Date: _____

Nervous System Investigation

Name: Brooklyn Drayton Investigation: Reaction Time

Your Task: Design an experiment to illustrate the effect of stimulus on response times.

SECTION	COMPONENT	Possible Marks	Mark allocated
PLANNING	**Aim:**	1	
	Variables ***Independent Variable:***	1	
	Dependent Variable:	1	
	Controlled Variables: *at least 5 are listed*	5	
	Prediction: The student states what they thought would happen and why	2	
	Hypothesis: A hypothesis is presented that states the effect of the independent variable on the dependent variable	2	
	Equipment: Listed correctly	1	
	Method: Detailed numbered steps are written. Instructions are clear and can be followed exactly at another time. Variables are clearly controlled. A diagram is used and labelled appropriately that clearly enhances the method	5	
RESULTS	**Results:** Displayed appropriately. Tables are used observations are adequately documented. Figures written to the same decimal place. Repeats or replicates are used. The mean is shown in the table. Units are used.	5	
	Graphing (if applicable): Results are graphed on the correct axis and the scale is correct. The correct type of graph has been used without any aid from the teacher. Labelling of units is correct and the graph is easy to interpret	5	
CONDUCTING	**Practical Application:** Safety, behaviour, laboratory skills and application during the investigative process can not be faulted	4	3.5
DISCUSSION Analysis	The results are summarised in a mature manner and pattern/trends in the results are identified and commented on.	2	
Evaluation	Inconsistencies in the results are identified and explained.	2	
	The experiment is classified as: valid; accurate; reliable. Valid reasons are given for the classification.	3	
	Problems and difficulties within the experimental design are identified and the student describes improvements.	4	
	The results of the experiment have been explained based on sound scientific principles taught in class or by doing extra research.	4	
	The discussion must make sense.	1	
CONCLUSION	Major findings are summarised.	1	
	Statement of whether hypothesis has been supported or not	1	
	TOTAL	50	

Brooklyn Drayton
Year 12

NERVOUS SYSTEM INVESTIGATION

Aim

To determine if one's response time to a visual stimulus varies between their dominant right and non-dominant left hand.

Variables

Independent: Dominant (right) or non-dominant (left) hand used

Dependent: How fast one's nervous system stimulates their skeletal muscles to respond to a visual stimulus.

Controlled:
- Colour of visual stimulus
- Laptop used
- Brightness of the screen
- Participant starting position
- Time of the day
- Size of the stimulus

Prediction

It is my prediction that when the participants are using their dominant right hand, they will be able to react to the visual stimulus at a faster rate, in comparison to their non-dominant left hand. This is because as the participants are right handed, the neurons that carry messages from the brain to their right hand, are used more frequently and the communication process is familiar.

Hypothesis

When a dominant right hand is used, one's nervous system will stimulate their skeletal muscles to respond to the visual stimulus at a faster rate, in relation to their non-dominant left hand.

Equipment

- Laptop
- Textbooks/paper to record results
- Pen or pencil
- Desk
- Chair

Key

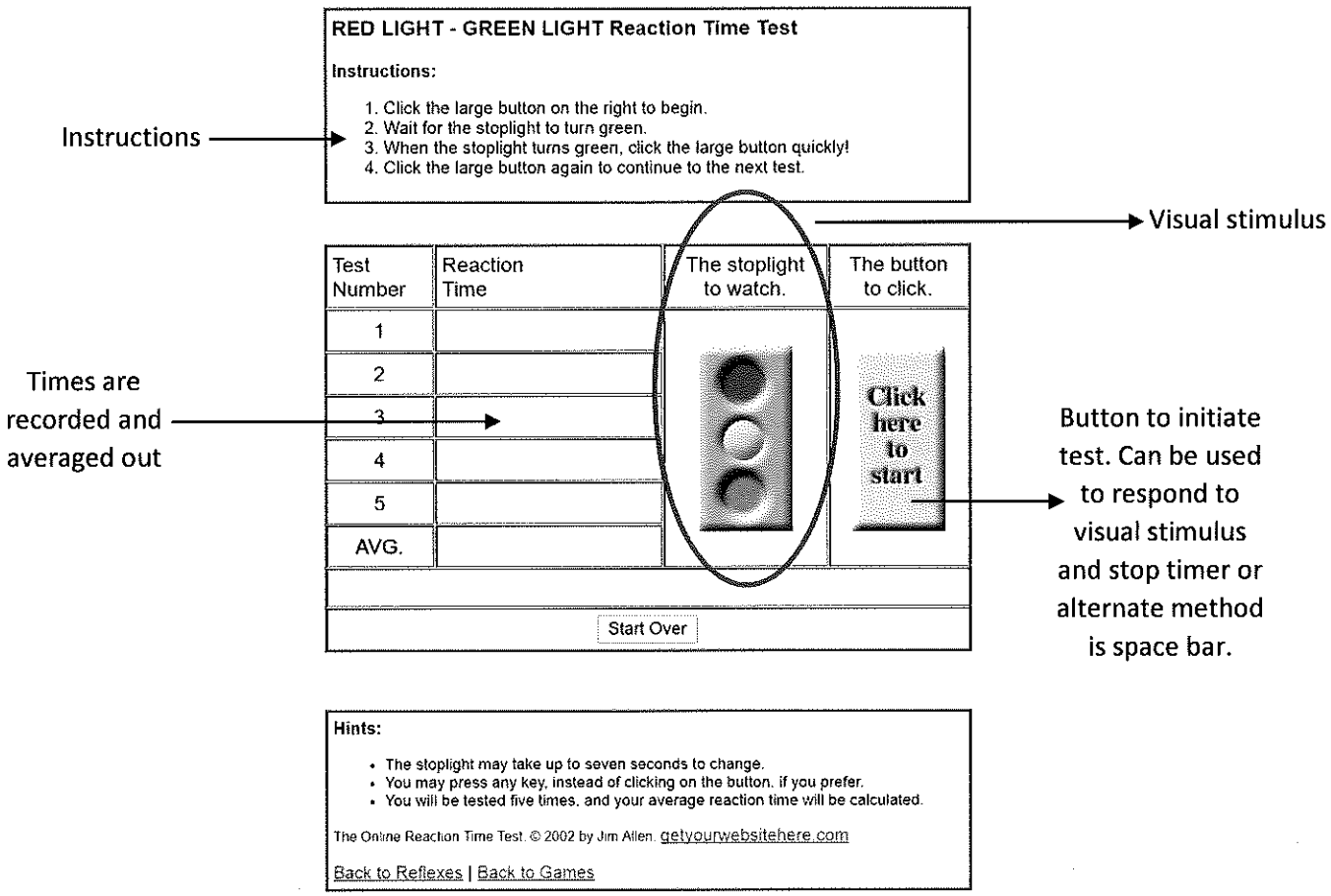
Observer: Person recording results and ensuring the method is precisely followed.
Participant: Dominant right, non-dominant left

