World Journal of Pharmaceutical ReseaRch
SJIF Impact Factor 5.045
Volume 3, Issue 8, 362-371. Research Article ISSN 2277 – 7105

EFFECT OF DISTRACTION ON CHOICE REACTION TIME IN NORMAL FEMALES AND MALES

***Dr. Pranjali C Shinde, Dr. Pushpa A Pazare**

Department of Physiology Padmashree D Y Patil Medical College,

Sector-5, Nerul, Navi-Mumbai, 400706.

Department of Physiology Seth G S Medical College & KEM Hospital, Parel East,

Mumbai, 400012.

Article Received on
08 August 2014,

Revised on 30 August 2014,
Accepted on 24 Sept 2014

***Correspondence for Author**
Dr. Pranjali C Shinde
Department of Physiology
Padmashree D Y Patil
Medical College, Sector- 5,
Nerul, Navi-Mumbai.

ABSTRACT

This study compared effects of Distraction on Choice Reaction Time in males and females. Audiovisual Choice Reaction Time was studied in 100 Medical students (50 Males and 50 Females) age range 17-19 years using a 608 Audiovisual Reaction Timer. Five stimuli viz Red, Green and Yellow lights and High and Low pitch sounds were presented at random and the subjects were asked to respond by pressing an appropriate button on the subjects' panel with index finger of their dominant hand. The statistical significance was determined by Students "Unpaired' test" for comparisons between males and females and Paired t' test" for comparison among themselves. Choice Reaction Time to Light and sound increased in cases of distraction in both males And Females respectively and the result were statistically significant.

KEY WORDS: Choice Reaction Time Distraction.

INTRODUCTION

In today's fast-paced world of digital technology the role of time in our lives has become extremely crucial, not only for the growth but also for the survival of the human being. The Olympic Games and even cricket most popular in India are testimony to the fact that the tests for speed of reaction and of movements are as necessary as the sports themselves. Even if we consider the routine mundane activities of everyday life we can see that today's man work invariably in complex setups, where he is required to react to a variety of situations or changes in the external environment promptly and correctly. He has to make choices in

responding appropriately to these changes and he also has to keep himself mentally and physically prepared to any unpredictable events to deal them efficiently.

Simple reaction time experiments involve presenting a uniform stimulus and requiring response. Thus, in simple reaction time tasks only one stimulus is presented which commands a single response. E.g. Spot the dot and reaction to sound all measure simple reaction time.
Choice reaction (Disjunctive reaction time) experiments involve presentation of multiple stimuli calling for specific response. Thus in choice reaction time tasks, several stimuli (minimum two) are presented and the subject is required to respond correspondingly e.g. pressing a key in response to the appearance of a particular light on screen. In choice reaction tasks the subject has to discriminate between various stimuli and make a choice amongst responses, which requires differentiation.

Determination of reaction time has important implications in sports physiology; since performance of an athlete is directly linked with duration of reaction time and can be used as an index of cortical arousal it can form an easy noninvasive test. [1]
In the present study we study the factor affecting Choice Reaction Time. The factor is Mental Fatigue. This factor was explored on the basis of Light and Sound, which would make a clear picture to understand the mental state of an individual with the help of detailed analysis of the various responses given by the individual. The detailed analysis of responses to various stimuli can be determined with the help of Reaction Timer. It was studied by employing Choice Reaction Time measured with the help of Audiovisual Reaction Timer.

MATERIALS AND METHODS

One hundred subjects were studied (50 Males & 50 Females) from the first year M.B.B.S., first year occupational therapy and first year physiotherapy students. After the volunteers were declared to be free from any impairment a basic General examination was carried out. Having been screened thoroughly the Auditory and Visual reaction time was evaluated in Department of Physiology.

Procedure

Training sessions: All subjects were thoroughly acquainted with the operation of the apparatus. Before conducting the actual tests 20 to 30 practical sessions were given to each subject over a period of one week maintaining the experimental conditions with regards to the

time and place of the test. Emphasis was laid on accuracy of response to minimize the error rate.

