INFLUENCE OF DISTRACTIONS ON AUDIO AND VISUAL REACTION TIME IN YOUNG HEALTHY INDIVIDUAL OF 19-26 YEARS

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ABSTRACT

Background: Reaction time is a measure of function of sensori, motor co-ordination and it is one of the valid and reliable tools for assessing cognitive functions. **Purpose:** The purpose of this study was to determine the influence of distractions on auditory and visual reaction time. **Methodology:** Testing was performed using a reaction time programmer developed with the help of JavaScript. 50 healthy participants (47 girls and 3 boys) aged between 19-26 years were exposed to different distractions (conversation, slow music, fast music and texting) in both ART and VRT tests. **Results and Conclusion:** Both auditory and visual reaction time with each distraction was found longer than normal. Auditory reaction time was maximally affected by conversation (f-value 8.27 and p-value <0.0001), whilst Visual reaction time was maximally affected by texting (f-value 8.71 and p- value <0.0001). By understanding the influence of distractions on reaction time the present study proposes that these distractions can be used as a progression in reaction time training thus improving the sensor-motor co-ordination.

Keywords: Auditory reaction time, Distractions, Sensori-motor co-ordination, Visual reaction time

INTRODUCTION

The modern era can aptly be called the era of speed and competition for which cognitive functions must be assessed and improved [1]. Reaction time is one of the valid and reliable tools for assessing cognitive functions [2] and is the measure of function of sensori-motor association [3]. Thus, it is defined as a time from the onset of the stimulus to the occurrence of appropriate voluntary response and is calculated in milliseconds (ms) [1]. Reaction time is about the simplest case of timing and includes the time required for the 'activation of the sense organ concerned, Afferent impulse to be transmitted to the brain, central processing within the brain, efferent impulse to be transmitted from the brain to the effectors organ and the activation of the effectors organ' to an extent that the recordable response is produced.

For about 120 years, the accepted figures for mean simple reaction times for college-age individuals have been about 190 ms (0.19 sec) for visual stimuli and about 160 ms for auditory stimuli [4]. But normal Indian values for ART is 332ms and for VRT is 357ms [1].

Types of reaction time experiment can be simple, choice and recognition. In simple reaction time experiments, there is only one stimulus and one response, 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. In recognition reaction time experiments, there are some stimuli that should be responded to, and others that should get no response [4].

Execution of functions involves multiple brain processes and consequently is the cognitive domain that is most difficult to assess. Mini Mental Status Examination (MMSE) has been widely used to assess cognitive functions but MMSE have focused on global cognitive outcomes. Thus the present study seeks to measure Reaction time which focuses on specific domain of cognitive functions like short-term memory, execution of function and processing speed [6].

R.T. varies according to the receptor system stimulated and R.T. for visual stimuli is appreciably slower than auditory stimuli [3]. But there is lacunae of literature about the potential of factors influencing the reaction time thus the current study determines the variation in RT in presence of the modern distractions like conversing, music and texting, and whether R.T. varies with the receptor system involved or not.

MATERIALS & METHODS

Study design: It was an observational study

Ethical approval: Ethical approval was obtained from the Institutional Ethical Committee of our institute and

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written inform consent was taken after which the whole procedure was explained to the subject.

Study location: V.S.P.M's college of Physiotherapy, Nagpur.

Inclusion criteria: Normal Healthy individuals aged between 19-26 years, both males and females chose according to the method of convenience

Exclusion criteria: Any subject with uncorrected visual deficit, hearing deficit, neurological disorder or experienced a recent trauma or surgery were excluded from the study.

