The Effect of a Visual Distraction on Test-Taking Performance

University of Wisconsin-Madison, Department of Kinesiology

Physiology 435

Lab 301, Group 9

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Keywords: Attention, Distractions, Electrooculography (EOG), Heart Rate, Performance, Stress, Test Time, Test Accuracy, Visual

Word Count: 5814

Abstract

Test performance is of the utmost concern for students. This is why a distraction during an exam is a concerning matter. Many studies have examined the different factors that can affect a student's performance on an exam, but few have specifically focused on visual distractions in the exam environment. This study aimed to evaluate whether visual distractions in a test environment impact exam performance. We hypothesized that visual distractions negatively affect exam performance directly via impairing attention and indirectly via inducing stress. Participants were instructed to take a short matching test and were randomly assigned to either a control group with no distractions or an experimental group with a distraction. Heart rate was measured to evaluate stress, while electrooculography (EOG) was measured to evaluate attention. Exam performance was assessed based on exam time and exam score. Results showed that there was no significant difference in the change of heart rate (p-value=0.826), EOG horizontal movement (p-value=0.240) and EOG vertical movement (p-value=0.549) between the baseline and test periods for the control and distraction groups. Additionally, no significant difference was found between the group's exam time (p-value=0.650) or exam score (p-value=0.625). These results suggest that the visual distraction used in this study may not have been substantial enough to impair students' exam performance. Future studies can be improved by increasing the number of participants, minimizing selective bias, utilizing higher quality equipment, and by administering a more stimulating visual distraction.

Introduction

Much of the world's education system revolves around taking exams. From kindergarten through college, students are expected to take exams and must excel if they wish to attain good grades. Exam performance is not a comprehensive measure to the student's understanding of the material. A host of other variables that can be categorized as extrinsic, intrinsic or personal factors can affect exam performance (Rasul & Bukhsh, 2011). For instance, some of these factors include: the sound level inside and outside the exam room, seating positions of the students, the vigilance of the staff, formatting of the exam and the sequence of questions, confidence level and stress (Rasul & Bukhsh, 2011). There are few studies that have researched the effects of environmental factors on one's test performance, and even less that have tested the role of visual distractions in the environment.

Visual distractions are commonplace in today's exceedingly demanding and technological world. Although they are generally hoped to be devoid from the exam environment, this is not always the case. It is understood that human beings are thought to exhibit selective attention, in which they can detect stimuli from different sources simultaneously but be able to focus on what they perceive as the most relevant (Lambert & Hockey, 1986). For an individual to accomplish this feat, it is believed that their information processing capacity will slow down (Lo & Suen, 2014). Research has indicated that distractor control processes are implemented by the prefrontal cortex when faced with multiple stimuli. There is likely a system of both suppression of irrelevant signals as well as selection of relevant signals that comes into play in processing task-related information (Cosman *et al.*, 2018). These findings imply that human beings are able to selectively attend to a specific stimuli within a sea of others, but this process takes additional time and may impair performance.

Stress can also serve as a personal factor that impairs exam performance. For instance, the Yerkes-Dodson Law states that an individual's performance on a task will suffer if his/her stress levels are too high (Yerkes & Dodson, 1908). Moderate levels of stress during the time of learning can enhance memory formation, but there is evidence that supports that stress can impair memory retrieval (Vogel & Schwabe, 2016). This reduction in memory retrieval can explain how stress can negatively affect exam performance. Stress can also impair exam performance by affecting attention. This happens as stress can cause a release of cortisol, which interferes with important frontal executive control functions that normally selectively process specific stimuli that are deemed more important or relevant in the individual's environment (Sanger *et al.*, 2014). As a result, impaired attention may be a common route through which a visual distraction negatively affects exam performance.

Therefore, we hypothesized that a visual distraction negatively affects exam performance directly by impairing attention and indirectly via stress. Attention was measured with electrooculography (EOG), stress was measured with heart rate and exam performance was measured with test time and accuracy. Since the human eye can be considered as an electrical dipole with a positively charged cornea and a negatively charged retina, an electrical potential difference can be measured between these two poles, and this corneoretinal potential typically lies between 0.4 and 1 mV (Muller *et al.*, 2016). Utilizing this anatomical feature of the eye, EOG is a technique that records the electrical potential difference between two electrodes positioned near the eyes of an individual (Muller *et al.*, 2016). EOG can then be used to infer eye movements, since ocular movements alter the orientation of the corneoretinal dipole, which can be recorded with electrodes placed to the left and right of each eye for horizontal derivation and above and below each eye for vertical derivation (Muller *et al.*, 2016). Also, there is evidence that eye movement shifts measured by EOG, align with brain activation in both the parietal and frontal cortex during attention shifting-related tasks (Corbetta & Shulman, 1998). Thus, by measuring eye movement with EOG, we can know when attention is diverted away from the test.