Apparatus: Reaction Timer – 608 Audiovisual Reaction Timer was used in this study. Display has 3 different types of light and sound on either side. Three visual stimuli red, green, and yellow color light and three auditory stimuli low, moderate, and high pitch sound system with independent operation are provided. The operating channel on the "Experimenter's side" consisted of red, green, and yellow lights. Digital time display in middle, below which a press button "Reset to Zero" press button and low, moderate and high pitch sound buttons are provided. The operating channel with middle partition, which is sloping on both sides, consisted of red, green and yellow lights and low, moderate and high-pitched sound buttons. A power ON and OFF button is present on the side of the instrument. Headphone is provided along with apparatus for clarity of sound.

Test procedure: Four practice trials were given each time before reading. Before presenting the stimulus a ready signal or warning in the form of a verbal instruction READY was given. Five stimuli viz Red, Green and Yellow lights and High and Low pitch sounds were presented at random and the subjects were asked to respond by pressing an appropriate button on the subjects' panel with index finger of their dominant hand.

Five readings were recorded for each stimulus and their respective average was calculated. Choice Reaction Time to Distraction was recorded after a MAZE work was given to each subject where they were asked to connect with the left hand the numbers on the maze outlined on a paper kept before them, while with the right hand he reacted as before when the signal was heard or visible.

Data analysis: The statistical significance was determined by Students "Unpaired 't' test" for comparisons between males and females and" Paired 't' test" for comparison among themselves.

Table 1. Comparison of Choice Reaction Time to Red, Green & Yellow light before & after Distraction in both males & females.

Stimuli		Mean		SD		T-value		P-value		Difference is	
		F	M	F	M	F	M	F	M	F	M
Red Light	Control	0.38	0.37	0.06	0.06	--13.992	--16.023	9.67E-19	4.07E-21	Significant	Significant
	Distraction	0.56	0.56	0.10	0.10						
Green light	Control	0.45	0.46	0.05	0.06	-9.570	-8.775	8.47E-13	1.28E-11	Significant	Significant
	Distraction	0.60	0.59	0.10	0.11						
Yellow light	Control	0.45	0.47	0.07	0.07	-13.449	-7.388	4.55E-18	1.67E-09	Significant	Significant
	Distraction	0.64	0.60	0.08	0.09						

SD-Standard deviation, M-Male, F-Female

In Table I Choice Reaction Time to Red, Green & Yellow Light when compared with control is increased in case of Distraction and the difference is statistically significant.

Table 2. Comparison of choice reaction time to High & Low pitch sound before & after Distraction in both males & females.

Stimuli (sound)		Mean		SD		T-value		P-value		Difference is	
		F	M	F	M	F	M	F	M	F	M
High pitch	Control	0.34	0.33	0.05	0.06	-14.159	-16.062	6.07E-19	3.68E-21	Significant	Significant
	Distraction	0.52	0.51	0.10	0.10						
Low pitch	Control	0.37	0.36	0.05	0.06	-19.545	-19.988	8.81E-25	3.56E-22	Significant	Significant
	Distraction	0.55	0.55	0.04	0.09						

SD-Standard deviation, M-Male, F-Female

In Table II Choice Reaction Time to High Pitch and Low Pitch Sound increased in case of Distraction in both Males and Females respectively. Result was statistically significant.

Table 3. Gender wise comparison of Choice reaction Time after Distraction.

Control-	Gender				Unpaired T-test		
	Female		Male				
	Mean	SD	Mean	SD	T-value	P-value	Difference is
Light-Red	0.56	0.10	0.56	0.10	-0.067	0.946	Not significant
Light- Green	0.60	0.10	0.59	0.11	-0.583	0.562	Not significant
Light- Yellow	0.64	0.08	0.60	0.09	2.715	0.008	Not significant
Sound-High pitch	0.52	0.10	0.51	0.10	0.111	0.912	Not significant
Sound-Low pitch	0.55	0.10	0.55	0.09	0.041	0.968	Not significant

In this Table showing Choice Reaction time after distraction, the difference in Choice Reaction Time results in both sexes is not statistically significant but if we see the readings Reaction Time in Males is definitely less than Females by 0.01 seconds. If we compare the color of lights Reaction Time is least to Red Light followed by Green and then yellow.