Method

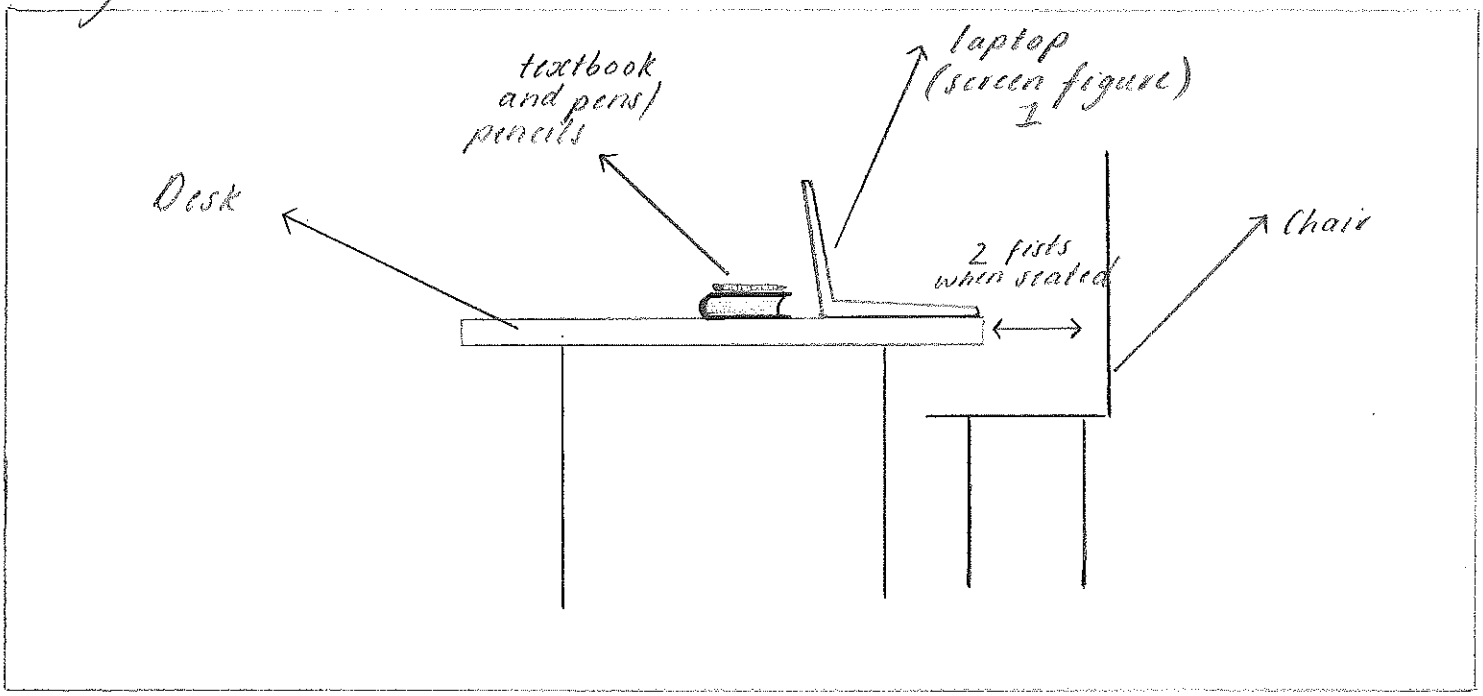
1. Log into the laptop, open internet explorer or google chrome.
2. Go to the web address bar and type in: https://faculty.washington.edu/chudler/java/redgreen.html
3. Place the laptop on the edge of the bench so both edges are flush with one another.
4. Place an appropriate sized chair, in comparison to the bench size, in front of the laptop. (Participants elbow crease should nearly be in line with the edge of the bench)
5. Once seated, the participant should be able to loosely fit two closed fists in between them and the bench. (Fists sideways)
6. The participant places both hands on their lap. They will conduct the first round with their dominant hand, then repeat using their non-dominant.
7. When the traffic light changes colour, the participant responds by clicking the space bar. They then proceed to place their hand back on their lap.
8. Once the participant acknowledges they are ready, the observer initiates the trial by pressing any key.

