Original Research Article

A study of gender difference in time perception in urban population of southern India

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Received: 16-05-2021 / Revised: 20-06-2021 / Accepted: 16-07-2021

Abstract

Background: It is well known fact that individual perception time is different from normal physical time. Time perception is a field of study within psychology and neuroscience that refers to the subjective experience of time. With the advancing age perception of time varies significantly. There are very few studies were done regarding gender differences in time perception**. Aims and Objectives**: To calculate the time perception in male and female population separately and compare the two groups to find any significant difference in time perception. **Materials and Methods:** 50 healthy males (Group A) and 50 healthy female individuals (Group B) within the age group of 20 to 25 years from the surrounding areas of Hyderabad were recruited for study. Individuals were asked to separate and count red colored beads from the colored mixture of beads which are present in a bowl. The means of perceived times of Group A and Group B are compared using student't' test to find out any significance. **Results:** Mean value of Group 1 is 33.13 ±7.04 and Group 2 is 40.38± 7.63. After statistical analysis for above test $p<0.05$ and it was considered to be statistically significant. **Conclusion**: From above data, there is statistically significant difference is seen in time perception of female and male individuals

Keywords: time perception, physical time, neuroscience, gender

Introduction

Time perception is a field of study within psychology and neuroscience that refers to the subjective experience of time, which is measured by someone's own perception of the duration of the indefinite and continuous unfolding of events [1-2]. Time is a very complex concept. Virtually no other concept is so central to human life and yet so poorly understood than psychological time. This implies subjective estimation of time [4]. The lack of a physical correlation with time perception is a reason for this. Gibson (cited by Fraisse, 1984) concluded that events are perceptible whereas time is not [3]. Piaget (1969) suggests that time perception is the product of a progressive understanding of succession, duration, and simultaneity through three cognitive-developmental stages. More specifically, succession and duration are constructs which, when developed, enhance perceptions of past and future.With the advancing age perception of time varies significantly [4]. There are very few studies were done regarding gender differences in time perception

Aim and objective

To calculate the time perception in male and female population separately and compare the two groups to find any significant difference in time perception

Materials and methods

50 healthy (mentally, physically and socially) female and 50 healthy male individuals within the age group of 20 to 25 years from the surrounding areas of Hyderabad were recruited for study. All the subjects are literate persons. Informed consent will be taken from the subjects. Yoga practicing and sports persons are excluded from study. Subjects should not consume alcohol before the day of test and should not consume coffee and tea 2 hours before the test. Utmost care is taken for inclusion criteria (Table 1). Institute ethical clearance was obtained before conducting the research work. Test was conducted in Department of Physiology, SVS Medical College and Hospital from 10.00 am to 11.00 am. Individuals were asked to separate and count red colored beads from the colored mixture of beads which are present in a bowl. Examiner will ask the subjects to stop the counting of beads after one minute of physical clock time. Subjects were asked to estimate the subjective experience of time after one minute of physical time (retrospective paradigm). This makes the subjects to engage in counting the beads with full attention. Making sure no person will be allowed to use wrist watch and cell phones while doing the test. No clock should be kept in the test room. All distractions which will affect the attention aspect of subjects should be avoided. Group A includes female individuals and Group B includes male individuals. The means of perceived times of Group A and Group B are compared using student't' test to find out any significance.

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Table 1:Inclusion and exclusion criteria

Inclusion criteria	Exclusion criteria
Age group 20 -25years	Alcoholics and Smokers
50 males (GROUP A) and 50 females (GROUP B)	illiterates
Mentally ,physically and emotionally healthy	Yoga and meditation practicing individuals
All subjects are from Hyderabad,Telangana (urban)	Sports personnel
	Subjects who are on psychotropic medications:Color blind individuals

Results

Mean value of Group 1 is 33.13 ±7.04 and Group 2 is 40.38± 7.63. $p < 0.05$ is considered as statistically significant. After statistical analysis for above test $p<0.05$ and it was considered to be statistically significant. Table 2 shows the mean values of perceived times in Group A and Group B.

Table 2:Comparison of perceived time between men and women Participants, listed as M (SD).