In case of sound reaction Time is less for High pitch sound than for low Pitch.

DISCUSSION

Most of our reactions in life are not like the Simple Reaction experiments. It is seldom in everyday life that we can be so sure of what is going to happen as to set ourselves to react automatically at maximum speed. Greater the complications, longer the reaction time [2]. Cognitive function refers to an individual's ability to think and reason in terms of temporal and spatial relationships and in symbols such as words and number.

Psychomotor function (sometimes called perceptual motor function) refers to an individual's ability to co-ordinate timely and appropriate responses to stimuli. Cognitive and psychomotor functions are not discrete; they overlap to the extent that the stimuli require thought. For example Simple Reaction Time test is usually considered a psychomotor test but if the stimuli are complex and require decisions about how to respond then the test becomes more cognitive. Choice Reaction Time has a longer latency than the simple reaction, measuring about 20-200milliseconds longer than the simple reaction time. This difference is the time required for mental processes such as discrimination and choice. [3] As the number of different stimuli is increased Choice reaction Time increases even though no response

selection is involved in such a task. [5] In this study Choice Reaction Time tasks were employed instead of simple reaction time tasks. The average values of the Visual and Auditory reaction times in both the sexes are slightly higher than the standard values. Further if we see the readings for visual and auditory stimuli the readings for auditory are less than for visual stimuli. So in our study Choice Reaction Time to Auditory stimuli is less than for Visual stimuli. In choice reaction time there is uncertainty as to the nature of stimulus to come and consequently of the response to be given. Paul Bertelson (1960) performed experiments and got choice reaction time to visual stimuli as 0.38, 0.42, 0.36 seconds as the average reaction time. [5] Boring et.al 1955 has accepted visual reaction time as 0.150-0.225seconds and auditory reaction time as 0.120-0.185seconds.[2] Sanford in 1968 postulates a more central relative slowness in the processing of visual signals.

David M Green1984 (6) and Madan Mohan in 1984 [7] got similar results after studying visual and auditory choice reaction times and concluded that auditory reaction times are faster than visual reaction times. This study supports our hypothesis this difference in overall speed simply reflects the difference in the ability to detect the auditory and visual stimulus. Compared with the ear, the eye takes longer time to get its message started along the nerve to the brain. This probably accounts for the difference in the auditory and visual Reaction Times. [3]

Further as we compare the overall readings between Males and Females we got that males reacted faster than females though our result is not statistically significant.

Following authors support our findings:

1. Botwinick and Brin 1962 found that young men were quicker than young women. [8]
2. Blaine and Baker 1964 studied age and sex parameters in psychomotor learning. According to their study males performed significantly faster than females. [9]
3. In 1962 J.D Pathak found that Female medical students show a slightly longer reaction time than that of Male medical students. [10]

Further as we studied the effect of color of light we found that Visual Reaction Time to Red light is faster as compared to Green and Yellow light in both the sexes. This observation is in agreement with the findings of Shenvi & Balasubramanian, 1994. This can be explained on the basis of the Trichromatic theory of color vision. When tomita & co-workers illuminated the retina with microelectrode penetration of a single cone, they found that 74% of units

peaked in the Red spectrum, 16% in the Blue spectrum &only 10% in the Green spectrum. [11, 12, 13]

Cattell 1887 studied Reaction Time given by different colors and found that Reaction time for Red and Green color is almost similar whereas reaction time for yellow color was more. [14, 15, 16] In our study we studied Choice reaction Time with maze work as a distractor and found that Choice Reaction Time to both auditory and visual stimuli in both males and females increased as a result of Distraction.