9. The participant completes the 5 trials and the results are then recorded in the graph. The trials are then repeated using their non-dominant hand and recorded.
10. Ensure that the brightness of the screen is the same for the remaining participants and the experiments are conducted consecutively after one another. This is so the participants are tested at the same time of the day and no other lurking factors, such as tiredness etc, affect the results.
11. Steps 5-9 are then applied to the next participant and the experiment is conducted on them.

FIGURE: 1



Diagram



Results *Figure: 2*

	REACTION TIME TO A VISUAL STIMULUS (sec)										
PARTICIPANT	DOMINANT (RIGHT)					NON-DOMINANT (LEFT)					AVG
PARTICIPANT 1	0.476	0.514	0.469	0.491	0.494	0.565	0.654	0.578	0.531	0.497	0.489
											0.565
PARTICIPANT 2	0.434	0.455	0.484	0.432	0.454	0.478	0.489	0.514	0.501	0.541	0.452
											0.505
PARTICIPANT 3	0.624	0.562	0.566	0.481	0.537	0.588	0.623	0.617	0.649	0.620	0.554
											0.619
PARTICIPANT 4	0.442	0.458	0.882	0.583	0.531	0.631	0.562	0.608	0.653	0.590	0.579
											0.609
PARTICIPANT 5	0.584	0.483	0.610	0.594	0.602	0.669	0.597	0.599	0.584	0.708	0.575
											0.631

