Example Student Outcome “Sensation and Perception”

Note:
This sample material was developed at UCF and is included in the CREATES Toolkit Co-creative Learning as an example of outcomes of Research-Based Learning. For more information and additional educational tools, visit: http://europe-creates.eu

THE INFLUENCE OF SUBJECT AWARENESS IN CHANGE BLINDNESS

Juliana Quevedo Zabala

Sensation and Perception

University College Freiburg

January 2019

Table of Contents

Introduction

Change blindness is a perceptual phenomenon that occurs when changes are missed under natural viewing conditions because they occur simultaneously with a brief visual disruption, like a flicker, a mudsplasher, an eye movement or a blink (O'Regan, Rensink & Clark, 1999). A flicker is defined by Simons (2000) an original and modified image which is presented in rapid alternation with a blank screen between them. Mudsplashers are objects superposed in the image that may distract the observer. Regarding eye movements, Simons and Levin (1997) consider researchers' Gimes postulate, stating that during an eye movement, we apparently lose, or at least lose access to, many of the visual details of the previous view.

However, it rather seems that change-blindness occurs because the internal representation of the visual world is rather sparse and essentially contains only central-interest information (O'Regan, Rensink & Clark, 1999). It is also pointed out by Ross (2014), that the human brain detects spatial changes using sensors, located in the parietal and frontal lobes, which work together. Now, with so many changes happening all the time our brain gives priority to sudden, more drastic changes – to keep us safe and alert. This means that we fail to notice changes to scenes when they do not produce a motion on our retina that attracts attention (Simons and Levin, 1997). Although changes to central objects are more likely to be detected, they are not detected automatically. Therefore attention is required, but not sufficient for change detection. In the report I will argue that awareness of change is the other fundamental factor for a person to be able to identify changes on an image. Besides, the making of the experiment will also endeavor to prove the change blindness hypothesis.

Research question

Are people more prone to detect changes on an image when they are aware there will be changes?

Methods

The primary material used in the experiment was a 10 second segment of Ross' (2014) video from the National Geographic program "Brain Games". The motion image showed a picture of a city which gradually changed during the 10 seconds. The changes happened simultaneously through fading in either of the following ways: by making some objects disappear, changing gradually the color of other objects or changing the position of some others. Each changing object had only one type of change. Changes occurred in a margin of 10 seconds, and participants were shown the image twice on the basis of the forced choice detection paradigm. Observers only receive one view of each scene before responding, so the total duration of exposure to the initial scene can be controlled more precisely (Simons, 2000).

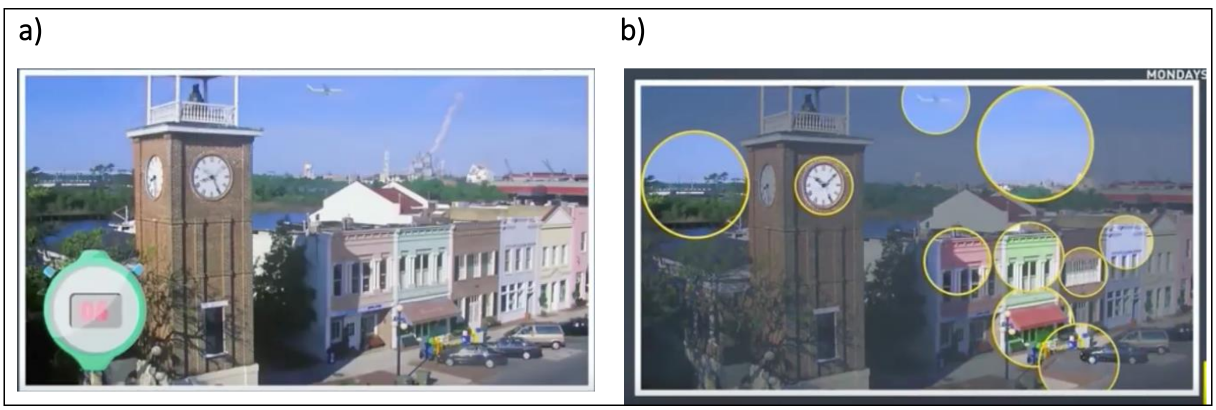


Figure 1. *a) image without changes; b) changes that occurred during the 10 seconds.*