Bomermann 1942 paired a mental arithmetic with a task in which the subject had to dot with a stylus through holes in a paper band passing over a drum. He found that the speed accuracy of one or other or both lowered than when the tasks were carried out separately. [17]

Mow bray 1952, 1953, 1954, whose subjects were required to report on data such as letters, digits or prose passages presented either visually or aurally. He found that subjects could not deal adequately with two different streams of information at the same time. [18]

Boring and Land field 1955 found that distraction usually lengthens Reaction Time, but sometimes the supposedly distracting stimulus acts as a spur and decreases reaction time. [19] Kalsbeek 1964 noted that subjects in double task experiments tended to build up a rhythmic pattern of performance in which the two tasks were regularly interdigitated and impairment produced by combining two tasks was reduced. Interference will depend on the extent to which each task requires active choice of responses and on the compatibility between signals and responding actions [17].

Broad bent 1971 suggested that sensory stimulation might capture attention momentarily and thus cause interference with performance. As a result reactions are frequently delayed and smooth flow of continuous performance may be interrupted. [20] Ruth 1981 performed two experiments, which required subjects to devote attention not only to adding and carrying digits a type of problem solving but to storing these items in working memory as well. The effect of increasing demand for processing capacity was to reduce performance. Performance of both age groups declined as task difficulty increased, with the decline being greater and more rapid for older subjects. [21]

P.P Mehrotra 1986 studied the effect of distraction on auditory and visual Reaction Time and found that the reaction Time was considerably prolonged with distraction. [22]

Connelly et.al 1991 indicated that younger adults were slightly disrupted when reading passages with distraction. Distractions placed in unpredictable locations would be more disruptive than in predictable locations. [23] Carlson 1995 studied the distraction and benefits of predictable events. He found that presence of distraction and positioning of distraction in unpredictable event lengthened Reaction Time. [24] D Esposito et.al found that dual performance of a verbal and a spatial working memory task was associated with prefrontal and cingulated cortex activity that was not seen in single task condition. Activation in these executive areas may reflect involvement of a hypothetical supervisory attention system or central executive. [8, 25]

Chen 1996 studied the effect of divided attention in adults and old. Both old and young had a significantly increased risk of obstacle contact while negotiating obstacles when their attention was divided but dividing attention degrade obstacle avoidance abilities of old significantly more than did in the young. [26]

Passing ham 1996 studied the effect of cognitive factors on sensor motor activation. Experiment shows that reducing attention to finger movement by asking subjects to perform a concurrent counting task is associated with decreased bold signal in motor cortical region, compared to signal evoked by performing the movement without distraction [27].

Jueptner 1997 concluded that dividing attention from movement causes a decrease in activation in sensorimotor areas including sensory motor area, cingulated motor areas and insula. Majority of subjects showed a smaller response in contra lateral primary motor cortex in dual task compared to single task. [28] Gold Berger and Klinberg 1998 in a number of studies found that dual task performance tends to be associated with decrease in task related rather than increase or recruitment of additional areas. [29, 30] Monicque 2002 studied that Choice Reaction Time increased in dual task performance compared to single task performance. [31]

CONCLUSIONS

The results obtained were statistically significant. In both Males and Females Choice Reaction Time after Mental Fatigue was increased. On comparing the Visual and Auditory reaction time readings the auditory Reaction Time was less compared to Visual Reaction Time in both Males and Females. On comparing Choice Reaction Time in Males and Females the difference was not statistically significant but, the readings in Female all over are

definitely more than Males. It was concluded that the increased Choice Reaction time with Distraction is due to interference with performance as a result of which Reactions are delayed and smooth flow of continuous performance is interrupted.

