
Sequential values of MEAN & MEDIAN for various duration of impulses.

Sequence		1000_ best	900_ best	800 _best
1	Mean	50.82	49.37	53.33
	N	82	82	82
	Std. Deviation	6.137	5.057	5.259
	Median	51.00	48.50	54.50
	Minimum	35	37	36
	Maximum	60	61	60
	Kurtosis	-.752	-.198	.587
	Skewness	-.306	.198	-1.001

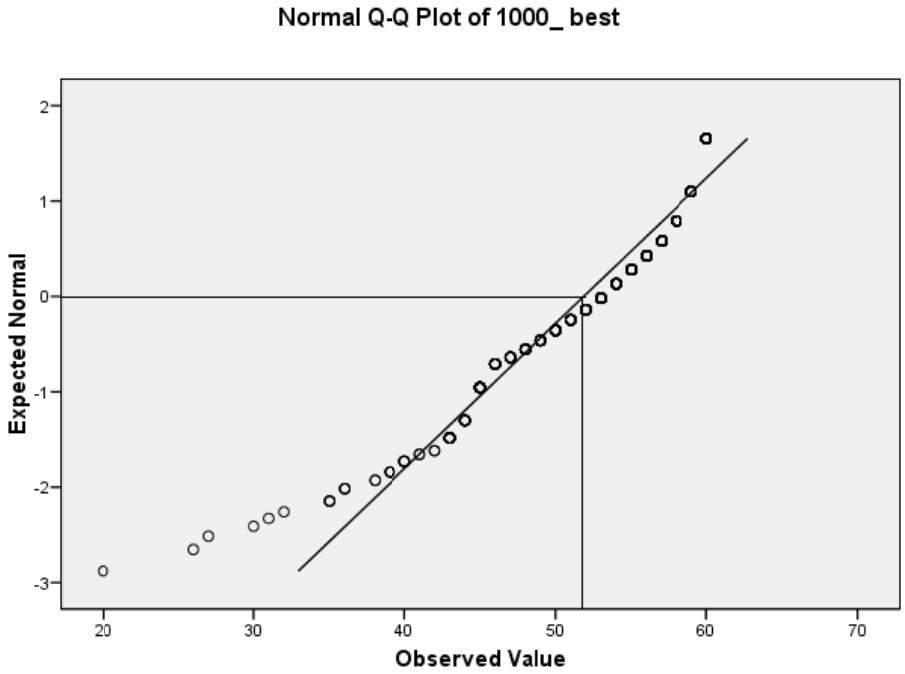
2	Mean	52.65	50.83	54.89
	N	103	103	103
	Std. Deviation	5.866	5.107	4.705
	Median	54.00	50.00	56.00
	Minimum	31	33	35
	Maximum	60	62	61
	Kurtosis	.530	.355	3.303
	Skewness	-.796	-.205	-1.618
3	Mean	49.33	48.44	51.54
	N	39	39	39
	Std. Deviation	7.057	6.151	6.557
	Median	47.00	47.00	52.00
	Minimum	35	36	36
	Maximum	60	61	60
	Kurtosis	-1.021	-.450	-.745
	Skewness	.008	.370	-.512
4	Mean	52.19	50.52	54.42
	N	91	91	91
	Std. Deviation	5.963	5.085	4.953
	Median	53.00	50.00	56.00
	Minimum	39	40	40
	Maximum	60	62	60
	Kurtosis	-1.133	-.648	.551
	Skewness	-.375	.052	-1.111
5	Mean	52.44	50.81	54.29
	N	86	86	86
	Std. Deviation	7.704	6.712	6.943
	Median	55.00	51.50	57.00
	Minimum	26	26	26
	Maximum	60	64	61
	Kurtosis	1.945	1.965	4.022
	Skewness	-1.422	-1.014	-1.969
6	Mean	52.10	50.58	54.54
	N	99	99	99
	Std. Deviation	6.701	5.127	5.713
	Median	52.00	49.00	55.00
	Minimum	20	33	23
	Maximum	60	61	60
	Kurtosis	5.030	.462	10.692
	Skewness	-1.599	-.129	-2.718
Total	Mean	51.86	50.29	54.11

	N	500	500	500
	Std. Deviation	6.571	5.514	5.669
	Median	53.00	50.00	56.00
	Minimum	20	26	23
	Maximum	60	64	61
	Kurtosis	1.212	.585	3.869
	Skewness	-.922	-.290	-1.699