Sample size: Done in 50 subjects (47 girls and 3 boys)

Methodology

Software was developed using JavaScript and installed in the laptop. Subjects were recruited as per the inclusion criteria. Whole test was performed in otherwise quiet room with one minute of time gap between each section and two tests. One trial was given to every subject so that subject becomes familiar with the software. First auditory reaction time testing was done under the five section i.e. Normal or controlled ART, Conversation ART, Slow music ART, Fast music ART and lastly Texting. Subject was instructed to press space bar as quick as he can after he hears the beep. Four repetitions were done in each section and average of four was taken into consideration. After one minute of completion of ART test the visual reaction time testing was done in a similar pattern. In this test subject was instructed to press the space bar as fast as he can after a shape appears on screen [1, 5]. Average of four repetitions in each section was recorded.

Statistical analysis: Data was collected and analyzed. One- way ANOVA test was applied within the group and paired t-test was used to determine comparison between ART and VRT group.

RESULTS

Influence of distractions on Auditory and Visual reaction time was assessed in normal healthy 47 girls and 3 boys of mean age 22.36 ± 1.53.

Table 1. Shows mean and standard deviation of ART group.

Sections	Mean ±SD
Normal ART (m.sec)	331.61 ± 79.25
ART while conversing (m.sec)	1414.17 ± 1110.23
ART with slow music (m.sec)	886.10 ± 721.55
ART with fast music (m.sec)	579.85 ± 385.01
ART while texting (m.sec)	982.38 ± 483.33

Table 2. Shows comparison of normal ART to ART with various distractions.

Comparison	Mean difference	f- value	p- value
Normal ART to ART while Conversing	1083	8.27	<0.0001
Normal ART to ART with slow music	554.5	4.236	<0.0001
Normal ART to ART with fast music	248.2	1.897	Ns
Normal ART to ART while Texting	650.8	4.972	<0.0001

Table 3. Shows comparison of various distractions in ART group.

Comparisons	Mean Difference	f- value	p- value
Conversation ART to Slow music ART	528.1	4.035	< 0.0001
Conversation ART to Fast music ART	834.3	6.374	<0.0001
Conversation ART to Texting ART	431.8	3.299	<0.0001
Slow music ART to Fast music ART	306.3	2.340	Ns
Slow music ART to Texting ART	-96.28	0.7356	Ns
Fast music ART to Texting ART	-402.5	3.075	<0.0001

Table 4. shows mean and standard deviation of VRT group.

Sections	Mean ±SD
Normal VRT (m.sec)	382.09 ± 96.86
VRT while conversing (m.sec)	842.83 ± 616.52
VRT with slow music (m.sec)	565.10 ± 367.73
VRT with fast music (m.sec)	442.81 ± 138.41
VRT while texting(m.sec)	1216.81 ± 777.22

Table 5. Shows comparison of normal VRT to VRT with various distractions.

Comparison	Mean difference	f- value	p-value
Normal VRT to VRT while Conversing	460.7	4.808	<0.0001
Normal VRT to VRT with slow music	183	1.910	Ns
Normal VRT to VRT with fast music	60.72	0.6336	Ns
Normal VRT to VRT while Texting	834.7	8.710	<0.0001

Table 6. Shows comparison of various distractions in VRT group.

Comparison	Mean Difference	f-value	p- value
Conversation VRT to Slow music VRT	277.7	2.898	< 0.0001
Conversation VRT to fast music VRT	400.0	4.174	< 0.0001
Texting VRT to Conversation VRT	374	3.902	< 0.0001
Slow music VRT to Fast music VRT	122.3	1.276	Ns
Texting VRT to Slow music VRT	651.7	6.801	< 0.0001
Texting VRT to Fast music VRT	774	8.077	< 0.0001

Table 7. Shows inter-group comparison between ART and VRT group.