Figure: 3

OVERALL AVERAGES	
DOMINANT (right)	0.530
NON-DOMINANT (left)	0.586

Graph

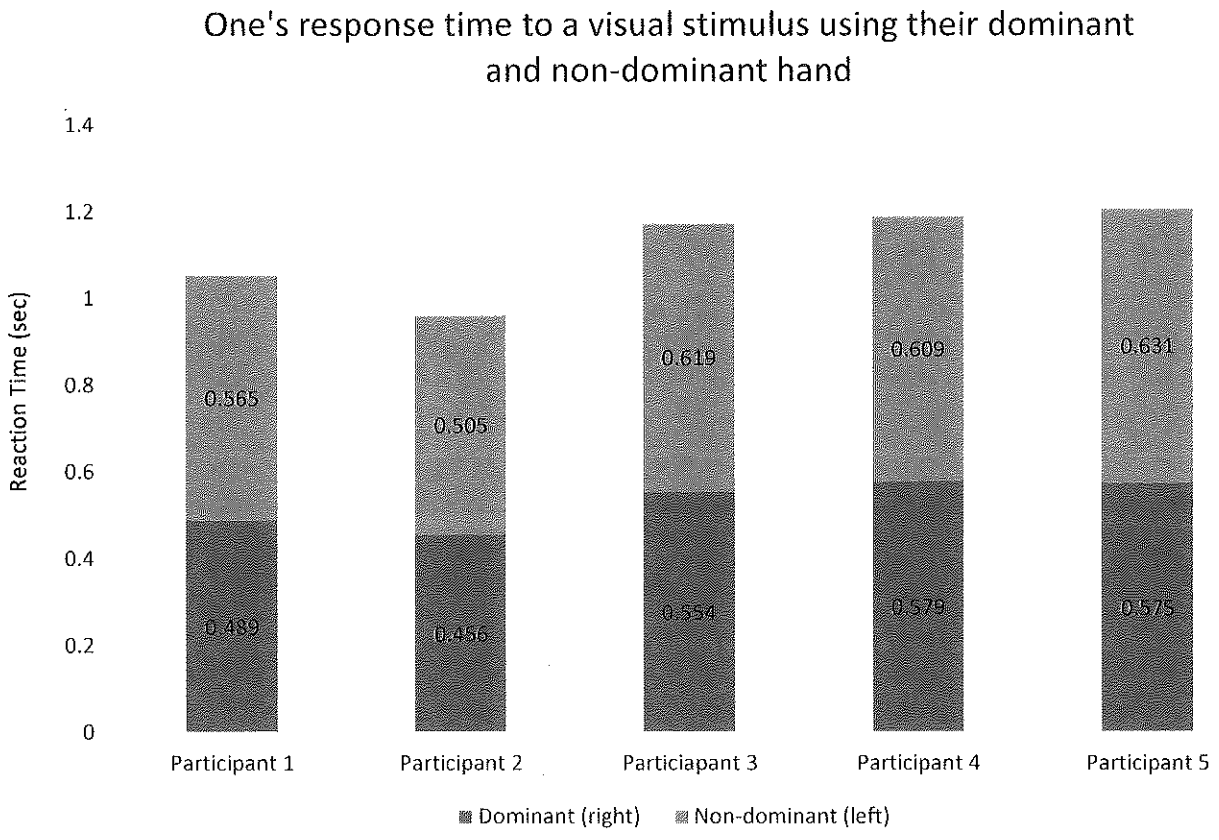


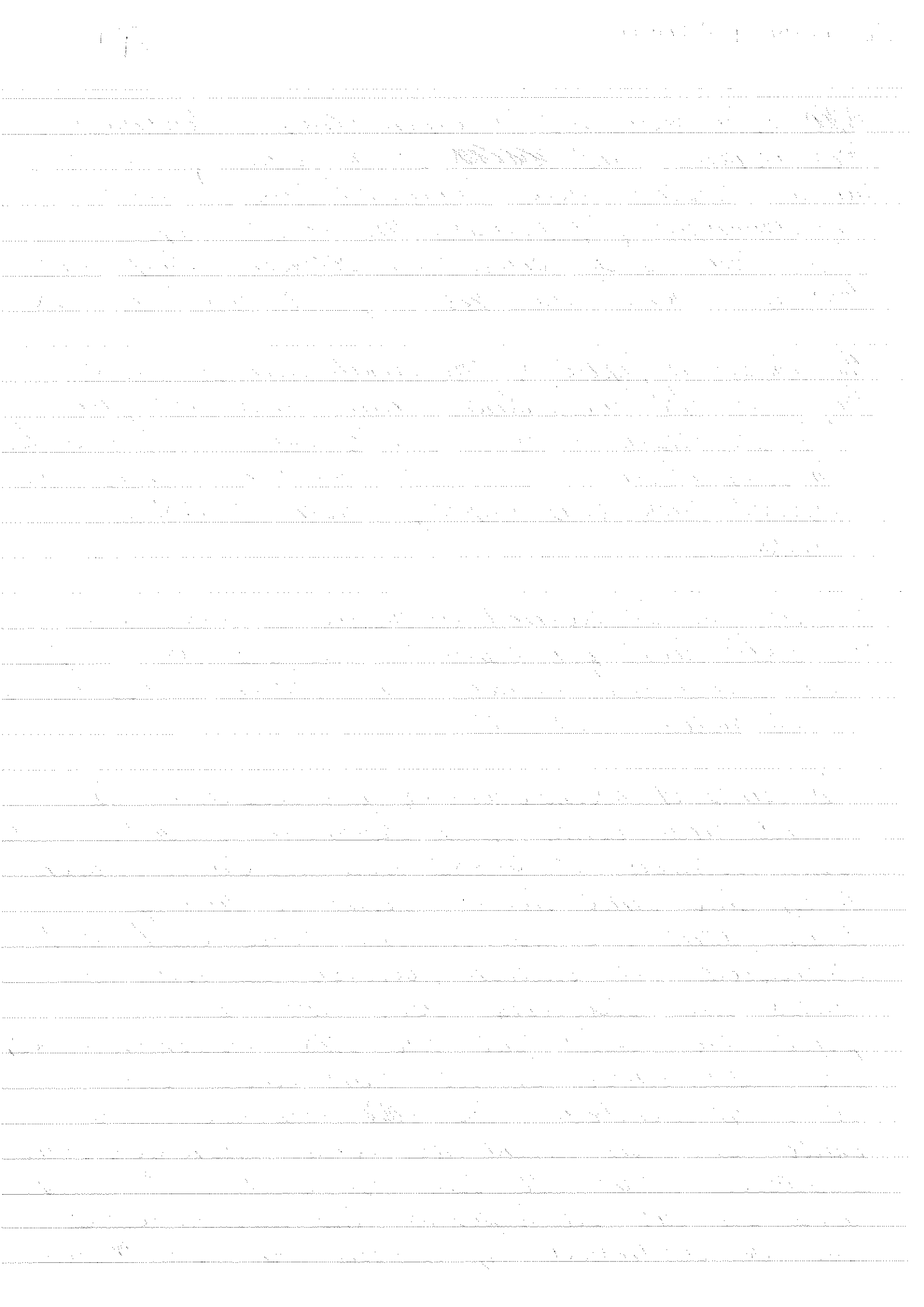
Figure: 4

After conducting the experiment; to determine if one's response time to a visual stimulus varied between there dominant (right) and non-dominant (left) hand, the results suggest that there is a correlation between using ones dominant hand and a faster reaction time.

As shown in figure 3, the overall average time for both the individual trials and the five (5) participants as a whole, was 0.530 seconds. In comparison to the non-dominant hand, the response time was slightly slower at 0.586 seconds.

It can also be observed in figure 2, that all the individual participant averages for using their dominant hand were faster in responding to the visual stimulus.

