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Project Name: Effects of Pupil Dilation, Eye Movement, and Blinking to Detect When Someone Lies

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Scientific Abstract

In this experiment, different methods of determining when a subject is lying would be analyzed, such as pupil dilation, saccadic movement, and blinking. Based on previous research, there can be many assumptions on what the data would look like. There are pre-researched and planned questions to ask subjects after it was determined if they were going to be lying or telling the truth. Pupil dilation would most likely increase, eye movement would increase, and the amount of times of blinking would decrease. These assumptions represent what can be expected of the data to look like at the end of the experiment.

Lay Abstract

What do you expect investigators to do when they are trying to determine if a suspect is lying? Often people will assume that a lie detector test would be used, but researchers wanted to find another way to detect when someone is lying. In the future, researchers will be conducting

an experiment to determine whether the pupils of a subject's eye changes in size, how much their eyes move, and how much they blink. The researchers found that these three different variables have been used in previous research to determine whether someone is lying. Different subjects would be gathered and chose whether they will lie when asked questions or tell the truth. The researchers have pre-planned questions to ask the subject, to which they will stick to their role when responding. The results of the data can be assumed that the pupil size would increase, the eye movement would increase, and the amount of times a subject blinked would decrease throughout the testing.

Background

Commonly in TV shows and movies, detectives want to be able to figure out whether someone is lying about their alibi or what occurred during an incident. This question has plagued many people and is constantly researched as well. There was a study conducted to compare pupil dilation when lying to if they were lying to a person of white or black background. When conducting the study, they found that there was no significant difference when the participant was lying to a white or black person, but they did however find that pupil dilation did occur when they were lying (Trifiletti 2020). More on pupil dilation, it has been shown that when someone is in fact lying, that the pupil dilation is constant rather than changing (Utz 2005). More evidence has even been shown that pupil dilation may be more effective than a polygraph. In that study, they did find that there was a significant difference in pupil dilation when asked probable-lie questions. When comparing these findings to that of a polygraph, the researchers stated that it may be more effective than the typical polygraph that has been used for so many years (Webb 2009).

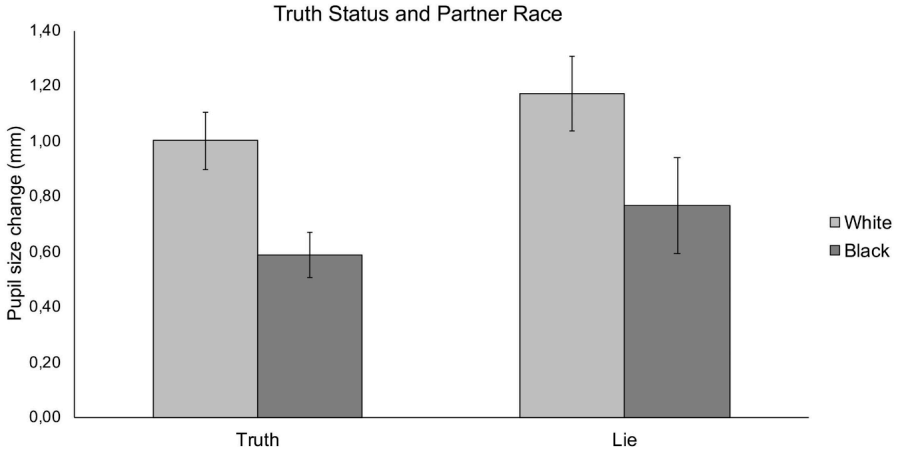
There has always been another question as well, and that would be whether there is a difference between if someone was questioned and their lie had been rehearsed or not. A particular study was watching the participants' saccadic movement, or their eye movement. They found that people who were lying had less saccadic movement than those who were telling the truth. The researchers make an assumption that people who are lying make less eye movements and more eye contact because they are trying to have the person they are lying to believe them, which is often associated with eye contact (Walczyk 2012). This assumption can be backed by another study, in which the researchers questioned the participants that were telling lies about why they had more eye contact. The participants' general answer was because they wanted to have the person believe them that they are lying, but also to check whether their lies were accepted or not by that same person (Mann 2013).

Another indicator that someone could be lying is how often they blink their eyes when they speak. A study was conducted to find out if the rate of blinking changed when a participant was lying to a human or technology. It was found that there was more blinking during the examination with technology than that with a human (Rauch).

Since finding research conducted on how people lie and what to use when detecting this, there isn't any research conducted on an analysis of all of the different ways to detect when someone is lying. This proposed study would be analyzing how pupil dilation, eye movement, and the amount of blinking help to identify whether a participant is lying.

Work Plan

This study is being conducted in order to determine whether lying while speaking affects pupil dilation, eye movement, and blinking. Studies have given conflicting results that support they can all decrease and increase, but no study has looked at the combination of these three detection techniques together. Blinking and pupil dilation is predicted to increase while eye movement is predicted to decrease. Eye movement should decrease because people believe that if they make great eye contact they are more likely to be believed while if they are looking away would make it seem as if they were not telling the truth (Mann, 2013).