In order to test the research question, two categories were defined. *Aware (A)* and *Not Aware (NA)*. In the *Aware* category, the participant was informed through written instructions (*see Appendix 1*) that there were changes in the image and how many, then they were asked to write down what they saw. The participant was transitively conscious, meaning that one is conscious of a feature of a scene, and to be conscious of a feature of a scene in this sense is simply to be visually aware of it (O'Regan & Nöe, 2001). While in the *Not Aware* category, the participant was not be given any information about changes in the image, and was asked to write down what he/she saw. Additionally, three groups were defined:

- NA–NA: participants were not aware of changes in neither of the times they saw the image. (see *Appendix 4*)
- NA–A: participants were not aware of changes the first time they saw the image, and were informed through the instructions shown in Appendix 1 about the changes before they saw the image for the second time. (*see Appendix 5*)
- A–A: participants were aware there were changes both of the times they saw the image, and were asked to write down the changes they saw. (*see Appendix 6*)

The instruction was given before showing the image, meaning that participants did not know what their second task was beforehand. Further, a short survey was conducted (*see Appendix 3*), where general information was gathered along with a self-evaluation question about change perception. The survey was filled in by the participants before they were informed about the changes; meaning at the end of the experiment for the NA–NA group, before the second video for the NA–A group, and before starting the experiment to the A–A group. It was performed in this way to avoid biases in the answer of the survey once they knew how they performed, since the third question asked how good they thought they were in perceiving changes.

Now that the set-up is explained, I will go through the process of the experiment. The participants were LAS students and family members – for which the experiment was conducted in English and Spanish. Participants were asked to take part on the experiment while being at the University common areas or in a family gathering. My sample size comprised 30 people, 10 per group.

Once they agreed to participate, they were handed in an informed consent (*see Appendix 2*), which they had to read and sign. Questions about the experiment were only allowed when the experiment was finalized. Participants were given the instruction corresponding to the group they were unknowingly set to (NA–NA, NA–A or A–A). Afterwards, they were shown the image and had maximum two minutes to write down their observations. When the experiment was finished, I explained my hypothesis, the different groups and what change blindness meant.

It needs to be pointed out, that the image contained a big chronometer counting down the seconds, which can be considered a mudsplasher and a TV sign on the top left corner which disappeared 5 seconds after I played the video. These objects were sometimes identified as changes, but they were not taken into account in the data collection.

Data collection

Answers of the participants were checked by hand and further digitalized (*see Appendices 4, 5 and 6*), and standard deviation calculations along with t-tests were conducted to test if there were significant differences. Additionally, the average age of the participants was 28.7 years old, and as I did not expect differences on the basis of gender, there were not equal numbers of males and females tested per group. Further, the majority of the participants felt average (3 in a scale from 1 to 5) about their ability at identifying changes in their visual field; but surprisingly, almost all participants felt that their change-perception was unsatisfactory when they realized that they could not identify all 10 changes in the image.

Results

Firstly, in the NA–NA group, participants tended to recognize few changes in the image. Although half of the sample recognized a change the second time they saw the image, but there were maximum 2 changes out of ten. Analyzing the *Correct* values, there is no significant difference between the 1st and the 2nd time responses