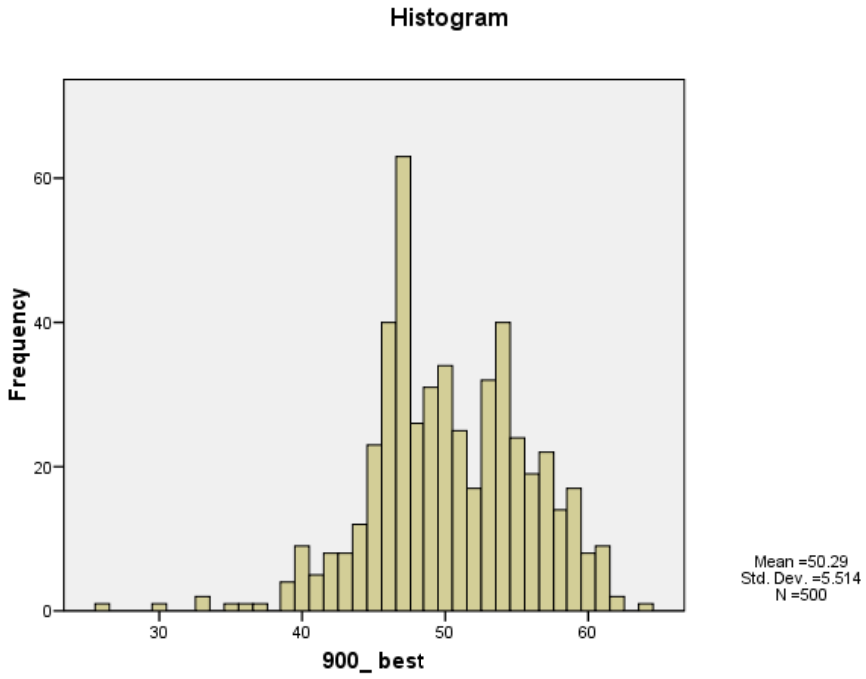
Graph 1 : No of samples and their best scores achieved at 1000 millisecond duration.



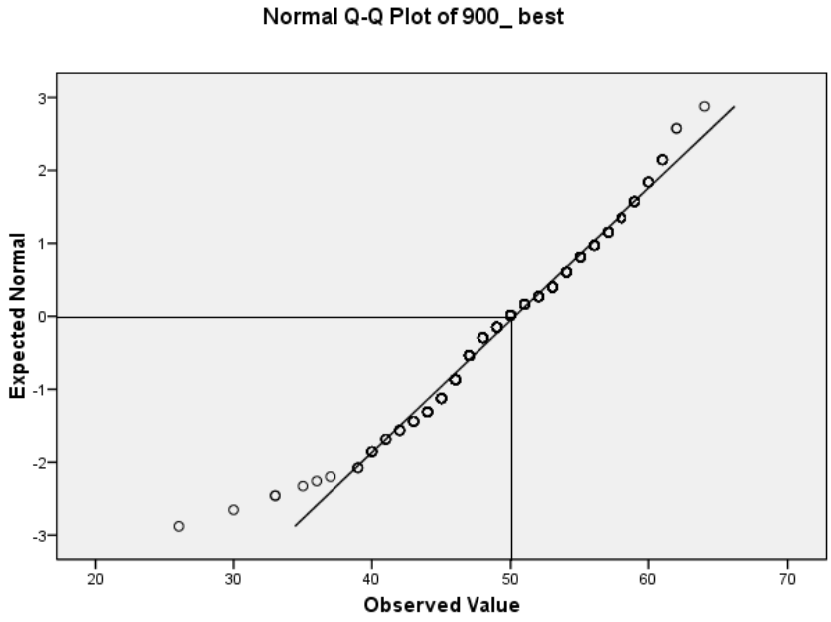
Graph 2 : The Q-Q plot for identifying the best intersection of the observed values at 1000 milliseconds



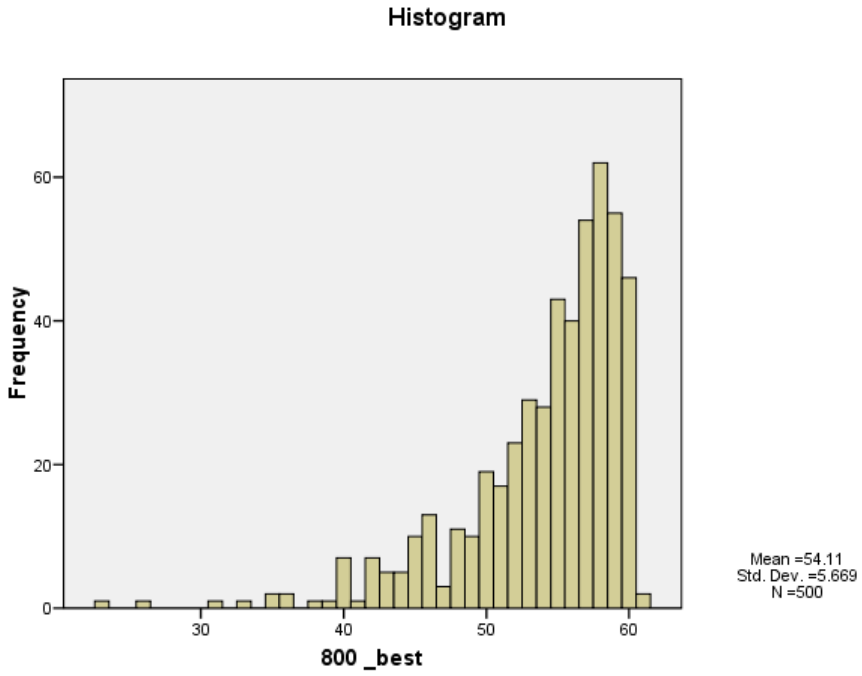
Graph 3 : No of samples and their best scores achieved at 900 millisecond duration