Heart rate is a physiological measurement of the interaction between the parasympathetic and sympathetic divisions of the autonomic nervous system, both of which are involved in emotional regulation (Appelhans & Luecken, 2006). In addition, stress is associated with physiological arousal of the sympathetic nervous system, and there is evidence that supports that heart rate is significantly higher when individuals are in a stressed condition (Dobkin & Pihl, 1992). Therefore, an individual's emotional stress state can be partially quantified via heart rate when they are in a natural or experimental environment. Finally, test time and accuracy were used for exam performance, since both the time spent on an exam and the actual number of questions answered correctly are relevant when evaluating an individual's overall test performance.

Materials

Heart rate, eye movement, and test performance were measured during the experiment. Heart rate was determined using a pulse oximeter/carbon dioxide detector to record the beats per minute (BPM) (Model number: 9843; Serial Number: 118102930; Made by Nonin Medical, Inc., Minneapolis, MN, USA). A Biopac Electrooculogram (EOG) SS2LB was used to measure the corneo-retinal standing potential (in mV) between the front and the back of the eye, which inferred eye movement direction (Serial Number: 1805B11892; Made by Biopac Systems, Inc., 42 Aero Camino, Goleta, CA 93117). Six Biopac electrodes were used congruently with the EOG to transfer the data from the participant to the computer for interpretation. The disposable electrodes consisted of circular patches with material that adhered to the face. The disposable electrodes were then clipped to two, three-lead electrode sets (Model: SS2L; SN: 711A14749, Biopac Systems, Inc., Goleta, CA) that then connected to there respective channels on the Biopac machine. The matching test was made by the experimenters. It comprised of 26 different clipart images taken from google images that were randomly selected by the researchers. The test was designed with a column of words down the left-hand side of a page that correspondingly matched to a clipart image randomly placed on the right-hand side of that same page. Beside each image was a letter from A through Z. The participant was asked to write the respective letter on the blank line next to its correct word match on the left-hand side of the page (**Figure 1**). Tests were printed in black and white, and they covered one entire side of a standard 8 in x 12 in sheet of printer paper. A 2002 Atari gaming console (Model number: 58079 V3; Made by Jakks Pacific, INC, Malibu, CA, 90265) was utilized as a visual distraction for the experimental group. The completion time for the test was recorded in minutes and seconds with an Apple IPhone (Model 8) stopwatch. Data recording and analysis was done with the Biopac Student Lab System (BSL 4 software, MP36). To ensure consistency in time management for the procedure protocol, a timeline for the participant's involvement in the experiment was made using Google Slides **(Figure 2)**. Microsoft Excel software (February 2018 version) was used for obtaining averages, standard deviations, t-test scores, p-values and creating graphical representations of the data.

Methods

Participants

Fifty students from the Spring 2019 Physiology 435 course at the University of Wisconsin - Madison were recruited to participate in this study. Students' ages ranged from 18-25. To be eligible for this study, all participants were required to sign a consent form, be ages 18-

25, and be enrolled in Physiology 435. It is important to note that no subjects were visually impaired to the point that they would have difficulty completing the assigned task.

Procedure

A private room in the Medical Sciences Center building on the UW-Madison campus was used for the experiment. The room contained no windows to minimize any visual or external distractions from outside of the designed experiment. Inside the room, there was one round table with two chairs. Before the participant arrived to take part in the study, the Atari gaming console was brought into the room and set up on the round table. The console was then covered with a dark sheet/cloth. In addition, the round table was set-up to have a copy of the matching test faced down and a pen beside it. The covered console was positioned directly behind the test paper.

Each participant in the study was randomly selected for the control or the experimental group before they entered the test room and without their knowledge. The random selection for each participant's group assignment was done by having a researcher pick one small slip of paper from an opaque bag that had a total of 50 slips of paper. The bag contained 25 slips labeled "1" and 25 slips labeled "2." If the researcher picked a slip labeled "1," that participant was assigned to the control group, while a slip labeled "2" would mean that the participant was assigned to the experimental group. Each participant's test was administered separately.

After the random group assignment, the participant was brought into the test room and asked to sit down in the seat next to the face-down sheet of paper. A total of three researchers accompanied the participant into the room and would remain for the entirety of the experiment. One experimenter would monitor the EOG data behind and out of the participant's sight, the second researcher would monitor and record the heart rate behind and out of the participant's sight as well, and the final researcher would sit in the other chair directly to the left and beside the participant at the round table. The participant was asked to silence and turn off any electrical devices that could make noise or vibrate during the experiment. Then, the participant was given a consent form and prompted to read and sign it if they were willing to continue onwards with the experiment.

Once the participant signed the consent form, one of the researchers explained the timeline for the experiment. The main points explained to the participant were that there would first be a baseline for two continuous minutes before they would be asked to flip over and begin the test. During this baseline period, the participant would complete a task in which they visually scan all four corners and a center marking on the back of the matching exam, which were labeled with circles numbered from 1 through 5 (**Figure 3**). More specifically, the participant was instructed to start at circle three and then go to circle one, then two, then one, then four, then one, then five, then one and then remain fixed on three. The participant would stare at each of the above locations for five seconds before traversing with their eyes to the next directed circle stated by the experimenter. At one minute and 45 seconds into the baseline period, a researcher would notify them that the test would begin in 15 seconds. They were then told that the test consisted of 26 matching questions, where they were to write the letter next to an image on the right-hand side of the page on the blank line of its corresponding paired word on the left-hand side. In addition, they should try to finish the exam as quickly as they can, while answering all of the questions correctly. Finally, the participant was told to vocally say “done” when he/she finished the exam.