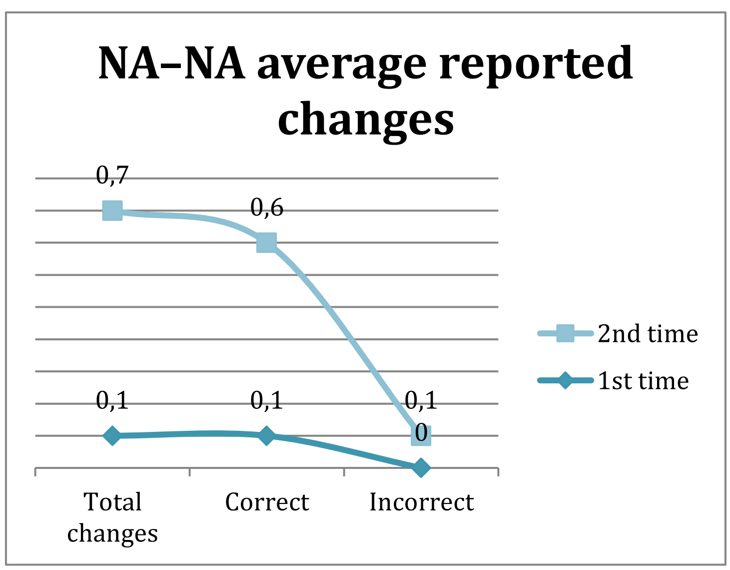


Figure 2. Total, correct and incorrect average of reported changes out of 10 on the NA–NA group.

(α=0.05, t= 0.7153, p [0.25, 0.1] > α).

The response to recognizing changes the second time, may be due to having more time cumulatively to process the information and looking for more things to note down, as stated by many participants. Common answers in this group were detailed descriptions of the image, lists of the objects they saw and even drawings.

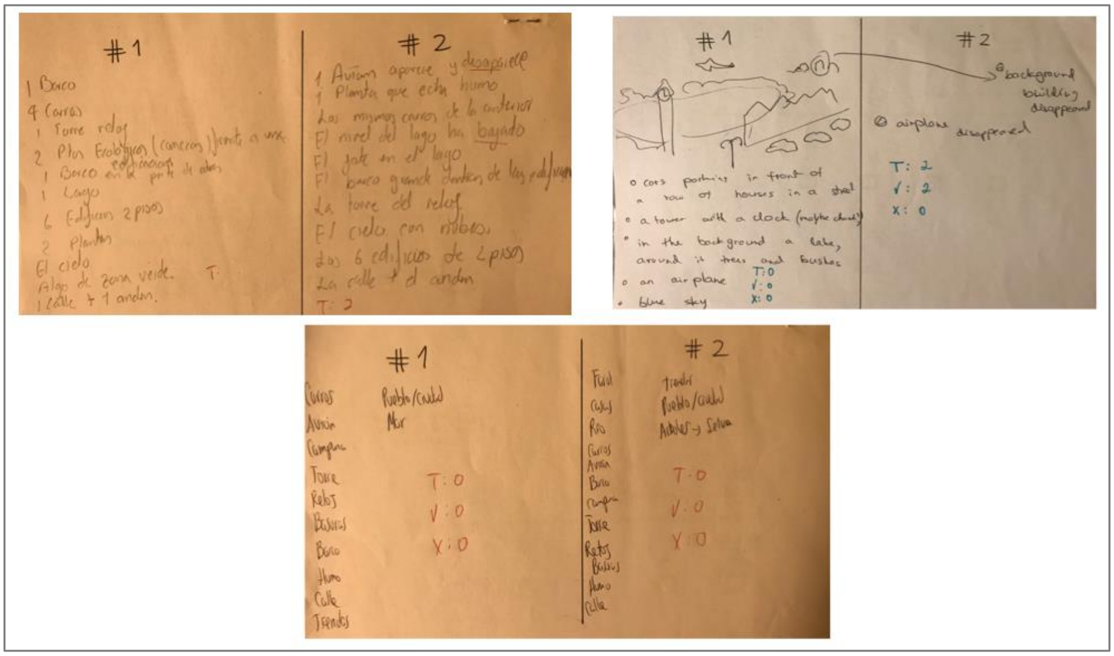


Figure 3. Examples of NA–NA answers.

However, some participants expressed that they did see changes, but that since it was not stated in the instruction to write them down, they omitted them. Nevertheless, it was interesting to see how many details people can recall from an image, seeming to have very good memory. It was also curious that every person described what they saw in the image very differently, depending on what they do and their interests. For instance, they would approach the image from an environmental point of view: polluting factory, from a historical point of view: architecture and time period, or from a business point of view: a harbor and created job opportunities.