REFERENCES

1. Chakraborty, Ghosh and Sahana. Physiological aspects of yogi's discipline. *In Ghost HN Ed 2 Human Physiology, Calcutta: New Bookstall,* 1984; 1234-1235
2. Boring and Land field. Foundations of Psychology 7th Edition 1955, Chapman London 1955; 176-479
3. Woodworth and Schlosberg-Distraction. *Experimental Psychology,* 84-90.
4. Warren. H. Teichner and Marjorie. Krebs. Laws of Visual choice Reaction time. *Psychological Review,* 1974; 81(1): 75-98
5. Paul Bertelson, JeanPaulBoons. Time uncertainty and Choice Reaction Time. Psychology, *Nature,* 1960; 187:531.
6. David M. Green and Susane M. VonGierke. Visual and Auditory choice reaction times. *Acta Psychologica,* 1984; 55:231-247.
7. Madanmohan, D. P. Thombre, AshokkumarDas, N. Subramanian and S. Chandrashekhar. Reaction time in clinical Diabetes Mellitus. *Indian Journal of Physiology and Pharmacology,* 1984; 28(4): 311-314.
8. Jack Botwinick and Larry. Thompson. Components of Reaction Time in relation to Age and Sex. *The Journal of Genetic Psychology,* 1966; 108: 175-183.
9. Blaine L. Baker and Thomas A. Jones. Age and Sex parameters in psychomotor Learning. *Perceptual and Motor skills,* 1964; 19:935-945.
10. Dixit, T. B, Amin, M. G and Pathak, J. D. Assessment of Mental Alertness after various Phenothiazines. *Journal of Indian Medical Association,* 1964; 42: 173-175.
11. Best and Taylor Physiological Basis of Medical Practice. 11th Edition. 420-421.
12. Devalios R. L. Central mechanisms of color vision. *Handbook of sensory Physiology vol. V11/3A: Central Visual Information, edited by R. Jung Heidelberg, FRG: Springer,* 1973: 209-253.
13. Devalios. R. L. Color vision mechanisms in Monkey. *Journal of General Physiology,* 1960; 43:115-128.
14. Cattell, J.MCk *Mind*.1886; 11; 63-65:220-242,377-392,524-538.
15. Cattell, J.Mck *Mind*.1887; 2:68-74.
16. Cattell, J.Mck**.** *Philos.studies*.1888; 4:241-250

17. Welford, A. T. Introduction: An Historical background sketch in Reaction Time. A. T. Welford (Ed.), 1980; *Academic Press, New York*: 1-24.
18. Mowbray, G. Hand Rhoades, M.V. On the reduction of Choice Reaction Time with practice. *Quarterly Journal of Experimental Psychology*, 1959; 11:16-23.
19. Boring and Land field. Foundations of Psychology 7th Edition 1955, Chapman London pp60-61, pp476-479
20. Broad bent, D.E Decision and Stress. *Academic press London.* 420-421.
21. Ruth E. Wright, PhD. Aging, Divided Attention and processing capacity. *Journal of Gerontology*, 1981; 36(5): 605-614.
22. P. P. Mehrotra and J. D. Pathak. Reaction Time-Effect of Interference on. *The Bombay Hospital Journal*. 1986; 28(3): 59-62.
23. Carlson, Hasher and Zacks. The impact of distraction. *Psychology and aging* 1991; 4:533-54.
24. Carlson, Hasher and, Zacks, Connely.Aging, Distraction and the benefits of predictable location. *Psychology and Aging* 1995; 10:427-436.
25. D' Esposito, M, Detre, J.A. Alsop, D.C, Shin R.K. atlas and Grossman M. The neural basis of the central executive system of working memory. *Nature* 1995; 378:279-281.
26. Chen Hc, Schultz AB, Ashton-Miller JA Stepping over obstacles: Dividing attention impairs performance of old more than your adults *Journal Gerontol Biol Sci Med Sci* 1996; 51(3): 116-122
27. Passingham, R.E.Attention to action. *Philos Trans R Soc Lond B Biol Sci 1*996; 351:1473-1479.
28. Jueptner, M, Stephan, K.M.Frith, C.D.Brooks, D.J, Frackowiak and Passingham, R.E.Anatomy of motor learning frontal cortex and attention to action. *Journal of Neurophysiology* 1997; 77:1313-1324.
29. Goldberg, T.E, Berman, K.F. Fleming K, Ostrem, J, Vanhom, J.D. Esposito. Uncoupling cognitive workload and prefrontal cortical physiology A PET or CBF study. *Neuroimage* 1998; 7:296-303.
30. Klingberg T. Concurrent performance of two working memory tasks: potential mechanism of interference. *Cerebral cortex* 1998; 8:593-601.
31. Monicque M. Lorist, Daniel Kernell, TheoF. Meijman and Inge Zijdewind. Motor fatigue and cognitive task performance in humans. *Journal of Physiology* 2002; 541(1): 313-319.