While the experiment instructions were told to the participant, the physiological measurement devices were set up. For the set-up of the EOG device, the electrodes were positioned on the participant’s face as follows **(Figure 4)**. One electrode was positioned above the participant’s left eye, a second was positioned vertically below the left eye, a third was positioned to the left of the left eye, a fourth was positioned to the right of the right eye such that this electrode was at the same horizontal level to the one positioned to the left of the left eye, and the two final electrodes were positioned on the forehead for grounding. Refer to the Biopac Systems, Inc. Student Manual for a more detailed description (Biopac Systems, 2013). The electrode leads were positioned behind the participant’s head, so that they were not in the participant’s field of view. The Biopac EOG device was plugged into channel one and channel two of the Biopac Systems machine with the horizontal leads in channel one and the vertical leads in channel two. An EOG calibration test was completed for only the first participant of a testing session as stated in the Biopac Systems, Inc. Student Manual (Biopac Systems, 2013). Also, the pulse oximeter was attached to the index finger of the participant’s non-dominant hand. The participant was instructed to keep their hand flat on the table for the entirety of the experiment. The pulse oximeter reader was shielded from the participant’s field of view.

After all test equipment was properly set-up, the participant was told that the experiment would begin. Throughout the experiment, heart rate measurements in BPM were recorded manually at 15 second intervals, while eye movement measurements were recorded continuously by the Biopac EOG. For the control group, the Atari gaming console would remain covered for the whole experiment, while for the experimental group, the console would be uncovered at five seconds into the test period. At that point in time, the researcher sitting next to the participant would begin to play the game Pong, which served as the visual distraction and was oriented directly in front of the participant’s line of view, approximately a foot away from them. It is important to re-emphasize that the game Pong was utilized solely for the purpose of serving as a distraction rather than as an explicit stressor. This researcher played the game until the participant finished their test. In order to maintain consistency across groups, a researcher remained sitting quietly near the participant in the same location for the control group. The amount of time the participant took to complete the test was also recorded. When the participant finished their test, the test equipment was removed, and they were escorted out of the room. After the participant left the room, their exam score was computed by dividing the total number of correct answers out of 26 to find a percentage correct.

Positive Control

To ensure functionality of the EOG device and the pulse oximeter, positive control tests were carried out by the experimenters. For the pulse oximeter positive control test, two minutes of baseline heart rate measurements were taken by recording the heart rate at 15 second intervals, and this baseline average was 72 BPM (n=2). Then, another set of heart rate measurements were taken every 15 seconds for one minute after the experimenters ran in place for one minute. The average heart rate during this post-exercise period was 118 BPM (n=2). The heart rate measurements increased as expected after a short period of physical activity. For the Biopac EOG positive control test, two minutes of baseline EOG measurements were taken. The baseline consisted of the experimenter focusing on a single point, and these average EOG values were 0.007 mV (n=1) for the vertical channel and 0.005 mV (n=1) for the horizontal channel. Then, another set of EOG measurements were taken for one minute while the experimenter followed a pendulum with their eyes, and these average EOG measurements were 0.868 mV (n=1) for the vertical channel and 0.826 mV (n=1) for the horizontal channel. Eye movements increased as expected when looking at a pendulum, and this indicates that the device was functional.

Negative Control

For the pulse oximeter and EOG negative control test, one experimenter put on the EOG electrodes and pulse oximeter for four minutes, roughly the length of the actual experiment. Measurements of eye movement and heart rate were collected by the Biopac EOG and pulse oximeter, respectively. The average heart rate during this time period was 74 BPM (n=1), while the average EOG measurements were 0.007 mV (n=1) for the vertical channel and 0.005 mV (n=1) for the horizontal channel. These results from the negative control test showed that the equipment accurately measured the physiological parameters being recorded when no experimentation was taking place.

Data analysis

All data analysis and calculations were done with Microsoft Excel and Biopac. Results were reported as mean ± standard deviation. For all participants, an average heart rate was calculated for both the baseline and test period, and the difference between the average heart rate between these two periods was then found. In addition, average eye movement amplitude (in mV) was found by highlighting the data on the Biopac System for either the baseline or the test period and then using the peak to peak value feature to record a value for both the horizontal and vertical channels. The difference between baseline and test period eye movement values was calculated for both the horizontal and vertical channels separately. Next, all individual participant differences for heart rate and eye movement values were averaged in their respective group (control or experimental).

After all group averages were calculated, two-tailed comparison of two means t-tests were carried out using Microsoft Excel to determine if the average changes in physiological parameters significantly differed between the two groups. The findings of these t-tests would demonstrate whether or not the visual distraction affected test performance by means of impairing attention or inducing stress. A p-value of less than 0.05 was considered to be statistically significant.

