A Comparative Study Of Choice Reaction Time In Young Males And Females

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Abstracts: Background and objectives: The reaction time has been known as an important psychophysical method useful for relating mental events to physical measures. Also it has been utilized as an index of sensory, motor and cognitive processes since the inception of the study of behaviour as a laboratory science. So the present study was undertaken to observe and compare the responses of young males and females in predictable and unpredictable environmental setting by employing choice reaction time tasks with constant fore-period of 2 seconds and randomly occurring variable fore-periods of 0.6, 2, 4, 6 seconds. Methods: The choice reaction time tasks were performed for visual and auditory stimuli with constant and variable fore-periods using "Techno Digital Response Time" apparatus. The data were analyzed by Z test. $P< 0.05$ was considered significant. Results: It was observed that choice reaction times to visual as well as auditory stimuli were lesser in males than in females ($p < 0.001$) in both constant and variable fore-periods. It was also observed that auditory choice reaction time was shorter than visual choice reaction time. Conclusions: In conclusion, males have shorter reaction time than females. Males react faster than females to changes in the external environment and males are quicker in responding to the unpredictable situations. Choice reaction time (CRT) to auditory stimulus is shorter than that to visual stimulus in both males and females. [Narhare P et al NJIRM 2012; 3(5) : 84-88]

Key words: Choice-reaction time, constant fore-period, gender, variable fore-period

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Introduction: Reaction time is the time discrepancy between the moment of change in the environment and the beginning of your response. Reaction time is a measure of how quickly an organism can respond to a particular stimulus.[1] Reaction time has been widely studied, as its practical implications may be of great consequence, e.g. a slower than normal reaction time while driving can have grave results. Many factors have been shown to affect reaction times, including age, gender, physical fitness, fatigue, distraction, alcohol, personality type, and whether the stimulus is auditory or visual.

In psychometric psychology reaction time is considered to be an index of speed of processing[1] i.e. it indicates how fast the thinker can execute the mental operations needed by the task at hand. In turn, speed of processing is considered an index of processing efficiency. The behavioral response is typically a button press but can also be an eye movement, a vocal response, or some other observable behaviour. Average values of between 150 and 250 milliseconds are typically found, for example, where the subject must press a telegraph key when a light is flashed; however, under some conditions, reaction times even shorter than one hundred milliseconds and even longer than one second may occur. Reaction time provides a tool for measuring the amount of time required for mental operations, thus it sheds some light on the cognitive processes that take place between the presentation of specific information to an individual and his response to that information. Reaction time happens to be crucially important in the performance tasks that require rapid responses to a stimulus. This is the case in many activities of day to day life such as driving a car and is particularly important in most sports related activities such as boxing, football, tennis etc.

There are three basic types of reaction time experiments[2-5] - 1) Simple reaction time experiments: involve presenting a uniform stimulus and requiring a uniform response. Thus in simple reaction time tasks only one stimulus is presented which commands a single response. (e.g. spot the dot and react to sound; both measure simple reaction time). 2) Choice reaction time (Disjunctive reaction time) experiments: involve presentation of multiple stimuli each calling for a specific response. Thus in choice

reaction time tasks several (minimum two stimuli) 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 a screen). In choice reaction time tasks the subject has to discriminate between various stimuli and make a choice amongst responses which requires differentiation. 3) Associative reaction time experiments: involve responding in the form of verbal association to a stimulus which can be either verbal or pictorial. Many believe that males have a quicker reaction time overall than females. The present study was undertaken to confirm whether or not this claim is true.

Materials And Methods: The study was approved by ethics committee of the institute. We recruited hundred (50 males, 50 females); apparently healthy medical students aged 18-22 years. All subjects provided written informed consent. Participants were non-athletes, non-smokers, non-obese and non-alcoholics. Subjects were asked to refrain from tea, coffee, chocolates and caffeinated soft-drinks on the day of recording reaction time.

The TECHNO Digital Display Time apparatus (Make Techno Electronics, Model No. RT-411, Lucknow, India) was used to record the reaction times. Two visual stimuli of red and green lights and two auditory stimuli of different tones with independent operation are provided on it. The chronoscope is the four figure seven segment LED display with a least count of 00.01 second and a maximum display of 99.99 seconds. It operates on 220 volts, 50 Hz AC only. It has sloping operating panels on both the sides with a middle partition which effectively shields the operations on either side.

The operating panel on the Experimenters side consists of red and green visual stimuli lights, digital time display, power on-off press button and reset to zero press button. The bottom row has four press buttons – two for visual stimuli and two for auditory stimuli (in this study only auditory stimulus of high pitch sound was used). The operating panel on the subject's side consists of Red and Green visual stimuli lights and four press buttons, two for responding to visual stimuli & two for responding to auditory stimuli.

All the subjects were thoroughly acquainted with the operation of the apparatus. Before conducting the actual tests, 20 to 30 practice sessions were given to each subject over a period of a week, maintaining the experimental conditions with regard to the time and place of the test. Four practice trials were given each time, before recording actual reading. Before presenting the stimulus a "Ready signal or Warning signal" in the form of a verbal instruction "Ready" was given. Three stimuli viz. red and green coloured lights and one sound of high pitch were presented at random by pressing an appropriate button on the subject's panel with the index finger of their dominant hand. The tests were conducted between 3:30 PM and 4:30 PM in a quiet secluded room.

First, a constant fore-period (time interval between the ready signal and the presentation of the actual stimulus) of 2 seconds was maintained. Thus stimuli were presented at random but every time the interval between the ready signal and the presentation of stimulus was kept constant at 2 seconds. Four readings were recorded with each stimulus and their respective averages were calculated.