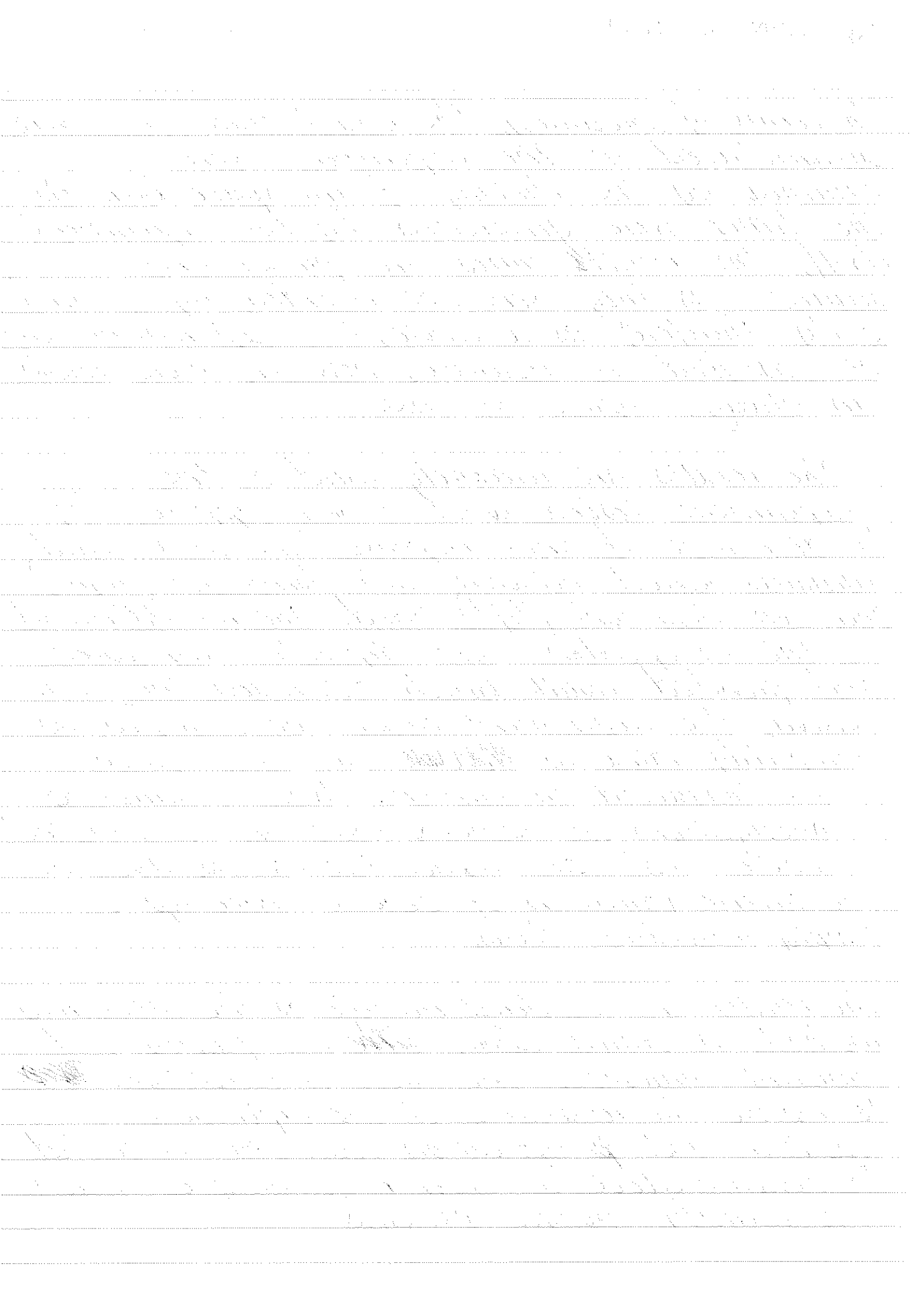
In terms of inconsistencies, participant 4's third trial using their dominant (right) hand was recorded at 0.882 seconds. On a larger scale, this time doesn't seem to greatly differ from the rest of the values and isn't considered an outlier. However, as reaction times are relatively fast, when put into perspective with all the other response times, the significance of its high value can be comprehended. This response time value not only alters the overall averages, but is slower than all the non-dominant hand times by all participants. This inconsistency can be addressed by conducting more trials.



In terms of accuracy, the result times that were accumulated in the experiment were obtained by the clicking of the space bar. As the times were generated by the experiment itself, the results times are precise and accurate as they were not recorded by a third party. Therefore, as a whole, the experiment can be classified as accurate, however, more trials can always improve on this.

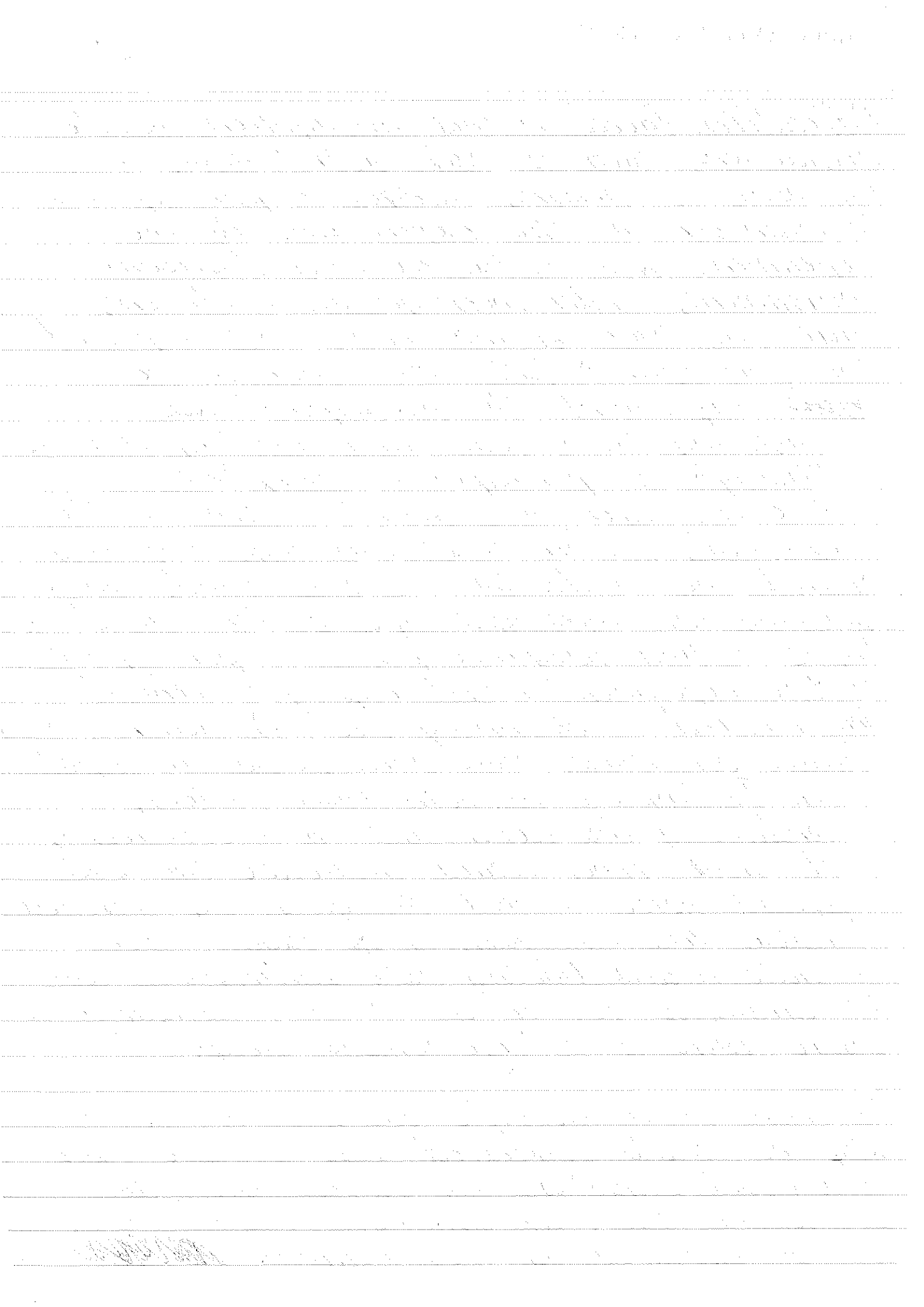
The results are relatively valid as the experiment tested what it was supposed to; to determine if one's response time to a visual stimulus varied between their dominant (right) and non-dominant (left) hand. The results related to the independent and dependent variables and provided results which addressed the aim. However, the experiment cannot be classified as completely valid as the investigation was conducted on humans. When conducting investigations on humans, there are uncontrolled variables that can impact the results, such as the diverse variation of genetic make-up or simply individual focus.