Secondly, in the NA–A group, participants had a similar response as in the NA–NA group, the first time they saw the image they did not identify changes. Yet, when they were told to track changes, the second time, they performed better, though identifying around two changes out of ten. Thus, analyzing the *Correct* values, there was no significant difference amongst the 1st and 2nd time responses (α=0.05, t= 1.2779, p [0.25, 0.1] > α). Participants commonly asked at the end, if the images they saw were the same ones. This is particularly interesting, because it is interpreted to mean that they were actually not aware there were changes occurring the first time –which is supported by the data.

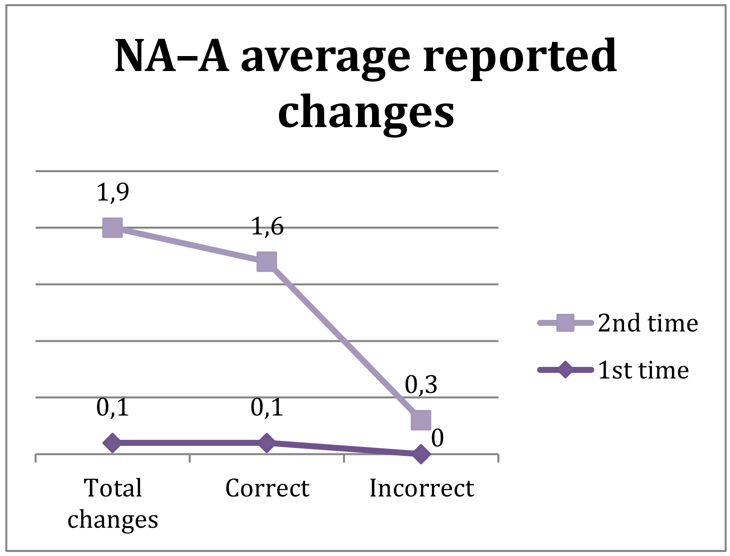


Figure 4. Total, correct and incorrect average of reported changes out of 10 on the NA–A group.

Lastly, in the A–A group, the performance of participants identifying changes was higher in comparison with the other two groups. However, it was found that there is no significant difference between the 1st and 2nd time responses (α=0.05, t= 0.4543, p [0.25, 0.1] > α).

It is however peculiar, to note that even though this group

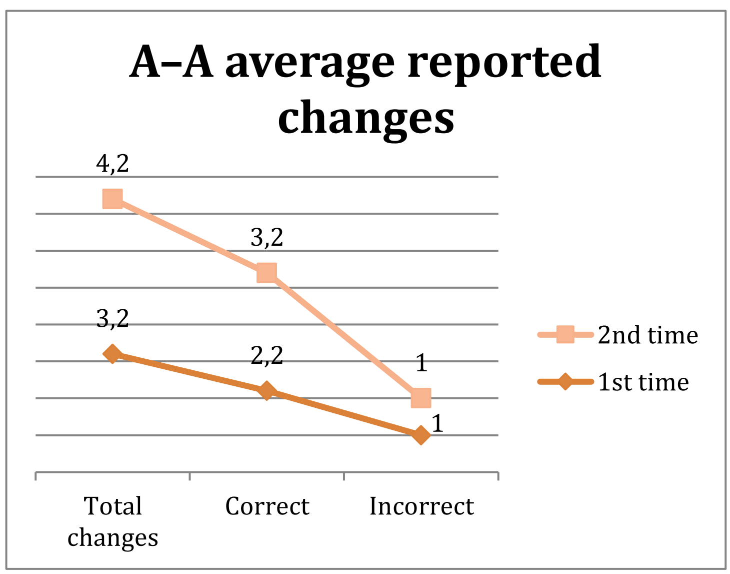


Figure 5: Total, correct and incorrect average of reported changes out of 10 on the A–A group.

had the largest response rate, it also had the highest rates for incorrect answers, from 10 of the total changes, only ~4 were noticed on average. Most participants reported that they applied a technique: when they were instructed to look for changes a second time, they left their previous findings aside and looked for different ones as the ones. Nonetheless, there are *intentional* change detection tasks in that observers know that changes will occur and actively search the display to find differences. This work, called 'forced choice detection paradigm', demonstrates that observers are change-blind even when their primary task is to search for change (Simons, 2000).