Second, for performing the tests randomly occurring variable fore-periods of 0.6 second, 2 seconds, 4 seconds, 6 seconds duration were used. Thus two visual stimuli and one auditory stimulus were randomly presented in such a way that every time the stimulus was preceded by any of the above mentioned fore-periods with equal probability. Four readings with each stimulus in each of the fore-period categories were recorded. The respective averages of the choice reaction time to the three stimuli were calculated for each of the categories of fore-periods i.e. with fore-periods of 0.6 second, 2 seconds, 4 seconds, 6 seconds.

Statistical analysis: Data are presented as means ± SD and analysed using the Z test. *P* values < 0.05 were considered as significant.

Results: It was observed that males responded faster than females. Choice reaction times to visual as well as auditory stimuli were shorter in males than in females (p < 0.001) in both constant and variable fore-periods. Choice reaction times to auditory stimulus were shorter than that to visual stimulus in both males and females (Tables 1-5).

Table-1. Choice reaction time with constant fore-period of 2 seconds

Choice Reaction Time	Males (in seconds) Mean ± SD	Females(in seconds) Mean ± SD	*P* Value
Visual -Red	0.42402±0.01372	0.52059±0.00757	< 0.001*
Visual-Green	0.5201±0.00957	0.62258±0.00821	< 0.001*
Auditory	0.31611±0.01112	0.41066±0.0027	< 0.001*

*highly significant

Table-2. Choice reaction time with variable fore-period of 0.06 seconds

Choice Reaction Time	Males (in seconds) Mean ± SD	Females(in seconds) Mean ± SD	*P* Value
Visual -Red	0.4102±0.003603	0.4681±0.005507	< 0.001*
Visual-Green	0.5202±0.00421	0.55109±0.00361	< 0.001*
Auditory	0.3072±0.004887	0.36952±0.003052	< 0.001*

*highly significant

Table-3. Choice reaction time with variable fore-period of 2 seconds

Choice Reaction Time	Males (in seconds) Mean ± SD	Females(in seconds) Mean ± SD	*P* Value
Visual -Red	0.46069±0.00344	0.51458±0.00568	< 0.001*
Visual-Green	0.550842±0.004604	0.6057±0.004625	< 0.001*
Auditory	0.35011±0.003521	0.41973±0.004607	< 0.001*

*highly significant

Table-4. Choice reaction time with variable fore-period of 4 seconds

Choice Reaction Time	Males Mean ± SD (in seconds)	Females Mean ± SD (in seconds)	*P* Value
Visual - Red	0.5211±0.00266	0.5817±0.006851	< 0.001*
Visual - Green	0.6026±0.00387	0.6701±0.004624	< 0.001*
Auditory	0.4087±0.003459	0.47803±0.004662	< 0.001*

*highly significant

Table-5. Choice reaction time with variable fore-period of 6 seconds

Choice Reaction Time	Males (in seconds) Mean ± SD	Females(in seconds) Mean ± SD	*P* Value
Visual - Red	0.57434±0.002597	0.62541±0.002866	< 0.001*
Visual - Green	0.66189±0.003577	0.7176±0.003343	< 0.001*
Auditory	0.4664±0.004565	0.5295±0.003101	< 0.001*

*highly significant

Discussion: The results of the present study demonstrate that males react faster than females to different types of choice-reaction time tasks. We attributed this result to males' advantage in movement time rather than any type of advantage

in perceptual speed because males tend to have more muscle fibers, which allows them to perform physical actions more quickly than females.

In a surprising finding, Szinnai et al. found that gradual dehydration (loss of 2.6% of body weight over a 7-day period) caused females to have lengthened choice reaction time, but males to have shortened choice-reaction times[6]. Research into sex differences in response time provides some evidence that males and females use different strategies when performing choice-reaction time tasks.

Adam et al. reported that males use a more complex strategy than females. for example, participants completed a choice-reaction time task that required them to vocalize the position of an "X" flashed on the computer screen (e.g. "one" if the stimulus was on the left side of the screen, "two" if it was on the right). Number of choices (either two or four) and naming of the position (either compatible or incompatible) were both manipulated. They found that males had shorter reaction times in all conditions. Furthermore, males seemed to employ a dichotomizing strategy (i.e. in the four-choice condition, they broke the screen into left and right parts and then chose an answer), whereas the females used a serial processing strategy (i.e. in the four-choice condition, they examined the screen from left to right and then chose an answer) [7].

Additionally, Welsh and Elliott found that females were likely trading speed for accuracy in a dichotic listening task, accounting for males' overall faster response time. This apparent male superiority has been found both in choice-reaction time tasks and in simple-reaction time tasks[8]. Barral and Debu found that while men were faster than women at aiming at a target, the women were more accurate[9].

The results of this study show that choice-reaction time to auditory stimulus is lesser than that to visual stimulus in both males and females. Lesser reaction time to the auditory stimulus compared to visual stimulus is in conformity with the findings of other researchers[10-13] but in contrast to that of Shenvi and Balasubramanian[14]. Compared with the auditory stimuli, the visual stimuli takes a longer time to reach the brain. This probably accounts for the difference in the auditory and visual reaction times.

Visual reaction time to red light is faster was compared to the green light in both the sexes. This agrees with the findings of Shenvi and Balasubramanian. This can be explained on the basis of Trichromatic theory of colour vision. When Tomita and co-workers illuminated the retina with micro-electrode penetration of a single cone, the found that 74% of units peaked in the red spectrum, 16% in blue spectrum and 10% in the green spectrum [15].

Conclusion: It can be concluded that males have shorter reaction time than females. Males react faster than females to changes in the external environment and males are quicker in responding to the unpredictable situations. Choice-reaction time to auditory stimulus is shorter than that to visual stimulus in both males and females.

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