Group A (males)	Group B (females)
33.13 (7.04)	40.38 (7.63)

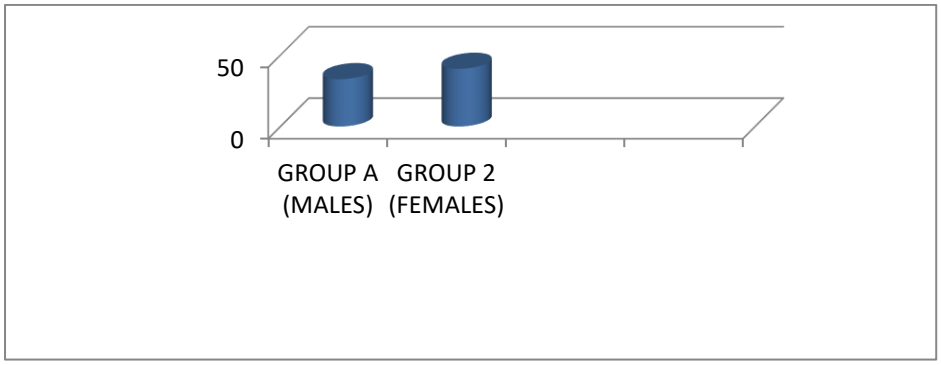

Fig 1:Comparison of groups

Discussion

From above data, statistically significant difference is seen in subjective time perception of male and female individuals. From figure 1 it is observed that both males and female individuals underestimated perceived time when compared with physical objective time. But, subjective time underestimation is more in males than females.The result of the study conducted on children confirms a lack of sex differences in time perception [5]. In another research sex differences were evident with older subjects [6-7], but not with children [8-12].Findings of the various studies suggested that the five minute time lapse estimations would be judged most accurately by older children [9-11, 13-14]. It was hypothesized that the more mature child has internalized a 'sense' of time which enables her/him to estimate lengths of time involved in activities. It was emphasizes that as the child develops, the estimation is more accurate and the cognition of time has shifted from the view of objective experiences (concrete objects and life experiences) to subjective experiences (internalized experiences) [5]. In real life, this type of time interval estimation tasks is usually implicit, automatic, and strongly associated with other cognitive processes such as perception, learning, and decision-making [16]. The study of psychological time has direct implications on the understanding of sex differences regarding cognitive processes [15].Results from work of several authors show the existence of sex differences in time estimation [17] as well as other cognitive processes such as the performance of certain verbal and visual-spatial tasks [18]. Several factors affect time estimation. Block et al (2000) point out that some of the most important factors are the length of time to be estimated and the time duration paradigm [15]. Another variable that may possibly influence time estimation is whether a person who will be required to estimate time duration knows in advance the length of time to be estimated [15]. In the prospective paradigm, the person knows this; in the retrospective paradigm, the person does not [15]. Magnitude and variability of the estimated time duration critically depend on this variable.Prospective estimations are usually longer in magnitude and shorter in variability than retrospective estimations [15]. In the retrospective paradigm, the magnitude of time estimation is directly related to the amount of attention paid to the temporal information processed during the length of the task to be estimated [15]. In brief, prospective time estimation is a task that requires division of attention. The current research is retrospective paradigm which allows the subjects to pay complete attention on the given visual-spatial task.Research has shown that estimation of time retrospectively and prospectively uses different neural processes; while retrospective time estimation uses primarily stored memory processes; prospective estimation utilizes attentional control and allocation [64]. Eson and Kafka state that disturbances in the experience of time generally come from (a) distorted external events, (b) physiological disturbances, such as varying heart and respiration rates, and (c) malfunctioning mechanism that is involved with the integration of the above two factors [19]. Studies have shown that a host of personal factors can affect the perception of time. Cognitive functions such as attention, memory (both long and short-term), drive states, mood, emotion, anxiety and personality have all been shown to affect time perception in some way [20-22]. Other studies have shown that age, sex, and metabolism are also factors that can in some way influence how people perceive the passage of time [23-24]. The effect of sex on time perception has shown conflicting results over the years [15,25-26].There are well-documented sex differences in some cognitive abilities [28]. In various research papers, it has been found that women tend to perform better in specific aspects of verbal ability, such as verbal fluency. On the other hand, it has been often documented that men have a better performance in spatial tasks such as those that imply mental rotation of objects [28]. Likewise, sex differences regarding time perception have been found [17].It has been observed that women provide relatively longer and more variable time estimations than men [15]. According to the findings of another research no significant sex difference in subjective time