The results are considered reliable as the measuring method, as stated above, was not faulty and consistent throughout the whole investigation. To improve the reliability of the experiment repetition and replication could be conducted to accumulated a larger # quantity of results and identify stronger patterns.



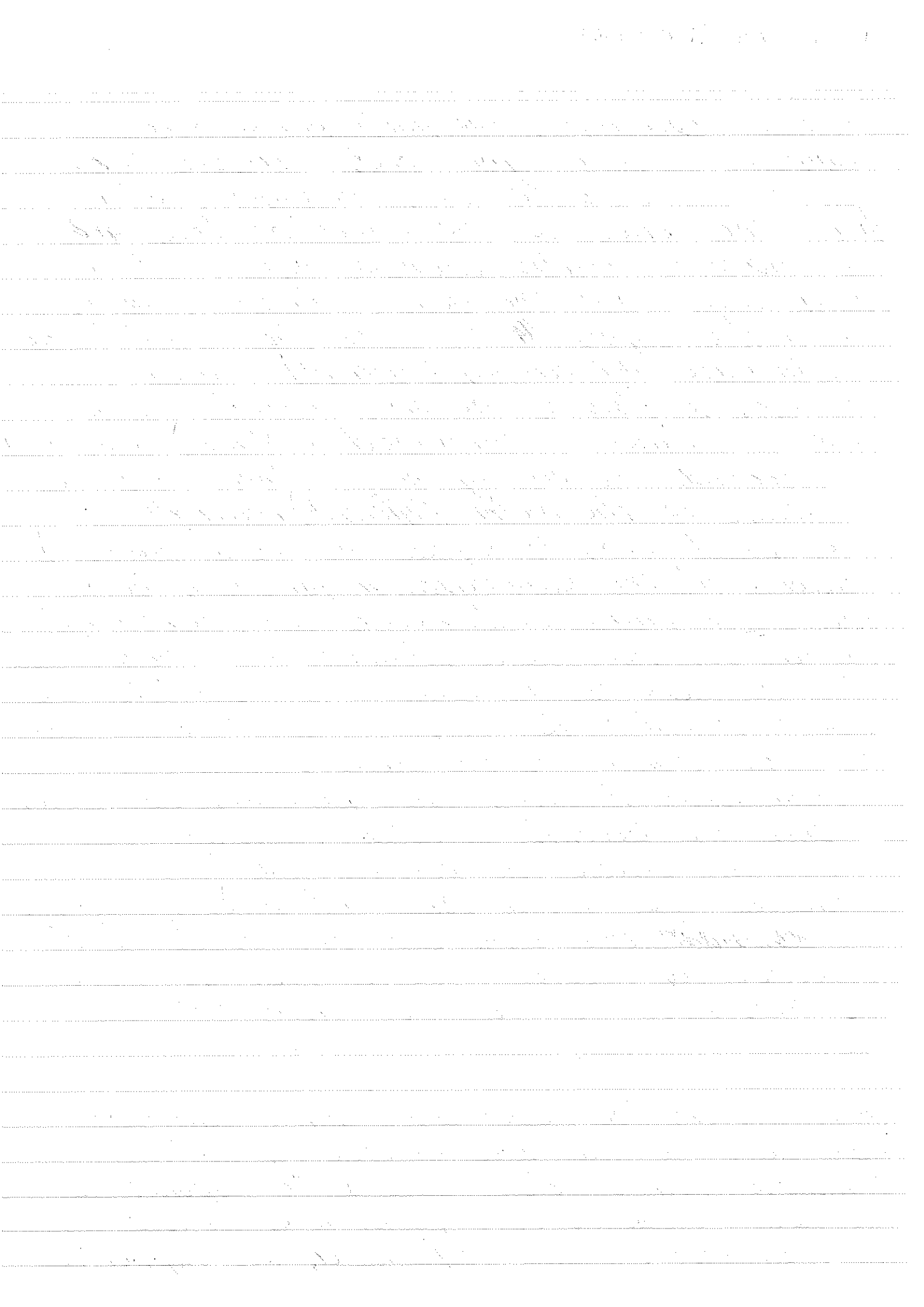
Difficulties faced in this investigation include distractions, such as back-ground noise, and the issue in finding adequate participants to volunteer in the experiment. As the experiment was conducted in a classroom environment, under investigation conditions, there was back-ground noise that impaired the participants full concentration on the ~~[illegible]~~ experiment. The participant was competing with visual and auditory stimuli. Although all participants attempted to block out cues that weren't relavent to the experiment, further trials can suggest if this altered the results. On the other-hand, whilst planning this investigation, a problem arised in trying to find adequate people to participate in the experiment whilst keeping it ethical. We resulted in obtaining five (5), however, with future ambitions, more participants are hoped for. To improve on both these factors, conducting the experiment in a classroom, at break-time, would eradicate the back-ground noise, without changing any controlled variable, and consequently go suggest more accurate results. Finding more participants can be arranged earlier on in the investigation to ensure there is a large sample group.