In addition to analyzing the differences in the change of physiological parameters between the control and experimental group, differences in test performance, defined as the amount of time it took each participant to complete the test and each participant's test score, were also analyzed. For each group, all of the the participant's test times (in seconds) were averaged. This was also done for all of the participant's test scores (in percent correct out of 26) with respect to the two groups. Finally, two additional two-tailed comparison of two means t-tests were carried out to determine if there was a significant difference in the average test times and the average test scores between the two groups. These t-tests would further provide evidence to determine whether a visual distraction negatively affects an individual's test performance.

Results

Cumulative results are displayed in **Table 1.** Main findings are detailed in the two sections below.

Physiological Assessment

The change in heart rate from the baseline to the test period was slightly higher in the distraction group (12.039 BPM) compared to the control group (11.664 BPM) (**Figure 5**). However, there was no significant difference in this heart rate change between the control and distraction group (p-value=0.826).

With respect to the change in EOG horizontal movement from the baseline to the test period, the control group had a positive increase of 0.402 mV, while the distraction group exhibited a decrease of 0.570 mV (**Figure 6**). Once again, there was no significant difference in this EOG horizontal movement change between the two groups (p-value=0.240).

Finally, the change in EOG vertical movement from the baseline to the test period was fractionally higher in the control group (0.162 mV) than in the distraction group (-0.140 mV) (**Figure 7**). There was also no significant difference in the EOG vertical movement change between the two groups (p-value=0.549).

Exam Performance Assessment

The exam completion time was longer in the control group (99.692 seconds) than in the distraction group (97.091 seconds) (**Figure 8**). There was no significant difference in the completion times between the two groups (p-value=0.650).

Finally, the exam score of the distraction group was slightly lower at 98.601% compared to that of the control group at 99.192% (**Figure 9**). There was no significant difference in exam scores between the two groups (p-value=0.625).

Discussion

Upon analysis of the data, it was concluded that the findings of this study were statistically insignificant. The p-values for all t-tests were greater than 0.05, indicating that our data does not support our hypothesis. More specifically, we cannot reject the null hypothesis that there is no difference between the variables examined between the control and the distraction group. In other words, we cannot accept our alternate hypothesis that a visual distraction negatively affects exam performance directly through attention and indirectly via stress.

Although our p-values were statistically insignificant, several of the metrics had promising trends. For instance, the change in average heart rate for the distraction group (12.039 BPM) was slightly higher than for the control group (11.664 BPM). This may suggest that a visual distraction could negatively affect exam performance indirectly via stress. However, because there was a similar increase in heart rate from the baseline to exam period in both groups of participants, varying degrees of test anxiety may have also had a confounding effect on heart rate. This makes it difficult to determine the actual cause for the increased change in heart rate for the distraction group. Rasul & Bukhsh (2011) support that varying personal factors, such as an individual's anxiety levels, can impact exam performance as well. Therefore, additional studies are needed to decipher the possible role of an increased stress response following a visual distraction as the mediator of poorer exam performance.

Unlike the heart rate data, the EOG results were more unexpected and harder to interpret. The change in EOG horizontal movement for the control group was a positive electrical potential value of 0.402 mV, indicating that on average their participant's eyes moved to the right, while the negative electrical potential value of -0.570 mV for the distraction group implies an average leftward eye movement (Meißner & Loose, 2012). With respect to a change in EOG vertical movement, the control group had a positive electrical potential value of 0.162 mV, indicating that on average the participant's eyes moved marginally downward, while the negative potential value of -0.140 mV for the distraction group implies a very small average upward eye movement (Meißner & Loose, 2012). However, these eye movement differences between the groups, as supported by the insignificant p-values, do not seem to suggest that the visual distraction significantly affected attention, since the presence of a visual distraction should not lead to an opposite direction of eye movement from the baseline to the test period. A possible reason for these findings could be due to a lack of validity in the measurements for EOG horizontal and vertical eye movement. Our positive control test, where an experimenter followed a pendulum with their eyes should have resulted in a larger horizontal than vertical eye movement, but roughly equal measurements instead were found. So, a more informative positive control test might involve recording EOG measurements, while a series of vertical and horizontal eye movement directions of specified sizes were given by another experimenter. In addition, many of the participants in both groups were observed to not completely follow directions during the baseline period, resulting in random eye movements and thus an inaccurate measurement in the change of eye movement from the baseline to the test period. In future experiments, it may be beneficial to stress to the participant before the experiment that it is important to follow directions during the baseline visual task.

Finally, differences in exam completion time and score between the control and distraction groups also did not have statistically significant results. However, they did exhibit trends that in part support our hypothesis. Although we predicted exam times would be longer for the distraction group, implying worse exam performance, the slightly shorter exam times for the distraction group (97.091 seconds) compared to the control group (99.692 seconds) could also signal decreased exam performance, since the participants may have been less focused on the exam and more eager to finish to get out of the distracting environment. This is in accordance with the lower exam scores in the distraction group (98.061%) than in the control group (99.192%). In the future, to more effectively determine if a visual distraction negatively affects exam performance, a time limit to finish the exam could be employed. By making the exam conditions slightly harder with the implementation of a time constraint, the effects of a visual distraction on exam performance might be more apparent. Having a time constraint would also be translationally beneficial, since most exams in the academic world are administered with a certain time limit.

