How Fast Do You React?

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Purpose

The purpose of our science project, is to explore the nature of the human mind through the study of reaction times. We built our own measurement and test apparatus (Fig. 1) and hoped to find out if reaction time would be affected while a person is holding a conversation. As a control, we first tested reaction times while the test subjects were not engaged in conversation.

Hypothesis

We believe that reaction time to a simple visual stimulus will be negatively affected (increased) when a test subject is holding a conversation.

Background

When we first discussed possible topics for our science fair project, we both agreed that it should involve a study of human behaviour. While surfing the internet we discovered the work of Francicus Cornelis Donders [1], the first scientist to investigate the nature of human reaction time. Donders performed his experiments in the 1860s and had to develop new technology to make his measurements. Inspired by Donders, we decided to build our own test apparatus, rather than just use a computer. We love to experiment with electricity and this project gave us an opportunity (and our biggest challenge) to use what we've learned about electronics and solve a problem in psychology. Donders' research proved that the brain takes time to process information, therefore thought is a physical process which can be studied and understood by science. Providing a kind of "window" to the mind, the study of human reaction time is still an important part of modern psychology. Donders led the way by taking a scientific approach to the study of the human mind and we are continuing in his footsteps.

Materials

- Toggle switch: used by the person conducting the test to begin the sequence.
- Electronic timing relay: provides a variable time delay so that the test subject does not know when to expect the visual stimulus; also enables clock pulse generation.
- Light panel: provides the visual stimulus; indicates start and end of the test sequence.
- Push button: activated upon reaction to the visual stimulus; stops the clock pulses.
- Electronic pulse generator: produces a very precise gated 10 kHz clock signal.
- Electronic pulse counter: counts and displays reaction times; 0.0001 second precision.
- AC adapter: changes 120 VAC to 12 VAC to power generator, timer, lights etc.

Constructing the Apparatus

1. Solder electronic components onto printed circuit board (pulse generator).
2. Mount timer and pulse generator inside metal enclosure; plug in power adapter.
3. Mount green, red and blue lights on plastic panel; supported by a camera tripod.
4. Make all necessary connections using wires and cables.
5. Calibrate pulse generator to 10 kHz to provide an accurate time base.

Procedure for Testing Reaction Time

1. Set up equipment in a safe and consistent manner; check calibration.
2. Explain procedure to test subject and obtain his or her consent.
3. Set timer to 1st position; flip toggle switch to start timer; green light will come on.
4. Timer will activate red light; test subject reacts and presses red push button.
5. The blue light indicates the test sequence is complete; the pulse counter displays the reaction time; record this data on chart; repeat using three different timer settings.
6. Repeat test while subject is engaged in conversation (answering standard questions).

