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# A comparative study of visual and auditory reaction times on the basis of distraction variable

**Abstract**

The purpose of this research was to determine whether reaction time is faster for auditory or visual stimuli and how distraction can be responsible for delayed reaction time. Fifty college-aged students volunteered to participate in this study (age 18-22). There are five groups, each group will have ten subjects. Each group is assign a different task. They will be assign a simple audio reaction test, simple visual reaction test, simple audio reaction test with distraction, or simple visual reaction test with distraction. Each participant will have five trials, and those times are averaged. The resulting average is then entered into Microsoft Excel. Groups 1-4 data will be put into a one-way ANOVA with/repeated measures test for the data analysis. Group 5 data will be put into a Two Factor ANOVA without replication. The result show that auditory stimuli have a faster reaction time then visual stimulus. With the addition of the distraction variable, the reaction times for both auditory and visual stimuli increased. However, auditory stimuli still have a faster reaction time.

**Introduction**

Reaction time (RT) is the duration between the sensory stimulus's appearance and the consequent behavioral response. Simple reaction time is the elapsed time for an observer to sense the presence of a stimulus. Reaction time involves the central and peripheral components of the human body and is used as a tool to reflect human cognitive and motor functions. Reaction times are used not only in laboratory exercises but also in sports environments and in our everyday life (Ashnagar et al,. 2014). An example of reaction times that we use in our daily life is when we are talking to one another, we must use reaction times in order to respond and converse. Another example is when we are driving and must react to traffic lights. Human reaction time is dependent upon the central nervous system to work. Our body contains billions of neurons, and these neurons work as messengers. When we are required to react to something, our brain sends out messages, these messages will then travel throughout our neurons to the brain and spinal cord, which then will cause a reaction. Several factors affect the human body's reaction times, such as age, gender, arousal, fatigue, and physical health. This is because physical change in the neuron’s fibers slow the speed of reaction over time as part of the brain that is involved in motor control losses cells over time. However, the effects of age on reaction time varies from person to person and with physical activity, you can actually reverse the effects of aging.

Three different types of reaction times are typically studied: simple, recognition, and choice (Balakrishnan et al,. 2014). In a simple reaction time experiment, there is one stimulus and one response. For example, a stimulus would appear, and the participant will try to respond to that stimulus as quickly as possible. In the recognition reaction time-experiment, some stimuli will need to be responded to, and some stimuli will need to be ignored. For example, there may be five words, four of which are just distraction words. Only one of the words is the word that the requires a response. Choice is the third type of reaction time experiment. In a choice reaction time, there are multiple stimuli *and* multiple responses. The participant is asked to pick the correct answer for each stimulus. For example, the game “BOP-IT” is a good example of a choice reaction time-experiment. In BOP IT you are asked to respond to each different stimuli with different reactions. There are three options to choose from in the game: bop it, twist it, and pull it. For twist it you are required to twist the device, for pull it you are required to pull on it, and for bop it you are required to press the button. While all three types of these experiments have different stimuli and responses, ultimately, they all have the same goal, and that is to test the reaction time of the test subject.

Two frequently studied situations are reaction times to auditory and visual stimuli. Auditory reaction time is the elapsed time between when an individual hears an auditory stimulus and responds. Visual reaction time is the elapsed time between when an individual can react after seeing a visual stimulus. A research study conducted by Thompson (Thompson, et al., 1992) showed that humans have a faster reaction time when it comes to audio stimuli compared to visual stimuli. Thompson documented that the reaction time for audio stimuli is around 140-160 millisecond while the reaction time for visual stimuli is about 180-200 millisecond. The reason that reaction time for the audio stimuli is faster than the visual stimuli is that it takes less time for the audio stimuli to reach the brain than it does for the visual stimuli. Research done by Kemp et al. (1973) showed that auditory stimuli take only 8-10 millisecond to reach the brain, while on the other hand, a visual stimulus takes up to 20-40 millisecond. A review of the literature by Geoff et al. (2006) illustrates that men, on average, have a faster reaction times than their female counterparts. This conclusion was based on a smaller time between the presentation of the stimulus and the beginning of muscle contraction (Aditya, et al., 2015).