Overall, aside from the reasons discussed above, it is also possible that none of our results were statistically significant due to the lack of stimulative strength of the visual distraction. A possible adjustment for the future could be using a larger monitor with higher resolution and more vibrant color displays than what was provided by our 2002 Atari gaming console. In addition, numerous limitations with the experimental design could have led to further confounding variables.

Limitations

There were many limitations present in this study that may have impacted the results. The small sample size, due to a lack of time, of 50 participants accounted for a considerable limitation. This made it difficult to account for confounding variables, such as a lack of sleep, caffeine consumption or other underlying health issues (e.g. visual impairments). For example, if an individual got a less than normal amount of sleep the night prior to participating in our experiment, their test time and accuracy results may be reflective of that lack of sleep, rather than as a result of the presence or absence of a visual distraction. In an experiment with only 50 participants, this may have a noticeable effect on the results. One may suggest that controlling for these types of confounding variables could be resolved by carrying out a study in which individual subjects served as their own controls. However, the reason that this type of experimental design was not utilized is that the subject may perform better on the exam the second time, regardless if there was or was not a distraction, simply from the prior exposure to the exam questions.

Additionally, the study was not a true representation of the general population. There was a selective bias, since all 50 participants were enrolled in Physiology 435 at the University of Wisconsin-Madison, a class that is predominantly comprised of biology majors with a junior or senior undergraduate standing. Compared to the general population, UW-Madison students are also likely more practiced, efficient and focused test takers. Therefore, there was little diversity among our sample size. Furthermore, all Physiology 435 students are required to conduct a study testing various characteristics of the physiology of the human body. Thus, participants were not completely blind as to what the study was testing, because they had an idea of what to expect. This in turn could have influenced their performance.

Finally, the equipment available was also a limitation. For example, utilizing the EOG required many electrodes to be placed on the participant's face. For some participants, there were issues with the electrodes sticking in place properly, especially if participants were wearing makeup or if they had more oily skin by nature. This caused an issue because when electrodes fell off the subject, the EOG was not able to collect data properly, impacting the readings. With the time constraint, it was difficult to test additional individuals to make up for the experiments where the electrodes fell off of participants. Consequently, using this inaccurate data affected our analysis and results.

Conclusion

Although administering a visual distraction during an exam was hypothesized to adversely affect overall test performance directly via impairing attention and indirectly via inducing stress, our study was not supportive of these relationships. However, due to the numerous factors discussed that could have played a disruptive role on accurate data collection and analysis, it would be unreasonable to conclude that a visual distraction doesn't impact exam performance. Instead, more research should be done employing larger cohorts, unbiased subjects, and finer equipment to obtain more accurate results.

Ultimately, the broad purpose of this study was to further our knowledge of physiological processes that are occurring in our everyday lives. The study conducted was of relevance to the University of Wisconsin - Madison's Fundamentals of Physiology 435 course, because the research focused on the body's functional responses to stimulation. This fits into the objectives of the course, since homeostasis, the main theme throughout lectures, is affected when individuals encounter a visual distraction in their environment, and its restoration occurs via neuronal and hormonal responses (units I and II). In addition, this research further develops our understanding of human physiology, because we were able to experimentally observe how extrinsic factors (i.e. visual distractions) induce changes in measurable physiological parameters (i.e. heart rate, eye movement) when engaging in common tasks (i.e. taking exams). Our knowledge of the mechanisms underlying the establishment of electrical potentials from the study of neuronal signaling was also shown to have important real-world applications, such as in EOG, where membrane potentials recorded with electrodes can provide information to that individual's changes in eye movement direction and extent.

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Tables and Figures:

Group	**Average (±SD) HR Difference (BPM)**	**Average (±SD) EOG Horizontal Difference (mV)**	**Average (±SD) EOG Vertical Difference (mV)**	**Average (±SD) Exam Time (seconds)**	**Average (±SD) Exam Score (%)**
Control	11.664 ± 6.896	0.402 ± 2.981	0.162 ± 0.600	99.692 ± 23.467	99.192 ± 4.528
Distraction	12.039 ± 4.815	-0.570 ± 2.272	-0.140 ± 2.267	97.091 ± 15.760	98.601 ± 2.531
P-Value	0.826	0.240	0.549	0.650	0.625

Table 1: Experimental results for the five metrics analyzed in this study. P-values are from two-tailed comparison of two means t-tests.

