

In order to test the effectiveness of a drug designed to make people react faster to visual input, a reaction time test should be conducted first. I would propose that the initial test be conducted on non-professional drivers, and later the results may be able to be replicated with people who drive for a living. This would establish the general efficacy of the drug. There should be at least 24 participants (with normal or corrected to normal vision), 12 in each condition, to help ensure that any effects found are not due to mere chance. The experimental group will receive an injection of the drug at a dose recommended by physicians and/or the creators. The control group should be injected with a placebo substance, preferably one that would mimic any side effects of the actual drug (independent variable). Thus we would ensure blinding of the participants to experimental group. Similarly, you, my assistant and experimenter, will not know which substance each participant will be given; everything in this regard will be coded to ensure blinding on all sides. Measures will include reaction time and number of correct/incorrect responses.

Subjects will be brought into the lab, where they will be seated in front of the computer screen for testing. Participants should be told ahead of time that the entire session will take roughly an hour and that they will be able to take breaks. The breaks will hopefully prevent boredom and tiredness from the task. The task will not be difficult, seeing as all participants will be adults with driver's licenses. The participants will view a series of trials depicting life-like visual scene of a traffic light. The scene will start out portraying a yellow light. Participants should be told that after some amount of time, the light will change. Participants should respond as quickly as possible by using their right foot to press either the gas pedal or the brake pedal (which will be at their feet positioned the same as the pedals in a real vehicle). If the light changes to green, they should quickly step on the gas, and if the light changes to red, they should quickly step on the brake. Upon stepping on either pedal, the screen will go blank and

will remain so for 5 seconds before the next trial appears. There are 20 trials in each block, and each participant will run through 6 trial-sets (3 of the scene in “night” and 3 in “day” conditions). Subjects will be allowed 5-10 minutes of a break between the 6 blocks, but should finish each set as it runs through (unless of course they decide they no longer wish to participate; participants can stop at any time).

We will be using a blocked-design, so as to rule out order effects and to provide counterbalance. Each block will consist of 20 trials of either day or night conditions, 3 blocks of all “day”, 3 of all “night”. Each trial is exactly the same except for length of delay, time of day condition, and change condition. Delays (time between presentation of stimulus and change of the signal light) will be 4, 8, 12, 16, and 20 seconds. These delays help to mimic real driving conditions, as drivers do not know how long they will have to wait for a light to change. Similarly, it will prevent subjects from figuring out how long of a delay they will be subjected to, so as to confound their response time. Four trials at each delay time will exist in each trial in a random order. Similarly, ten red changes and ten green changes will exist in each block, also presented in random order.

Participants 1, 5, 9, 13, 17, 21 will receive block order 1 (D-N-N-D-N-D). Participants 2, 6, 10, 14, 18, 22 will receive order 2 (N-D-N-N-D-D). Participants 3, 7, 11, 15, 19, 23 will receive order 3 (D-N-D-D-N-N). Finally, subjects 4, 8, 12, 16, 20, 24 will receive order 4 (N-D-D-N-D-N). Within each order group, three will receive the actual drug while three will receive a placebo injection.

For every participant, the computer will measure reaction time from stimulus onset to response as well as whether or not the response was correct. After all the data has been collected, we will do as any smart researchers would, and hire a statistician to analyze the data. T-tests and ANOVA’s will be run to determine whether or not there were significant differences

($p < 0.05$) between groups (experimental and control). Our hypothesis is that participants given the drug will react faster to stimulus changes than those in the placebo group. We also feel that they may respond correctly more often; however we do not believe this will reach significance. So although those in the placebo group will respond correctly, we feel they will take longer to do so. For exploratory purposes, we will also run t-tests to determine whether there were significant differences between males and females, day and night condition, red or green light change, and length of delay. We do not feel that any of these variables will produce significant differences.

Upon completion, publication, and presentation of our findings, we hope to secure more grant money for further studies on the drug. Future studies could include eye-tracking. This would help determine at what point in the visual process time is gained for quicker reaction. It may lead to insight into the drug's mechanism of action (whether it is altering something in the eye itself, speed of neural transmission, etc.). Similarly, the results of the current study would help lead us to designing a simulation program that could better replicate real-world driving conditions, such as those for long haul truckers, race car drivers, or police and military personnel.

The compound eye of the fly is made up of hundreds of thousands of individual "eye units", called ommatidia. Each of these units has its own cornea, lens, and photoreceptor cells

to help distinguish brightness and color. The cones in the fly eye are similar to those in the human eye in that they allow for 3-color vision (with the help of red, blue, and green light sensing pigment cells). Each ommatidia collects light and directs it separately to a receptor to build up an image. The resulting visual creation is a mosaic-like image. The ommatidia are arranged on a convex surface, and their perimeters are octagonal, thus there are limited gaps in vision. This convex surface also means that each ommatidia points in a slightly different direction.

In the fly, the pair of compound eyes, with its numerous ommatidia, positioned on the side of the fly's head, allow for a large viewing angle. Fly's have nearly 360 degree vision, as compared to human vision, which is roughly 90 degrees. However, their visual range is much smaller than human vision, in that the fly can only see in detail a few millimeters. However, this detail is something that we could only see with help from a microscope. Unfortunately for the fly, things farther away are seen in very poor resolution. Flies, however, may not need this detail-laden vision, as they are able to detect fast motion very efficiently, even at a distance, due to the ommatidia and their varying directional angles. Compound eyes are also sometimes able to detect ultraviolet and polarized light, allowing them to see wavelengths that are invisible to humans. Some species with compound eyes, such as the honey bee, have specialized fovea zones that allow for more detailed vision, although still not as advanced as humans.

Human eyes, on the other hand, see in much better resolution, due to our high density of rod and cone cells and our fovea. However, the anatomy of our eyes does not allow us to detect motion as sensitively as a fly. Similarly, our visual field is only about a quarter the size of a fly's. Also, although we can see much farther away than flies, even up as close as an inch, we cannot see in as much detail as a fly. We can also not see ultraviolet light.

The differences in vision between humans and flies take into account the differences in evolution. Humans have evolved to a point where our ability to see our world in great detail is of great importance. On the other hand, flies do not necessarily need such detail in their day-to-day lives. In order to survive, their large visual field and high sensitivity to movement benefit the fly by keeping them safe against predators. After all, how many times have we swatted at a fly only to have it fly away before we even get close? Their sensitivity to changes in light, and thus motion, allow them to fly away unscathed. Similarly, this high sensitivity to motion allows them to navigate efficiently upon escape.