Figure 1

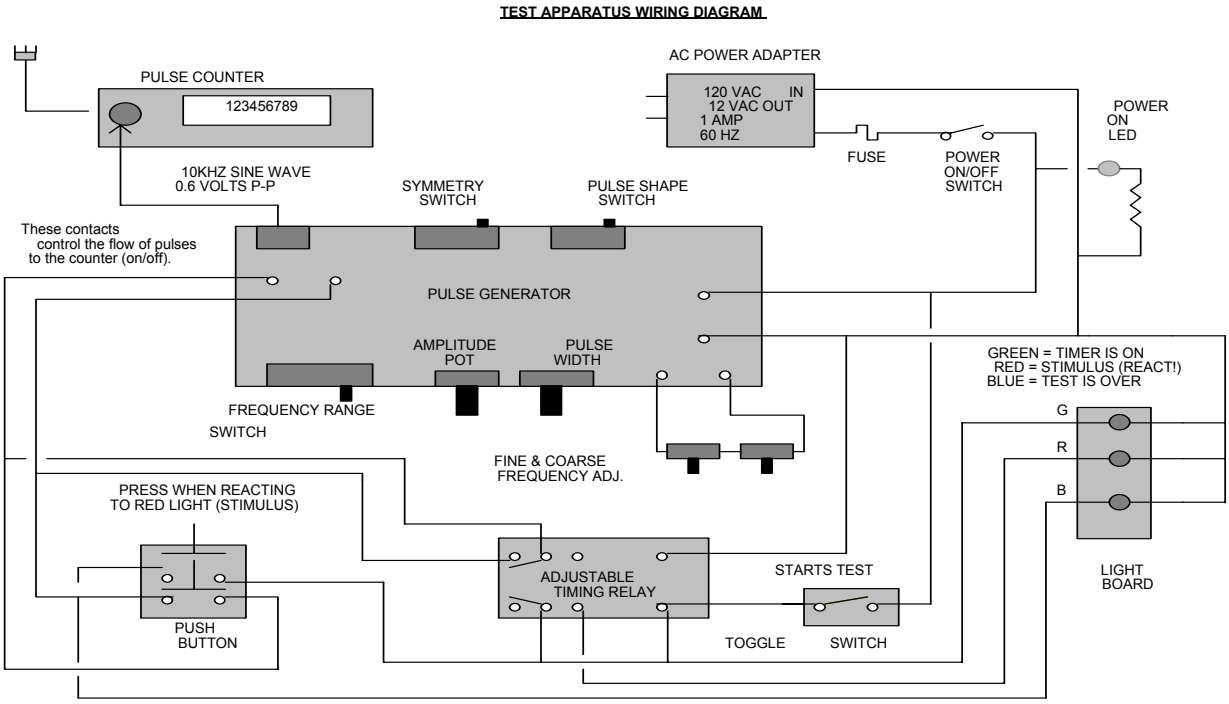
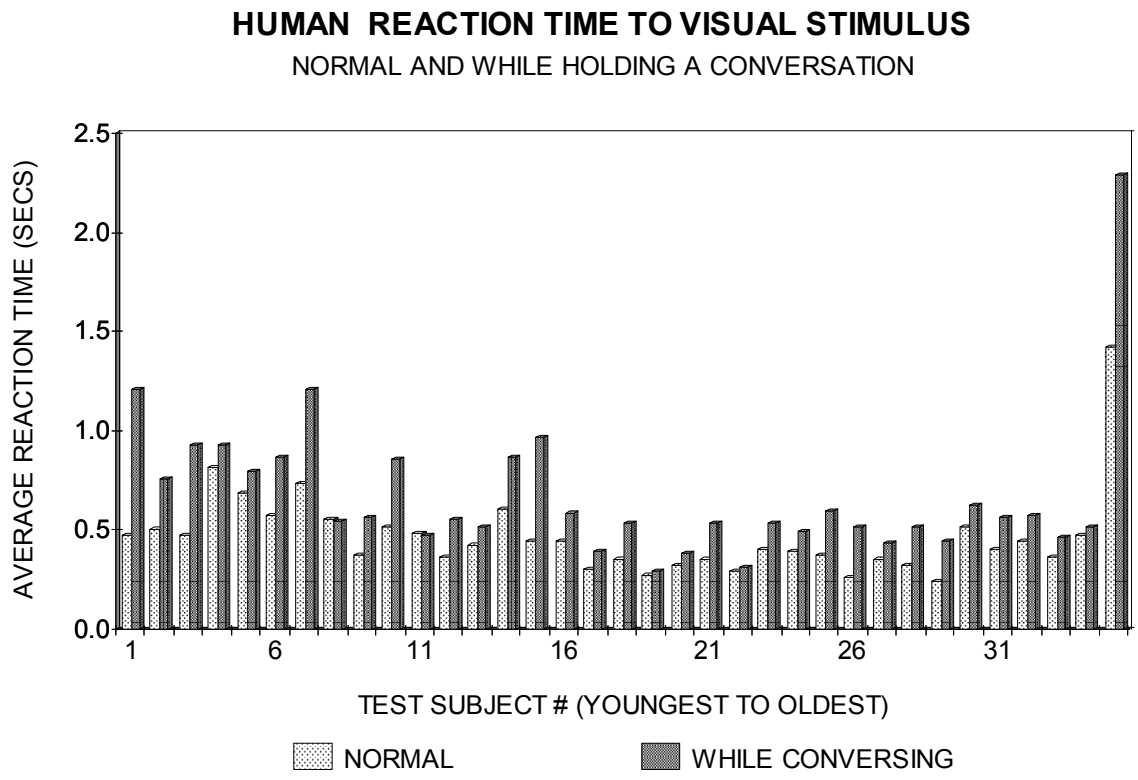


Figure 2



Interpreting Test Results and Observations

We tested the reaction times of 35 people. Each person was tested three times while engaged in a conversation and three times without conversation (the experimental control). The average values were calculated for each phase of testing and plotted on the graph (Fig. 2). We used average values to try to reduce the effect of uncontrolled variables on our data. The standardized conversation consisted of a list of simple questions designed to make the test subject pause and think. The data we collected includes both the human reaction time and the response time of the test equipment. We did not estimate or subtract the equipment response time from our data (we are working on this). We assumed this factor was small and constant so that it would not affect our conclusions. The overall average reaction times were 464 mS. without conversation and 673 mS. while holding a conversation; a 45 percent increase.

Conclusions

Our hypothesis was proven to be correct. Having a conversation increases your reaction time to a visual stimulus significantly. Interestingly, we also noticed from looking at our graph that reaction time seems to be affected by age. Very young and very old people have longer reaction times relative to young and middle aged adults. Donders' values for human reaction time to a simple stimulus were lower than what we obtained (220 mS). However, Donders tested college aged students who tend to have the fastest reaction times; he also used different stimuli and test equipment. Our research on the internet [2] shows that many factors effect human reaction times; males react faster than females, left handed people react faster than right handed people etc. Studying reaction times has helped scientists to understand much about the workings of the human mind. For example, it is interesting to note that reaction to sound is faster than reaction to light because an auditory stimulus reaches the brain faster than a visual stimulus. Reaction to

a simple stimulus is faster than reaction to a recognition situation and reaction involving choice is the slowest of all. A recent study [3] proves that cell phone use dramatically increases a drivers reaction time and may be responsible for 2600 deaths in the U.S.A each year. Much more work could be done to develop our research now that we have the test equipment. We could experiment with other variables, estimate and extract the response time of the apparatus, and try other types of sensory stimulus. Much work needs to be done in the field of psychology before the human mind will ever be fully understood. It's time to think about thinking!

Proof of Requirements

Approvals for human participants were obtained and will be available at the display.

Acknowledgements

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