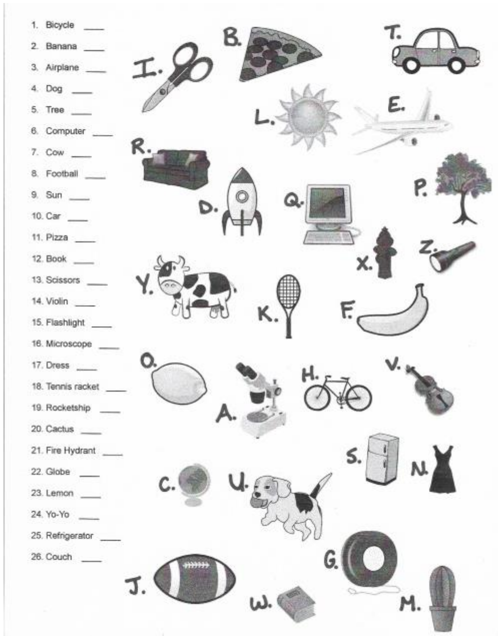

Figure 1: Matching test made by the experimenters and administered to participants.

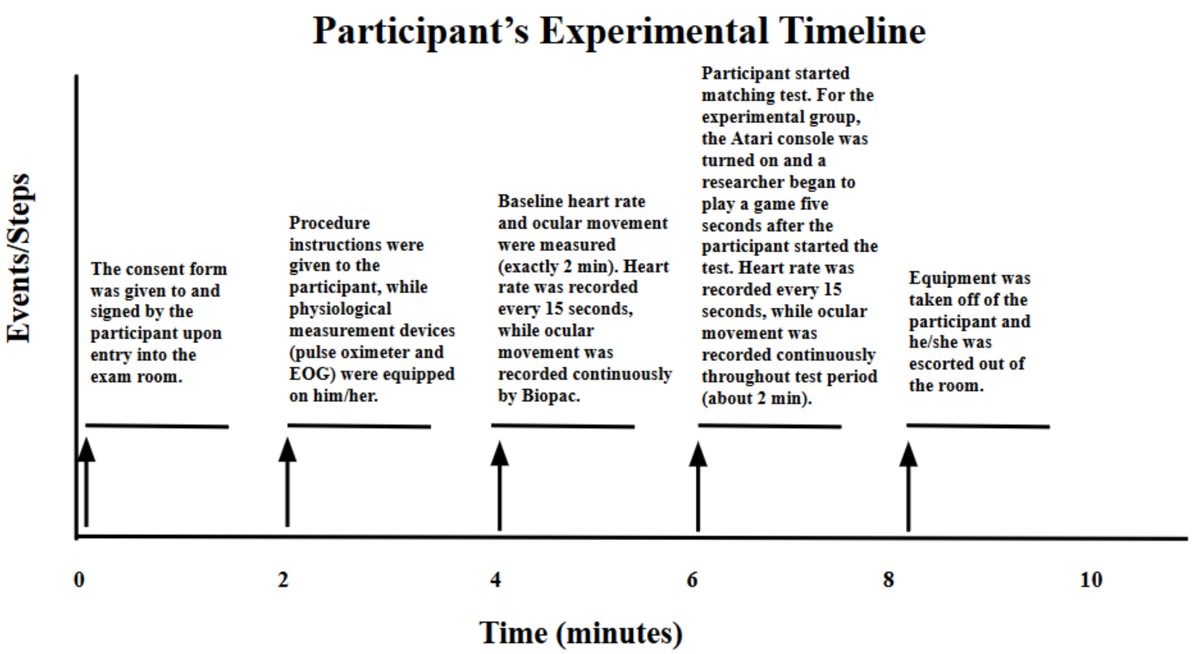

Figure 2: Experimental procedure timeline for participants.

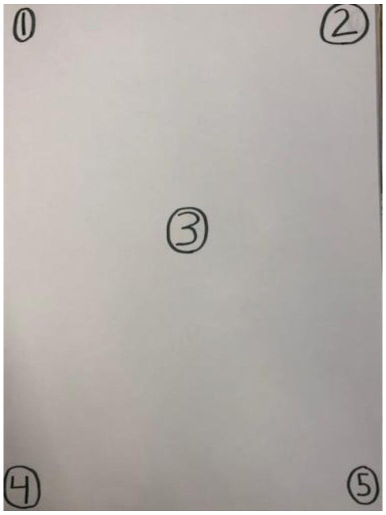

Figure 3: Back of exam paper that was used for EOG baseline recordings of eye movement.

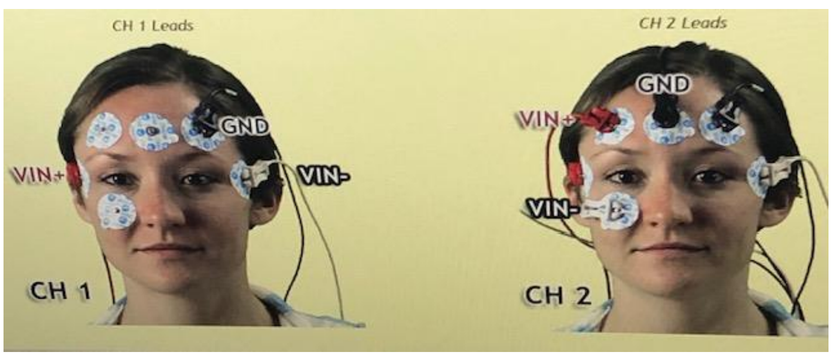

Figure 4: EOG electrode and channel placements on participant.