In terms of a scientific explanation, as to why the results suggested one's response time to a visual stimulus, was quicker when the participant used their dominant (right) hand, can be explained by their neurons. [illegible]



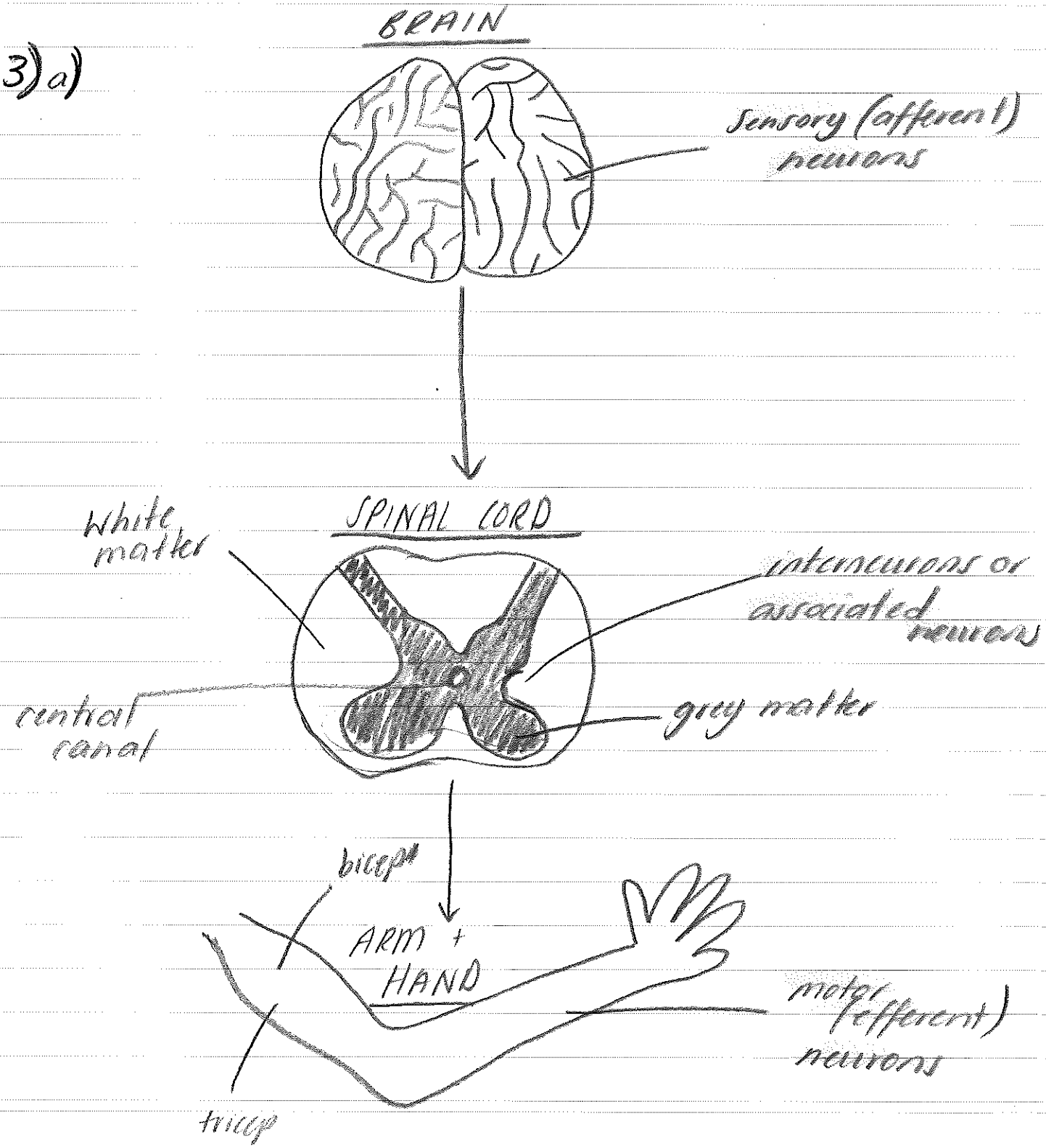
In this experiment, the participants were dominant in their right hand, therefore, their neurons are able to carry massages faster from the brain to the hand as they can transmit electro-chemical signals at a faster rate. When the visual stimulus, being the traffic light, initiates the visual cortex to stimulate the sensory (afferent) neuron in the eye, a flow of action potentials occur. This is because a threshhold (-55mV) has been exceeded. The sensory neurons then carry the message to the associated or interneurons in the spinal cord, to signal the motor (efferent) neurons. At the neuromuscular junction, between the motor neuron and muscle, the neurotransmitter acetylcholine is released and stimulates the movement of the muscle to respond to the visual stimulus. As the participants right hand is their dominant, the neurons have communicated along that pathway repeatidely and has become familar. Through this continuous process the participants have increased their motor skills and muscle memory in their right arm and hand, which consequently enables a faster reaction time in comparison to their non-dominant left hand.