estimation performance during the verbal task was observed [27]. However, there was a significant sex difference in subjective time estimation performance in the spatial task. Cognitive Psychology has generated various attentional models for time perception [29]. It has been found that when time is estimated under prospective paradigm conditions, the number of stimuli processed during a certain period of time inversely correlates with the estimated subjective length [29].Likewise, perception depends on the presence of attention [29]. It is commonly assumed that attention is a system with a limited capacity [29]. Therefore, if two tasks are processed simultaneously, available attention for each task is reduced [29].When more attention was given to time passing, time estimations were significantly longer in the control task than in the verbal and spatial tasks. In different studies of time manipulation and memory overloading tasks, participants were requested to devote a certain percentage of attention to a task and another percentage to time calculation [30]. Several research works have shown that when a lower percentage of attention is devoted to time, time underestimation error increases [30].Subjects can be prevented from underestimating time considerably if they had focused mainly on either the verbal or spatial task and paid little attention to time [27].In comparison with the control groups, the verbal and spatial task groups estimated the 2 minutes quite more accurately. Then, when there is less attention capacity for time processing, the perceived period of time appears as shorter [29]. This could explain why both men and women overestimated time when making the control task. Likewise, the spatial and vebal tasks probably were more interesting stimuli than the control task. According to Schiff and Oldak (1990), positive stimuli cause an underestimation of time length [31]. This somehow suggests that the cognitive processes executed in mental rotation are related with the cognitive processes in prospective time estimation. Therefore, there were no sex differences regarding the capacity to estimate time accurately in a prospective manner, but when men and women interacted with a visual-spatial task, significant differences occurred [27].In addition, it was found that the verbal task does not influence subjective time estimation in women. There were no differences in time estimation performance by women between the verbal and spatial tasks. [27]. this rejects the hypotheses stating that women have a better performance in subjective time estimation when performing a verbal task. The capacity to register time order and structure of outer world events requires a coherent synchrony with visual perception [32], time of motor behavior [32], and estimation of time interval length [32].At the same time, relevant brain areas for time perception have been identified. However, several lines of research have shown that the lower right region of parietal cortex is indispensable for time perception [32]. As well, Rao et al [32] have observed a relevant activity in the lower right region of parietal cortex when time is estimated prospectively. It is likely that the right parietal cortex uses representation systems that are codified spatially [32] and are common to time, space and quantity.It has been stated that there is higher brain activation in the lower left frontal cortex (Broca's area) and medial left frontal gyrus (dorsolateral prefrontal cortex) [35]During the performance of the verbal fluency task, no brain regions which use the same spatially codified representation system, common to time, are activated. Thus subjective time estimation is not influenced. [27].Both men and women had a significant brain activation in the left prefrontal cortex, right prefrontal cortex, cingulate gyrus, and rightregion of the cerebellum [33]. Then no significant sex differences in brain activation pattern during a verbal fluency task were found when there are no performance differences [33]. In turn, the spatial task influenced men's subjective estimation of time since there were a significant difference in estimated time performance between the spatial and verbal tasks. This provides confirmation that men have a better performance in subjective estimation of time while executing a 3-D visual-spatial task. [27].Patients with damage of the right side of parietal cortex have severe perceptual problems in relation to time [32]. These patients are unable to judge time passing during medical sessions, such as an interview. Time seems to pass very quickly; objects seem to move very rapidly, very slowly, or not smoothly. When the right parietal cortex is used in representation systems that are spatially codified for time, space, and quantity, it shows the need for a common measure of time and space in order to assure a correct action that requires information about time [32]. It is suggested that since brain activation sites are closely related while performing a mental rotation task and estimating time prospectively, time calculation is easier due to the type of cognitive processes carried out in both tasks. [27]. Then it is likely that estimation of time while performing a mental rotation task —which implies visual-spatial abilities— causes a more accurate calculation than while executing other kind of tasks which does not involve this type of abilities. [27].In the research conducted by Rilea et al (2004), no differences were found in male and female performance of a mental rotation task. However, men showed a higher right parietal activation than women [34].Since the same parietal region is used for time perception and visual-spatial task performance, it may be inferred that cognitive processes related with time perception and mental rotation tasks either are spatially codified or use the same code.. Therefore, it may be assumed that men estimate time more accurately while executing a visual-spatial task such as 3-D mental rotation. This is due to the type of cognitive processes men carry out and the brain zones they use in performing both tasks. [27].According to results found by Roberts and Bell (2005), men and women use differentneurological processes in mental rotation tasks. Men displayed higher activation patterns in the left parietal region than in the right parietal region in simple 2-D mental rotation tasks. However, they obtained higher activation in the right parietal region in complex 3-D mental rotation tasks [36].Women, in turn, obtained higher activation patterns in the right parietal region during both types of mental rotation tasks, but even higher activation was observed in the right parietal region when performing the 2-D mental rotation tasks than the 3-D ones (36). In spite of these sex differences, Yoshino, Inoue and Suzuki (2000) suggest that task processing in mental rotation is a dominant function of the right parietal region. Jordan, Wustenberg, Heinze, Peters and Jancke (2002) state that there are sex-specific activation patterns during mental rotation tasks [38]. These patterns are observed although there are no sex differences in the task performance [37]. Sex differences in time estimation observed in the spatial task can be investigated with above information.Men and women use different strategies to solve these tasks [37]. In relation to this, men and women can pay attention in a different way in such tasks [37]. There may possibly be a sex-specific topographic organization of neural connections involved in mental rotation tasks. This shows that men and women use different cognitive processes due to the specific strategies they apply in mental rotation, even though there are no performance differences. Therefore, when cognitive processes used to solve a 3-D mental rotation task cause a higher activation of the right parietal region, common relevant information for time is provided that improves time calculation from the prospective paradigm. [27].Time perception is a basic function of the vital human development in cognitive function evolution [40]. The existing relation between cognitive processes executed during a task and time perception can be understood from the fact that same right parietal region is activated in men during prospective time estimation and mental image rotation in men, significant differences with women may be occurring. [27]. Therefore, this may be an indication that these two tasks are evolutionally related in men due to the type of cognitive processes involved in the performance of certain specific strategies in these cognitive issues. [27]. Knowledge about the way various tasks affect time estimation may provide relevant information about the way different cognitive processes and strategies used in a task performance modify the way time is estimated, and thus the way one is aware during the experience of psychological present [27].It has