In this research project, the participant were asked to participate in one or more of the following tests: a visual reaction time test (VRT), an auditory reaction time test(ART), a visual reaction time test with a distraction(VRTD), an auditory reaction time test with a distraction(VRTD, or all four of these options. In the VRT condition, the subject was asked to react whenever the visual stimuli was presented. In the ART, the subject was asked to react whenever the audio stimuli was present. In the VRTD condition, the subject was asked to react whenever the visual stimuli is present (as before), but during this they had to answer random questions provided by the proctor. In the ARTD condition, the subject was asked to react whenever the audio stimuli was present, but during this time, they had to answer random questions provide by the proctor. Each participant performed five trials, the times were then averaged to get a final reaction time. The result was recorded by the software programs and was accounted for in milliseconds. There will be five groups, with ten subjects in each group.

*A 2010 study by Shelton* examined whether simple reaction time was faster for auditory or visual stimulus. There were 14 subjects, and each subject was assigned randomly into a group of 2. Both members from each group was then asked to perform both the visual and auditory test from the DirectRT software. The results show that the mean visual reaction time is around 331 milliseconds as compared to the mean auditory reaction time of around 284 milliseconds.

A 2015 study done by Jain et al., 2015 compare visual and auditory reaction times on the basic of gender and physical activity levels. The study was conducted on 120 medical students with age ranging between 18-20 years. The study used software Inquist 4.0 to record the reaction time. The task was to press the spacebar as soon as the stimulus is presented. Their result show that the reaction time to the auditory stimulus was significantly less as compared to the visual stimulus.

The purpose of this study is to find out whether reaction time is faster for auditory or visual stimuli and how distraction can be responsible for delaying reaction time. Our hypothesis for this study is that audio stimuli reaction time will be faster than visual stimuli. With the addition of the distraction variable, we predict that the reaction time will go up but we still expected for the audio stimuli reaction time to be faster than the visual stimuli.

**Materials and Methods**

Institutional Review Board: Approval for human subject use was obtained from the Asbury University Institutional Review Board (IRB). The investigator explained the procedures to all participants who provided consent. Each participant was assigned a group and number. No names were sued to protect confidentiality.

Subjects: Fifty volunteer subjects were recruited to participate in the experiment. The subjects were randomly assigned to one of five groups (10 subjects per group). The subjects in this experiment were all volunteer college students from Asbury University, with an age range from 18-22 years old. There were both male and female participants. Gender was not an independent variable in this study.

Reaction Time Tests: Two open-sources reaction time tests were used: [visual reaction test](https://faculty.washington.edu/chudler/java/redgreen.html) or an [auditory reaction test](https://new.cognitivefun.net/task/cogfun-16-auditory-reaction-time). The visual test was a red light, green light test developed at the University of Washington. The task of this test is for the test subject to react to the green light stimuli when appropriate (Allen, 2002). The audio reaction time test was the cognitive neuroscience. The task of this test is for the test subject to react when the audio stimuli is provided (cognitive neuroscience, 2008).

Procedure: There were five total groups; each group was assigned a different task variation to complete. Group one was assigned a simple audio reaction test (ART): when the subjects heard the specified test sound, they pressed the spacebar on the keyboard to record their reaction time. Group two was assigned a simple visual reaction test (VRT); when the subject saw the green light option out of red, yellow, and green, they pressed the spacebar right away when they saw the green light. Group three was assigned a simple audio reaction test with a distraction (ARTD); when the subject hears the specified test sound, they are then required to press the spacebar to record their reaction time, and while doing this, they will have to answer random questions from the proctor. Group four was assigned a simple visual reaction test (VRTD\_; when the subject sees the green light option out of red, yellow, and green, they are asked to press the spacebar right away when they see the green light, and while doing this they will have to answer random questions from the proctor. In Group five, each participant performed all four conditions: ART, VRT, VARTD, and VRTD. For each participant the order of presentation of the four conditions was randomized to control for any possible order effect

Data and Statistical Analysis: Each subject performed five trials. The average of the five trials was calculated and recorded as the subject’s score. Means and standard deviations were calculated for all conditions. Scores were then entered into a Microsoft Excel spread sheet. Performance for Groups 1-4 data was analyzed using one-way ANOVA. Group 5 data was analyzed using one-way ANOVA with repeated measures. An open-source statistical program (VassarStats) was used for all analyses.