In one study pupil dilation was found to increase when lying, but this does not affect race. (Trifiletti, 2020). This is important to our study because this study supports our hypothesis that pupil dilation will increase with lying.

Relevance

This study is relevant because detectives, judges, policemen are all trusted to be able to determine whether someone is lying or not. Studies have shown that lying can be individual to each person, but that there are usually some patterns most people do. (Rauch, 2015). This study could help confirm whether or not eye movement, blinding, and pupil dilation can be a key to detecting lies or not.

Methods

To begin the experiment twenty participants will be randomly assigned to either lying or telling the truth. Every participant will be enrolled in Biology 301 at Longwood University, but

will not be very well known to the researchers so they do not know the backgrounds of the participants giving them more knowledge and skewing the data. The groups will be unknown to the researchers to blindly detect characteristics and see if there are patterns to tell if someone is lying or telling the truth. A list of questions will be asked to each participant, but they will not see the questions before their turn. This is so they cannot rehearse their lies beforehand which makes it easier to deceive (Utz, 2005). Fourteen questions were picked, seven of which were neutral questions that the researchers and participants knew the answer to. This is done to have a control to see what each participant's habits are when they are telling the truth and to compare against the other seven questions where they may be lying or not. Having twenty participants and fourteen questions means there will be 280 trials which will be more than enough to keep the likelihood of errors low.

Each participant will be alone except for the researchers, and they will sit in front of a camera. The researchers will sit directly behind the camera to imitate regular eye contact as much as possible. The participant will then be asked each question so that there is repetition instead of just giving one question which could skew the results.

After the questioning is done each clip will be uploaded to the program ImageJ where the researchers will go frame by frame in order to measure pupil dilation and take a blinking count. This will also make it easier to see how much eye movement is happening and see if there are noticeable patterns. After each clip has been analyzed, the liars and non-liars will be revealed to the researchers.

The average pupil dilation and blinking will be calculated for lying and non-lying. A significance test will be conducted to see if there is a significant difference in lying or telling the truth. Eye movement will be rated as none/little, some, and a lot of movement. These will then again be compared for lying and non-lying to see if there is a difference.

Statistical Analysis

To analyze the data, a test of significance will be conducted in order to provide a conclusion about if the data collected supported or did not support the hypothesis made. A null hypothesis and alternative hypothesis will be used as the judgement for whether the data supports the experimental hypothesis. Being able to compare our obtained data to the null hypothesis, null meaning the assumption of no difference, we are able to make clear judgements about the facts gathered. When conducting a statistical test, the goal is to present evidence to reject the null hypothesis, and if this is successful, then conclusions can be made.

The data obtained from every participant will be the same: the dilation of their pupils will be monitored, the amount of times they blinked will be counted, and each will be asked the same set of questions. The experiment will include 20 participants, each answering all 14 questions.

This makes it so that there will be 280 trials of data to work from. With a data set with this much information, the number of errors should be small enough to allow for there to still be a lot of usable data for conclusions to be made.

Ethical Considerations

Each participant will sign an agreement to participate in the study and will be told what they will be doing before doing the actual experiment.

Data protection will be conducted by the researchers not knowing the participants well so that they will not know whether the participants are lying or not. The researchers will also be blind as to who was assigned to which group (telling the truth or lying) so they cannot influence the participants.

Also the participants will not see each other while answering the questions so they will not know the questions beforehand. The only people who will see the clips of the participants will be the ones conducting the study.

Work package structure

The list of questions each participant will be asked is as follows:

1. Are you aware that you are answering questions for an experiment today and that you may be lying or telling the truth? (Buffer)
2. Is today _____?(Neutral)
3. At Longwood, have you ever cheated on a test? (Lie)
4. Are you registered in Anatomy 301 this semester? (Neutral)
5. What is your favorite childhood memory? (Lie)
6. What is the color of your hair? (Neutral)
7. Have you ever had a nickname? What is it? (Lie)
8. What building are we in currently? (Neutral)
9. What is the meanest thing you have ever said behind someone's back? (Lie)
10. What is the location right outside this building? (Neutral)
11. What did you want to be when you were small? (Lie)
12. Do you go to a university in Virginia?(Neutral)
13. How often do you lie to your friends to get out of hanging out with them? (Lie)
14. Who is the professor for Anatomy 301 this semester? (Neutral)

Data Management Plan-DMP

All of the collected data will be attached to a software program called ImageJ. This software will allow the participants' pupils to be tracked throughout the experimental process. After all the data is obtained, it will be put through the statistical testing required, most likely using a program like Microsoft Excel or something similar. The data that is collected throughout the experiment will only be shared with the researchers during the time of experimentation but will be shared at a later date through a presentation to peers.

References

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