Data analysis

As Simons (2000) assures, observers are more likely to focus attention on important objects they are more likely to notice changes to objects in the center of interest of a scene. In this case, the most recurrent identified changes were: airplane disappeared, car disappeared, factory disappeared, the clock changed or the bottom right part got brighter (color change in houses). But, will these changes be enough to find a significant difference between groups? A comparison of the three groups in the experiment results in the following chart:

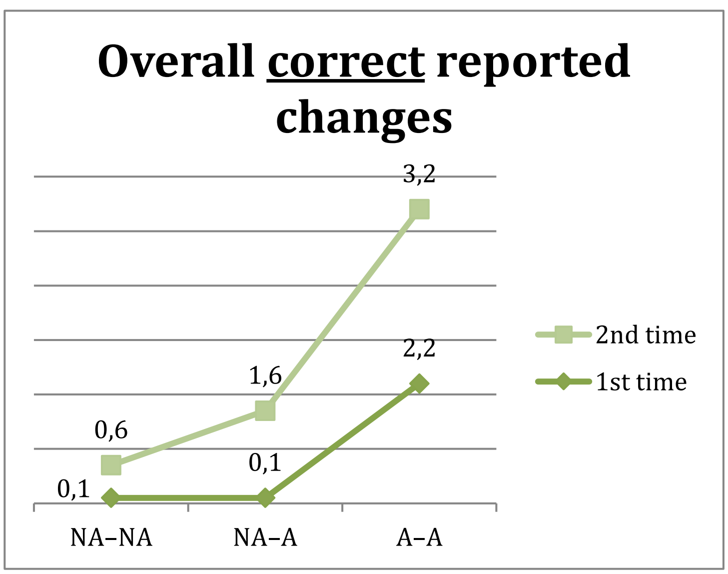


Figure 6: Total average of correct reported changes on the NA–A group out of 10.

When participants were aware that there would be changes and how many, there was an increase in response rates regarding change identification. Nevertheless, these changes are *not* significantly different from the other groups. The three groups were compared in terms of the 2nd time responses, and it was found that surprisingly, no comparison is significantly different from each other.

- NA–NA and NA–A (α=0.05, t= 0.0852, p > 0.25 > α).
- NA–NA and A–A (α=0.05, t= 1.1812, p [0.25, 0.1] > α).
- NA–A and A–A (α=0.05, t= 0.7269, p [0.25, 0.1] > α).

Even though A–A values are very high compared to the other groups, it is not significant because it is still an average of 3.2 over 10, and participant responses were scattered and led to a very high standard deviation.

Limitations

There were various limitations to this study:

a) The resolution of the image was not very good; it would be better to have an HD image.
b) Due to participants' convenience and time, instructions were given either verbally or in a written way. Although the instructions were exactly the same, it is preferable that all participants have the same information in the same medium.
c) Experiments were performed individually and also in groups from 2-4 people. This also alters the experiments' setting.
d) Scenes and objects on computer screens clearly lack many of the properties of real world objects.

Naturally, there are also some aspects that can be improved in the experiment:

a) Eliminate the on-screen chronometer, the experimenters should measure the 10 seconds on their own.
b) Avoid including mudsplashers on the screen, to have more precise data.
c) Have a gender balanced sample and compare
d) The sample size should be larger, at least 30 people per group.

Conclusion

It can be concluded from this experiment, that regardless of the given instruction (being aware or not of the changes), participants did not identify changes to a significant level ($\alpha=0.05$). Therefore, this study is further evidence in favor of the change blindness theory, and additionally, awareness did not make a significant difference in the theory, though in this experiment it was due to a high standard deviation.

Simons and Levin (1997) state that as we view scenes in the real world, we move our eyes three to four times each second. We perform saccades, rapid movements of the eye between fixation points. They assure that across fixations, objects in the world are projected onto different parts of the retina. Somehow, we integrate information across these fixations to achieve a stable representation. However, during eye movements, we lose access to many visual details. This is probably one of the reasons why participants were unable to identify all changes. They were blinking and looking at different spots in the image to either remember details to later describe them, or try to identify a change. In this rapid movement, some visual details such as the fading changes were not noticed.