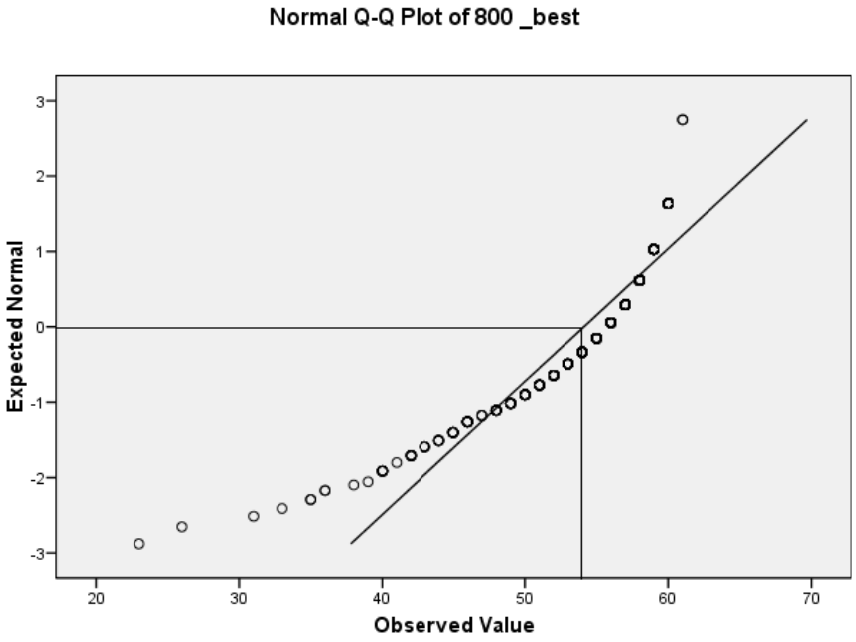
Graph 4 : The Q-Q plot for identifying the best intersection of the observed values at 900 milliseconds



Graph 5 : No of samples and their best scores achieved at 800 millisecond duration.



Graph 6 : The Q-Q plot for identifying the best intersection of the observed values at 800 milliseconds



DISCUSSION

The study was done to find out the reaction time for various time intervals and to propose for the normative data for three different sequences. The total number of subjects was selected for the study is 500. New reaction time board has 3 different sequences i.e. 1000, 900, 800 milliseconds.

250 male and 250 female were included in the study. However, not analysed individually.

Duration	Poor	Fair	Good	Very good	Excellent
1000	< 41 – 43	44 – 45	46 – 53	54 – 58	59 >
900	< 41 – 43	44 – 46	47 - 53	54 – 57	58 >
800	< 42 – 45	46 – 51	52 – 56	57 – 58	59 >

The mean value for 1000 msec. is 52 and median of it is 53. For 900 msec. the mean value is 50 and median is 50.however, mean value for 800 msec. is 54 and median is 56.

Based on this, normative values for 1000 msec : 46 – 53 is considered as good as mean is 52 so, maximum number of people have done it. Those who scored better than it, is considered to be very good. People who scored below 46 were considered as fair and 44 and below is poor and those who scored above 59, they were categorise as excellent.

Normative values for 900 msec. : 47 – 53 is considered as good as mean is 50 so, maximum number of people have done it. Those who scored better than it, is considered to be very good i.e. 54 to 57. People who scored below 46 were considered as fair and 44 and below is poor. People who managed to score above 58, were categorized as excellent.

Normative values for 800 msec. is : 52 – 56 is considered as good as mean is 54 so, maximum number of people have done it. Those who scored better than it, is considered to be very good. People who scored below 52 were considered as fair and 46 and below that is poor. Some people have managed to score above 59, they were categorized as excellent. This is the proposed normative data for new reaction time board.

This study also shows that reaction time vary because of sequences that subject performed. 6 sequences has been made to avoid learning bias.

Person who is performing first on 800 msec, may score less and the same person performing for 1000 msec at the end will get good score. This is because at first time person is not used to it, once he gets accommodate to it, there is decrease in reaction time.

CONCLUSION

The study was done to find out the normative data for three sequences. For 1000 milliseconds, 46 – 53 is good, 54 – 58 is very good, below 46 up to 44 is fair, 43 and below is poor and 59 and above is excellent. For 900 milliseconds, 47 to 53 is considered as good, 44 – 46 is fair, blow 44 it is poor. 54 – 57 is very good and 58 and above is excellent. For 800 milliseconds, 52 to 56 is good, 57 – 58 is very good, below 52 up to 46 it is fair, 45 and below is poor and 59 and above it is considered as excellent.

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