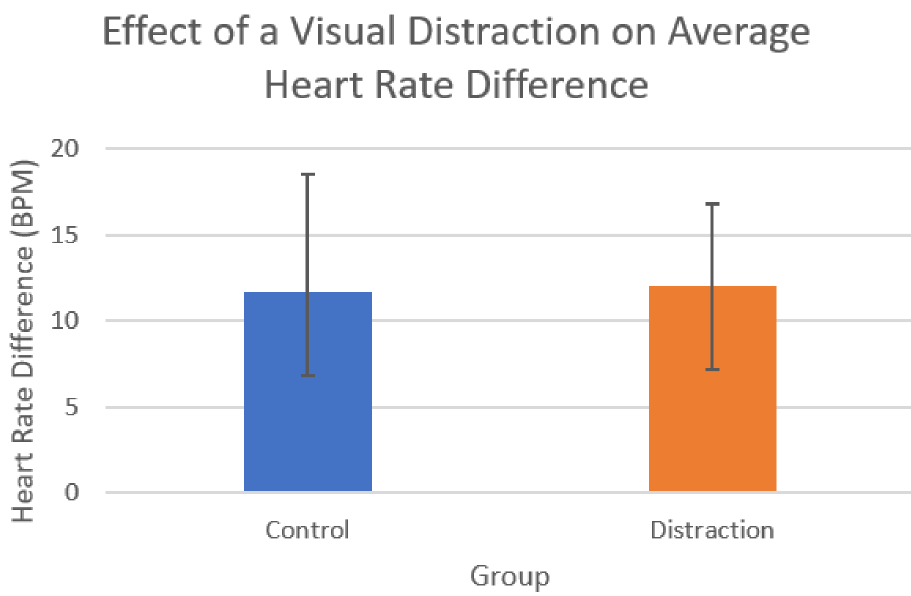

Figure 5: Average heart rate difference between the exam and baseline periods for the control (n=25) and distraction (n=25) groups. Standard deviation bars are shown. There was no significant difference between the group's average heart rate changes (p-value=0.826).

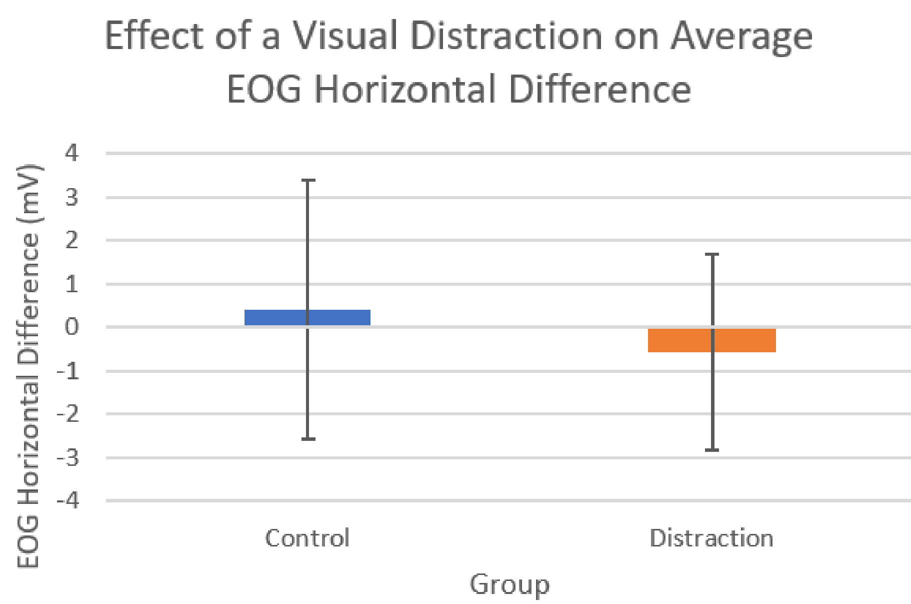

Figure 6: Average EOG horizontal difference between the exam and baseline periods for the control (n=25) and distraction (n=25) groups. Standard deviation bars are shown. There was no significant difference between the group's average EOG horizontal changes (p-value=0.240).