Furthermore, two more variables are needed to see change: attention and awareness. In the one hand, attention is necessary for conscious change and perception, thus changes to semantically central items are detected faster than changes elsewhere, even when the changes are of equal physical salience, suggesting that objects in a scene that preferentially receive attention are more likely to be encoded and compared (Simons, Ronald & Renisnk, 2005). In spite of that, changes to attended objects frequently go unnoticed particularly when the changes are unexpected, as also noted by Simons and colleagues. Taken together, the change blindness literature suggests the following hypothesis: Subjects notice only changes to features that have been encoded by the visual system. Thus, change blindness suggests that under normal viewing conditions only a minor part of the environment is encoded in detail (Noë, Pessoa & Thompson, 2000).

References

Noë, A. (2005). What does change blindness teach us about consciousness? *Trends in Cognitive Sciences , 9* (5), 218.

Noë, A., Pessoa, L., & Thompson, E. (2000). Beyond the Grand Illusion: What change Blindness Really Teaches Us About Vision. *Visual cognition , 7*, 93-106.

O'Regan, J. K., Rensink, R. A., & Clark, J. J. (1999). Change blindness as a result of 'mudsplashers'. *Nature , 398*, 34.

O'Regan, K. J., & Noë, A. (2001). A sensimotor account of vision and visual consciousness. *Behavioral and brain sciences , 24*, 939-959.

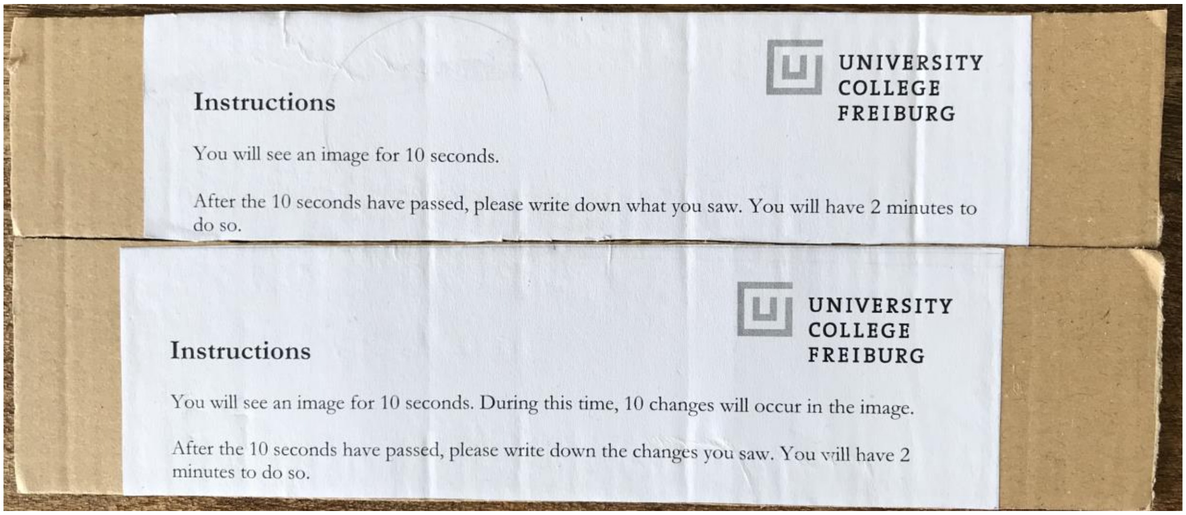
Ross, P. (2014, June 18). *Brain Games- Change Blindness, Speed of Changes, and Spatial Awareness*. (0:11 – 0:21). Retrieved December 03, 2018 from Youtube: https://www.youtube.com/watch?v=_FoghxotdYU

Simons, D. J., & Levin, D. T. (1997). Change blindness. *Trends in Cognitive Sciences , 1* (7), 261- 267.

Simons, D. J., & Rensink, R. A. (2005). Change blindness: past, present, and future. *Trens in Cognitive Sciences , 9* (1), 16-20.

Appendices

Appendix 1: instructions



Appendix 2: informed consent

Participant Number: ____

UNIVERSITY COLLEGE FREIBURG

Informed Consent

Thank you for participating in this student research project. It is part of the course "Sensation & Perception" offered at University College Freiburg during the winter semester 2018/19 by Dr. Simon J. Büchner.