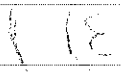
In conclusion, the hypothesis; When a dominant right hand is used, one's nervous system will stimulate their skeletal muscles to respond to the visual stimulus at a faster rate, in relation to their non-dominant left hand, was supported.



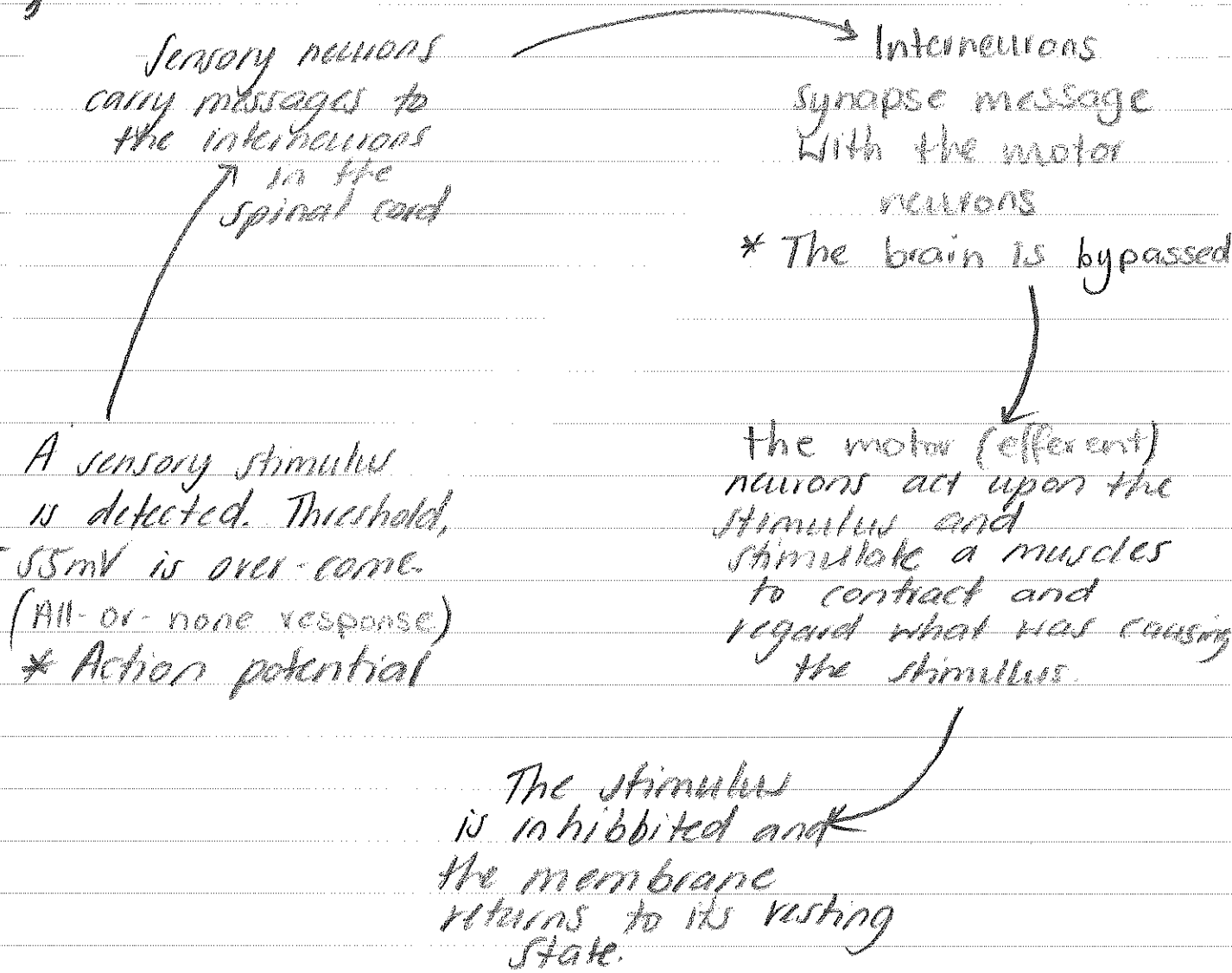
The results suggested a correlation between a faster response time, when using their dominant right hand.

3) a)





b)



c) in a response, the message is processed in the brain, the sensory neurons stimulate the interneurons in the spinal cord to carry the message to the brain. The brain then processes the message and then it is then carried back down the interneurons where the motor neuron are signalled to act. Therefor, juxtaposed next to a reflex arc, when the sensory neuron pass the message to the interneuron in the spinal cord, the motor neuron are immediately activated and the response is performed