Comparison	Mean Difference	t- value	p- value
Normal VRT to Normal ART	50.49	3.376	0.0014
Conversation VRT to Conversation ART	-571.3	3.616	0.0007
Slow music VRT to Slow music ART	-321	3.925	0.0003
Fast music VRT to Fast music ART	-137	2.571	0.0132
Texting VRT to Texting ART	234.4	2.009	0.0500

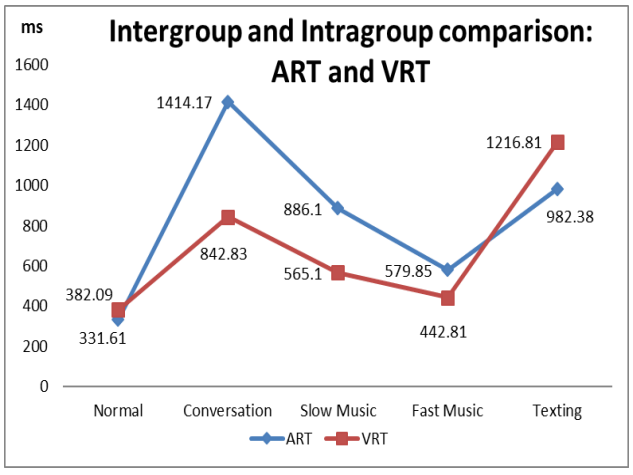

Figure 1. Shows intra-group and inter-group comparison between ART and VRT.

DISCUSSION

The present study has determined the influence of distractions on audio and visual reaction times in young healthy individual of 19-26 years by using a reaction time programmer designed on the basis of JavaScript.

Reaction time is a simple, non invasive method to assess neural integrity and sensori-motor coordination of an individual. Many factors have been shown to affect RT, including age, gender, physical fitness, fatigue, distractions, alcohol, personality type and whether the stimulus is auditory or visual [1].

Distraction: The responder's mental processing time, however, is highly subject to change in the presence of distractions that add to his or her cognitive load. The higher a subject's cognitive load, the longer his or her mental processing time is expected to be [5].

Intergroup comparison: ART

The mean normal or controlled ART of the sample population came out to be 331.61 (Table 1). As conversing is an active listening process comprising of three elements namely, comprehension, retention and response that increases the mental processing time and which in turn can increase the RT, thus in the present study conversation is affecting ART. It can be also because of decreased activation of parietal association area which may be due to auditory processing. Hence in the present study ART is maximally affected by the conversation with the mean of 1414.17 and p-value of <0.0001 (Table 2). ART is affected by all the distractions and the sequence of distractions affecting ART can be represented as, **"Conversation (1414.17) > Texting (982.38) > Slow music (886.10) > Fast music (579.85)"** (Table 3). As music is a passive listening process, fast music has cause a non-significant increase in ART whereas slow music has cause the minimal increase. This finding is supported by the study done by Majinder Kaur et al [7] in 2013 and Mariam Abbas [8] in 2012.

Intergroup comparison: VRT

The mean of normal VRT in the present study was 382.09 (Table 4). Ellen Anderson [5] in 2012, Chinmay Shah et al [9] in 2010 and Mariam Abbas [8] in 2012 found that VRT is highly susceptible to increase with texting, as the cognitive distraction from a text message is similar to active listening; the person must comprehend the message, retain its information, and develop a response. To complete this task brain has to switch continuously between two visual stimuli which increases the time of responding to each visual stimuli and thus increases the reaction time. Therefore the sequence of distractions affecting VRT can be represented as **"Texting (1216.81)> Conversation (842.83)> Slow music (565.10)> Fast music (442.81)"** (Table 5, 6).

Intra-group comparison between ART and VRT:

When intra-group comparison was done between ART and VRT group, normal VRT is non-significantly slower than normal ART with mean difference of 50.49 (Table 7) (Figure 1). It can be justified by the fact that visual stimuli needs 20-40ms to reach the brain whereas auditory stimuli needs only 8-10ms [10]. Jose Shelton [10] in 2010 have also showed the similar result. It is also seen that ART is more vulnerable to increase with distractions than VRT (Figure 1). This finding is in parallel with the findings presented by Ellen Anderson [5] in 2012.

Age: Obrist W [11] in 1953 determined the influence of age on speed of reaction time and found out that the reaction time shortens from childhood into early 20 (19 -26 years) and then increases slowly until 40s. It was shown that speed increases with age up to the nineteenth year and then remains constant till about 26 years of age and then begins to decline as age advances further [14]. Thus the current study has checked the extent to which distractions have affected the RT only in individual aged between 19-26 years.