Results

VRT- Visual Reaction Time

ART- Audio Reaction Time

VRT-D – Visual Reaction Time with Distraction

ART-D – Audio Reaction Time with Distraction

Table 1 Mean & Standard Deviations (Group 1-4)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | VRT | ART | VRT-D | ART-D |
| Means (in ms) | 293.7\* | 243 | 412.1 | 324.6 |
| Standard deviations | 39.96123 | 29.96665 | 76.28084 | 48.14838 |

Figure 1 Means & Standard Deviations (Group 1-4)

Table 2 Means & Standard Deviations (Group 5)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | VRT | ART | VRT-D | ART-D |
| Means | 268.4 | 225.4 | 355.5 | 317.9 |
| Standard deviations | 21.05327 | 34.70504 | 63.57712 | 66.59197 |

Figure 2 Mean & Standard deviations (Group 5)

The audio reaction time is faster than the visual reaction time. With the added distraction the reaction times for both audio and visual reaction time increased by about 100 milliseconds, respectively.

**Discussion**

This study aimed to determine whether reaction time is faster for auditory or visual stimuli and how distraction can be responsible for delayed reaction time.

As shown in table 1, the mean for the audio reaction time is 243 milliseconds compared to the mean for the visual reaction time of 293.7 milliseconds. The result in table 2 shows a similar result: the mean for audio reaction time is 225.4 milliseconds, while the visual reaction time is 268.4 milliseconds. These results support our hypothesis that auditory reaction time is faster than visual reaction time. Our results also show similar results to the studies done by Shelton & Kumar (Shelton et al., 2010), which also show that auditory reaction time is faster than visual reaction time.

Research done by Kemp (Kemp, et al., 1973) shows that auditory stimuli takes only 8-10 milliseconds to reach the brain, while on the other hand, a visual stimulus can take up to 20-40 milliseconds. Kemp's study shows us that the faster the stimuli reach the brain, the faster the reaction time will be. Our result corroborates the research indicating that the audio reaction time is faster than the visual reaction time.

With the addition of the distraction variable, the reaction times for both audio and visual stimuli increased. As the results shown in table 1 indicate, the mean for the audio reaction time with distraction is 324.6 milliseconds, and the mean for the visual reaction time with distraction is 412.1 milliseconds. Compared to the reaction time without the distraction variable, the reaction time for audio reaction time increased by 81.6 milliseconds. As for the visual test with distraction, the time increased by 118.4 milliseconds. This proves to be true once again in our group 5 group, as shown in Table 2. The audio reaction time increased by 92.5 milliseconds with the addition of the distraction variable. In comparison, the visual reaction time increased by 87.1 milliseconds with the addition of the distraction variable. These results confirm our hypothesis that with the addition of the distraction variable, the reaction time would increase.

A study conducted by Christine Yager (, an associate transportation researcher in Texas A&M Transportation Institute’s (TTI) Center for Transportation Safety, showed that human reaction time increased drastically when distracted. In the study, Yager tested driving with a distraction, and the result showed that the people who weren't texting had a reaction time that averaged between one to two seconds. In comparison, those that were looking at their phone took between three to four seconds to react (Yager, et al., 2013). If a driver was on his phone while driving a vehicle that is traveling 60 miles per hour, by the time the driver reacted, the car would have traveled 440 feet. As proven in Yager's study, being distracted can be dangerous as it has a significant impact on human reaction time.

**Conclusion**

Reaction time (RT) is the duration between the sensory stimulus's appearance and the consequent behavioral response. Simple reaction time is the elapsed time for an observer to sense the presence of a stimulus. Reaction time involves the central and peripheral components of the human body and is used as a tool to reflect human cognitive and motor functions. This study demonstrated that audio reaction time is faster than visual reaction time. However, if a distraction variable is presented, reaction time will increase tremendously, but audio reaction time will still be faster than visual reaction time. Future research should continue to examine the differences in reaction time, dependent on the difference in distraction variables.

**Citation**

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