The University College Freiburg supports the practice of protection of human participants in research. The following will provide you with information about the experiment that will help you in deciding whether or not you wish to participate. If you agree to participate, please be aware that you are free to withdraw at any point throughout the duration of the experiment without providing any reason.

In this study we will ask you to observe an image of a city to subsequently write down what you saw. It will also require a small survey on general data such as age, gender you identify with and a self-evaluation question.

If you have any complication during the experiment, please inform the experimenter and the study will end immediately.

All information you provide will remain confidential and will not be associated with your name. If for any reason during –or even after– this study you do not feel comfortable, you may quit the experiment and your information will be discarded.

Your participation in this study will require approximately 6 minutes. When this study is complete you will be informed about the purpose of the experiment and you will be free to ask any questions.

Your participation is solicited, yet strictly voluntary. All information will be kept confidential and your name will not be associated with any research findings. If you have any further questions concerning this study please feel free to contact us through phone or email: Dr. Simon J. Büchner | buechner@ucf.uni-freiburg.de | 0761-203-67444.

Please indicate with your signature on the space below that you understand your rights and agree to participate in the experiment.

______________________________ Participant's signature

______________________________ Student Investigator's name

UNI FREIBURG

Appendix 3: participant survey

UNIVERSITY COLLEGE FREIBURG

Survey

Participant number: ____

1. Age: ____

2. Gender you identify with: ____________________

3. How good do you consider yourself to be when identifying changes that occur on your visual field?

Very bad **Very good**

1	2	3	4	5
☐	☐	☐	☐	☐

Appendix 4: NA-NA data

Not aware – Not aware

#1										
Total changes	0	0	0	0	0	0	0	0	0	1
Correct	0	0	0	0	0	0	0	0	0	1
Incorrect	0	0	0	0	0	0	0	0	0	0

#2										
Total changes	1	0	0	1	2	0	0	1	0	2
Correct	1	0	0	1	1	0	0	1	0	2
Incorrect	0	0	0	0	1	0	0	0	0	0

Age	70	28	55	29	29	28	21	23	22	21
Gender	M	F	F	M	F	F	F	F	F	M
Question	4	3	4	3	3	3	3	3	2	3

Average	#1
0,1	Total changes
0,1	Correct
0	Incorrect

	#2
0,7	Total changes
0,6	Correct
0,1	Incorrect

32,6	Age
3,1	Question

Appendix 5: NA-A data

Not aware – Aware

#1										
Total changes	0	1	0	0	0	0	0	0	0	0
Correct	0	1	0	0	0	0	0	0	0	0
Incorrect	0	0	0	0	0	0	0	0	0	0

Average	#1
0,1	Total changes
0,1	Correct
0	Incorrect

#2										
Total changes	2	3	2	2	3	4	1	0	1	1
Correct	2	2	2	2	2	4	1	0	1	0
Incorrect	0	1	0	0	1	0	0	0	0	1

	#2
1,9	Total changes
1,6	Correct
0,3	Incorrect

Age	24	28	22	29	22	40	10	40	48	58
Gender	F	M	M	M	M	M	F	M	F	M
Question	2	4	4	2	4	5	4	3	3	3

32,1	Age
3,4	Question

Appendix 6: A-A data

Aware – Aware

#1										
Total changes	3	3	4	4	3	1	5	1	4	4
Correct	1	3	3	1	2	1	5	1	2	3
Incorrect	2	0	1	3	1	0	0	0	2	1

Average	#1
3,2	Total changes
2,2	Correct
1	Incorrect

#2										
Total changes	4	4	6	6	3	6	7	2	4	0
Correct	2	3	5	3	3	6	7	1	2	0
Incorrect	2	1	1	3	0	0	0	1	2	0

	#2
4,2	Total changes
3,2	Correct
1	Incorrect

Age	22	21	22	23	20	22	23	22	19	20
Gender	F	F	F	F	M	F	F	F	F	F
Question	3	3	4	3	3	3	3	3	3	4

21,4	Age
3,2	Question