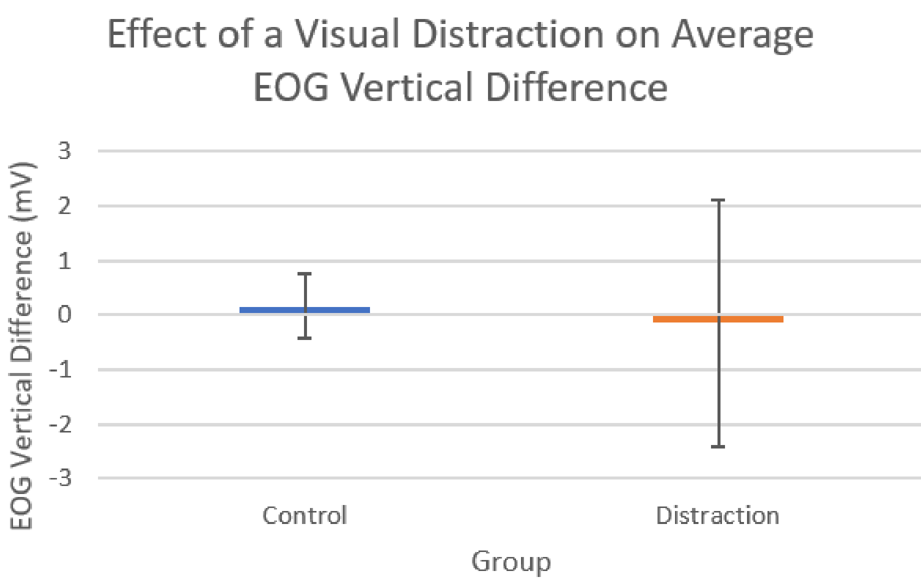

Figure 7: Average EOG vertical difference between the exam and baseline periods for the control (n=25) and distraction (n=25) groups. Standard deviation bars are shown. There was no significant difference between the group's average EOG vertical changes (p-value=0.549).

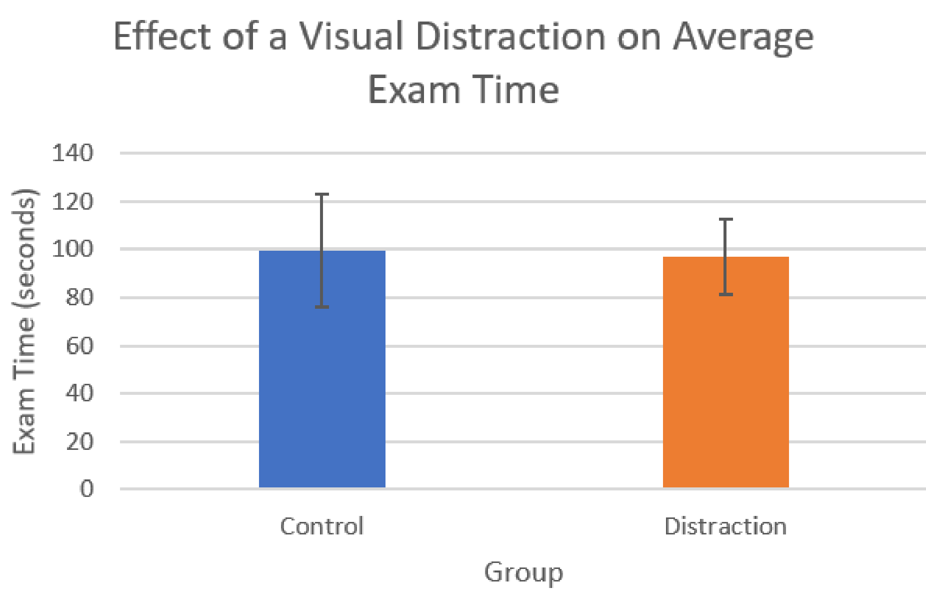

Figure 8: Average exam times for the control (n=25) and distraction (n=25) groups. Standard deviation bars are shown. There was no significant difference between the group's average exam times (p-value=0.650).

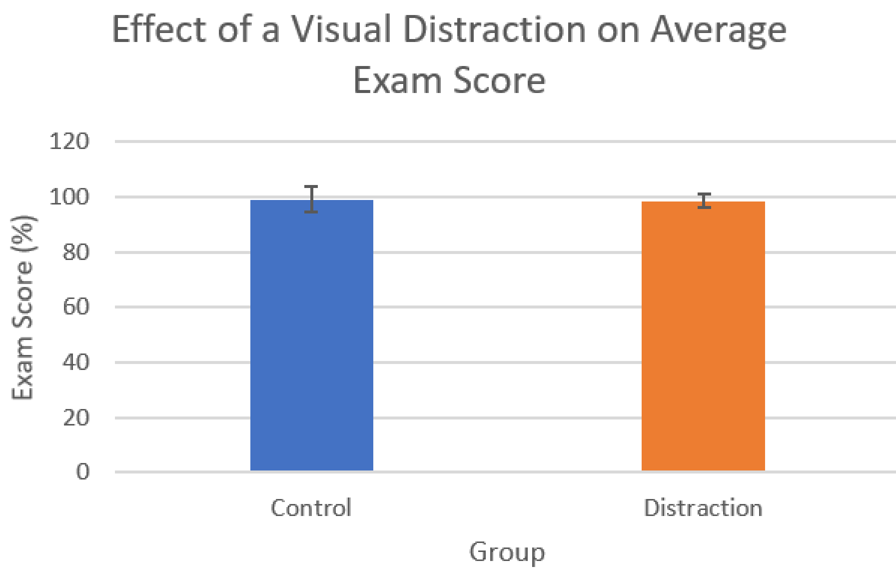

Figure 9: Average exam score percentages for the control (n=25) and distraction (n=25) groups. Standard deviation bars are shown. There was no significant difference between the group's average exam score percentages (p-value=0.625).