Effects of Auditory and Visual Distractions on Working Memory

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Abstract

Studies indicate that humans are distractible. Furthermore, a person’s focus is disrupted, specifically, by visual and auditory distractions. The following research proposes that working memory, alone, is negatively impacted when visual and auditory distractions are present. Using college student volunteers as participants, this research will subject participants to both visual and auditory distractions, while performing a working memory task. It is hypothesized that when these distractions are present, a factor of learning (working memory) is impaired.
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In a typical college classroom, there are inevitable distractions, including chatter from passersby in the hallways, disrupting posters pinned to the chalkboard, and noisy technological devices. In order to foster an effective educational atmosphere, researchers must ask: do auditory and visual distractions in the classroom have a negative impact on students’ ability to perform working memory tasks that further their learning, or do students maintain focus despite distractions? The construct at hand is of particular interest because it has widespread relevance; distractions in the classroom might be capable of influencing all students.

Literature Review

Focusing on the dependent variable, Wright and Fergadiotis (2012) review operational definitions for working memory. Their article explores working memory deficiencies in individuals with aphasia, discusses different theories regarding working memory, and provides several ways to measure/operationalize an individual’s working memory capacity (Wright & Fergadiotis, 2012). Though Wright and Fergadiotis (2012) do not draw any conclusions about working memory’s relation to aphasia, they thoroughly summarize the ideal ways to operationalize working memory. The article’s explanation of the N-back task (a computer stimulated program that measures someone’s working memory) was particularly helpful; this test is further explained in the methods section.

Other articles provided information regarding the independent variable: distractions. Banbury, Macken, Tremblay, and Jones (2001) explain that background noise can have a negative impact on working memory. They summarize multiple studies that explore irrelevant sounds and their effects on cognitive performance and memory, and they conclude that an irrelevant sound has a negative effect on a person’s cognitive performance; even soft,
background noise can impair performance on cognitive tasks (Banbury et al., 2001). This research gives reason to subject participants to auditory distractions, creating one level of the independent variable that will be used in the study.

Williams, Pouget, Boucher, and Woodman (2013) found that visual distractions can also affect working memory capacity, thus creating a second level of the independent variable. They found that visuals divert eye gaze and, in turn, limit working memory. Williams et al. (2013) performed three different experiments in which they tracked participants’ eye movements as they performed multiple memorization tasks. They found that when eye gaze was diverted from the task, favorable performance decreased. In addition, they found that the human mind can store up to four images while employing visual working memory, further influencing the choice of the N-back test described in the methods section.

Because research shows that both auditory and visual distractions can affect working memory, it seems particularly worthwhile to explore the effects of both of these distractions on working memory, creating a third level of the independent variable. Furnhan, Gunter, and Peterson’s (1994) explored the impact television (a device that provides both auditory and visual distractions) has on one’s ability to read and comprehend text. They exposed participants to television while performing a reading comprehension task, and they found that the television interferes with one’s ability to concentrate. Students, then, are better able to perform memory tasks without distractions (Furnhan et al., 1994). The article supported the fact that a human at any given time has only a limited amount of attention aptitude, especially while performing multiple tasks simultaneously.

Research shows that visual and auditory distractions can impact working memory which plays an important role in learning (Banbury et al., 2001; Williams et al., 2013; Furnhan et al.).
Because the amount of distractions exposed to students can be easily manipulated, distractions serve as practical independent variables. The dependent variable, then, is working memory. By measuring working memory, researchers can observe the degree to which distractions impact learning (Wright & Fergadiotis, 2012). By using this research, it can be hypothesized that there is a negative correlation between distractions and working memory (which can impact learning). Further, it is hypothesized that working memory is most affected when both visual and audio distractions are present, more so than when only a visual or audio distraction is present.

**Methods**

The subjects for this study will be eighty young adults between the ages of eighteen and twenty-one, who are current students enrolled at Youngstown State University. All of the participants will be volunteers. Each person will be assigned randomly to one of the four groups described below, making this a within-subjects design (20 participants in each group).

The independent variable in this study will be the level of distractions to which the participants are exposed. There will be four total groups: a control group in which the participants complete the task at hand with no distractions, a visually distracted group in which the participants will complete the task while a muted television is turned on and placed in front of them, an auditorially distracted group in which a radio is playing music and is placed on the table that they are seated at completing the task, and a multi-distracted group in which a video will be playing on the television in front of them with sound.

The dependent variable, working memory, will be measured by using the N-back test, previously mentioned in the article written by Williams, Boucher, and Woodman (2013). Each participant will be exposed to this test under whichever condition they are randomly assigned to. The test will be administered through a computer program in a classroom-setting computer lab. The program will present the participant with a constant stream of ten words, with a one second
pause between each word. There will be one word repeated again some time throughout the stream after the initial presentation of that word. The participant will have to hit the “space bar” for each word that was presented before the repeated word. For example, the computer will display the following list of words: “cabinet”, “dog”, “paper”, “frog”, “candy”, “hat”, “frog”, “computer”, “flower”, “cat.” In this case, the participant would be expected to hit the space bar twice. Each participant will be exposed to twenty-five streams, each with ten words, as previously stated. The researcher will measure simply by stating “YES,” if the participant hit the space bar the correct number of times, and “NO,” if the participant was incorrect for each stream of words. The number of “YES’s” each participant received will be totaled, as well as the number of “NO’s” they received.

As the participants volunteer, they will arrive at a scheduled time to complete the task. When they walk into the classroom-setting computer lab, the level of distraction to which they were randomly assigned will already be in action. They will first be given the Informed Consent document, which after reading through, they can choose whether they would still like to participate. If they choose to do so, they will be instructed to open the program and begin reading the instructions on how to complete the task. They will have five practice rounds to be sure they understand what they are doing, and then the recorded rounds will begin. After completing the task, they will then be free to leave.

**Results**

Once the data is collected, researchers will organize the information into a table. They will assign each participant a number, and next to their number, they will record the amount of CORRECT responses each participant generated. Using a factorial design, researchers will compare the means of each group under the four independent variables in order to determine the
main effects of each type of distraction. Furthermore, researchers will conduct a one-sample t-test by calculating the sample means and sample standard deviations. These will then be used to create a sampling distribution of the means. Last, researchers will calculate the correlations between the level of distraction and the number of correct responses. This will better show how each level of distraction affected the participant’s ability to focus.

**Discussion**

It is important to note the effects of distractions on one’s ability to focus, especially when considering college students. With all of the technological advancements of the twenty-first century, students’ working memory is extremely vulnerable. This study aims to quantify these effects by studying which distractions are most detrimental to one’s ability to focus, as well as any combined effects.
References