Suggesting Hypothesis*:* The information flow within an organism can be represented as:

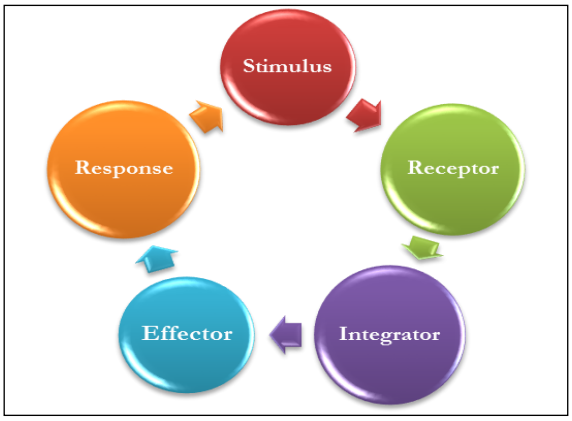

Figure 2. The cycle above represent the sequence of information flow in an organism.

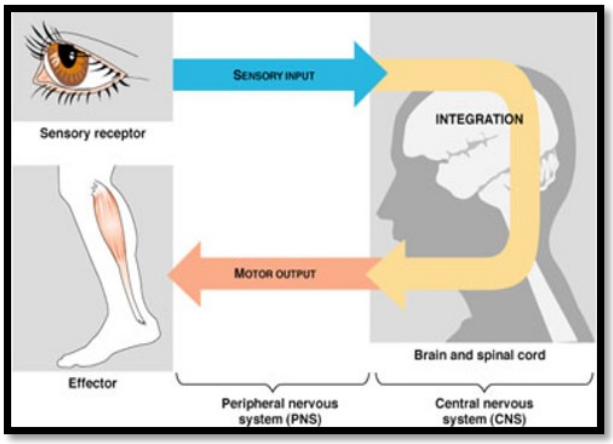

Figure 3. Shows organization for information processing [14]

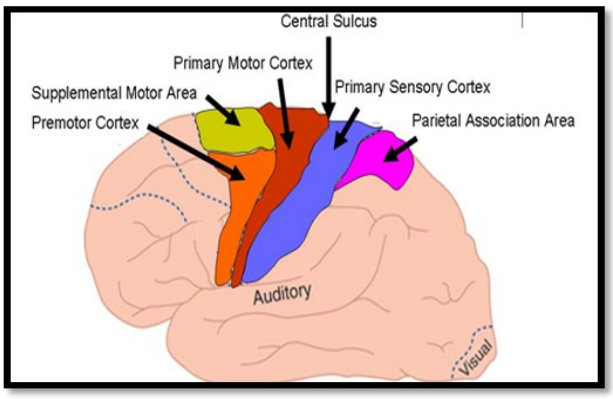

Figure 4. Shows Primary sensory motor areas

- The integration of information takes place in the area of brain called Primary Motor Cortex (area 4), Shown in Figure 4
- The primary role of Motor cortex is to generate the neural impulse that controls the Execution of Movement via Extra-pyramidal tract.
- Neurons from primary motor cortex, Supplemental motor area and pre-motor cortex (Figure 4) give rise to the Extra-pyramidal tract controlling the voluntary movement.
- The blood supply of Primary Motor Cortex is Middle cerebral artery and anterior cerebral artery.
- Thus we can hypothesize that any condition compromising the blood supply of motor cortex can lead to disturbed sensori-motor coordination and increased reaction time, for instance Stroke and Traumatic brain injury [12].
- It is also affected in Parkinson disease primarily because of delay in information processing [13].

CONCLUSION

The study concluded that ART is maximally affected by conversation and VRT by texting and that VRT is non-significantly slower than ART. Also ART is more vulnerable to increase in presence of distractions.

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