been proposed that the neural mechanisms of interval timing are modulated by thalamo-cortico-striatal circuits, requiring DA communication between the dorsal striatum and regions of frontal cortex [50-57]. Electrophysiological studies in rats [58] and neuroimaging studies in humans [55-58] have provided evidence that cortico-striatal circuits are crucially involved in the control of the internal clock. Interestingly, the structure of the striatum is sexually dimorphic even during embryonic development, when the striata of females are more densely packed with DA axons and the GABAergic neurons that form striatal synapses than those of males.The human literature suggests that overall, females overestimate time by approximately 10% while males do not, and females have greater variability in their time judgments [15,41,48-49].Evidence exists that the two sexes differ not only in spatial perception, but also in elementary time processing abilities such as duration estimation [15,17,29,43-45].More and more evidence accumulates showing that these differences have a neuro-physiological basis [39]. The main finding is that females make larger time estimates than males. One possible explanation is that females pay more attention to time, thereby experiencing dilated subjective durations [15].In the domain of cognitive skills, the best documented of these differences are those in spatial perception, which promote sex asymmetries in a vast range of abilities. More specifically, females perform better in tasks involving production and comprehension of language, fine motor skills, and perceptual speed, whereas males have a higher capacity for managing spatial relationships and carrying out visuaospatial transformations [46,47].Gender differences in time perception are biologically, rather than culturally based [42].Factors like age, level of attention, memory, type of tasks, duration of task, complexity of task, type of duration judgment paradigm and distractions will affect the subjective estimation of time. In the present study, underestimation of time is more in males than females and is line with the meta-analytic review of Richard A. Block and Peter A. Hancock(2000) [15]. Exact mechanism for such difference is the matter of debate. Even exact role of hormones on functioning of brain has to be studied in detail. More research is required to understand the reasons for differences in time perceptions and its relation to many psychological disorders.

Limitations

- No gold standard method to test time perception.
- Small number of subjects.
- Varying level of attention and sensitivity to distractions.
- Only one type of visual-spatial task was compared. Time perception may change with type of task, length of task, varying degree of difficulty of task and number of tasks.

Conclusion

From above data, there is statistically significant difference is seen in time perception of female and male individuals. This is in line with previous research reports on time perception. Perception time is underestimation is more in male individuals (GROUPA) when compared with females (GROUP B). Both males and female individuals underestimated perceived time when compared with physical clock time. More attention involving tasks, pleasant tasks with fewer distractions makes persons to perceive time fast when compared with less pleasant tasks and distraction involving tasks. Exact mechanism for such difference is the matter of debate. More research is required to understand the reasons for differences in time perceptions and its relation to many psychological disorders.

Aknowledgement

We like to thank our Principal Dr. Suseelamma.D for her constant support. We also like to thank Dr.Narsing Rao, Professor and HOD, Department of Physiology for his support and encouragement for conducting the research and also we like to thank all the subjects for their kind cooperation.

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Conflict of Interest: Nil Source of support:Nil