Visual Attention

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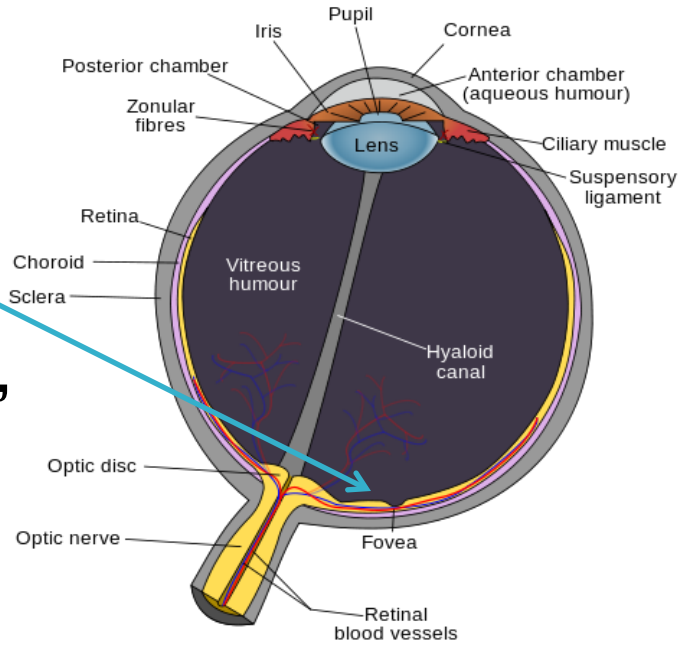
What I Learned

- When one focuses his/her attention by looking (making a saccade), the items we focus on become more detailed in our vision
- Why?
  - Our eyes scan our surroundings and aim the fovea in the back of our retina to the item we want to focus on and see the details of.
- What is the fovea?
  - The fovea is basically a
  - Depression in our retina. It
  - has the highest density of cones,
  - and it is responsible for
  - sharp vision.



- There are two main types of attention
  - Divided Attention: you can pay attention to a number of things at once
    - However, there is a limit of how many things you can pay attention to
  - Selective Attention: you focus on a specific object and ignore others.
    - We look at things that are interesting to us
    - Our visual system has been constructed to operate this way
- We are able to pay attention to things that are directly in our line of vision, to things that are in our peripheral vision, or simply look straight at something and not be paying attention to it (also known as zoning out)
- Why?
  - Attention and Perception are two different things

- Perception can occur without Focused Attention and can be affected by a lack of it.
  - Inattentional blindness: failure to perceive an item that isn't attended to even if it is in full view
  - Have you ever played the game of 'Look for 10 differences' in between two pictures? If you look at the pictures for only several seconds separately, you would not be able to tell the differences clearly even though you have perceived the items in the images.
- Why?
  - Could be a range of possibilities, from the color of the item, to the size, to the location, etc.

- Items can capture our attention more if there is movement involved.
  - Attentional capture: ability for motion to attract attention.
    - Occurs when you are consciously looking for something but also paying attention to something else.
    - Ex. Talking to a friend in a park, and a car drives by.
  - Movement attracting attention is important for survival. If something doesn't move, then it does not attract attention and therefore is not in danger.
  - Also, if an object is in motion, people tend to look at it to understand what it is, and if it may cause any danger. Therefore, the movement has a distracting effect from the task one if focusing on.

Article: Influence of Attentional Capture on Oculomotor Control by Jan Theeuwes et. al.

- This article looks at the effects of distraction by the presence of an additional item on the screen.

- Hypothesis: the presence of an additional item would affect the reaction time.

- Method: Participants were presented with a screen containing 6 circles in gray. All circles changed to red, but one remained gray (target).
- In the target circle, there was a C or a backwards C, participants had to determine which one it was and press a certain letter on the keyboard for each. This was utilized to measure the reaction time.
- There was an additional red circle that would appear in the screen, either when all circles turned red, 80ms after, or 150 ms after. They were placed 30 degrees, 90 degress, and 150 degrees from the target.
- To measure the eye movements during the task, researchers used an ISCAN eye tracker.

Article: Influence of Attentional Capture on Oculomotor Control by Jan Theeuwes et. al.

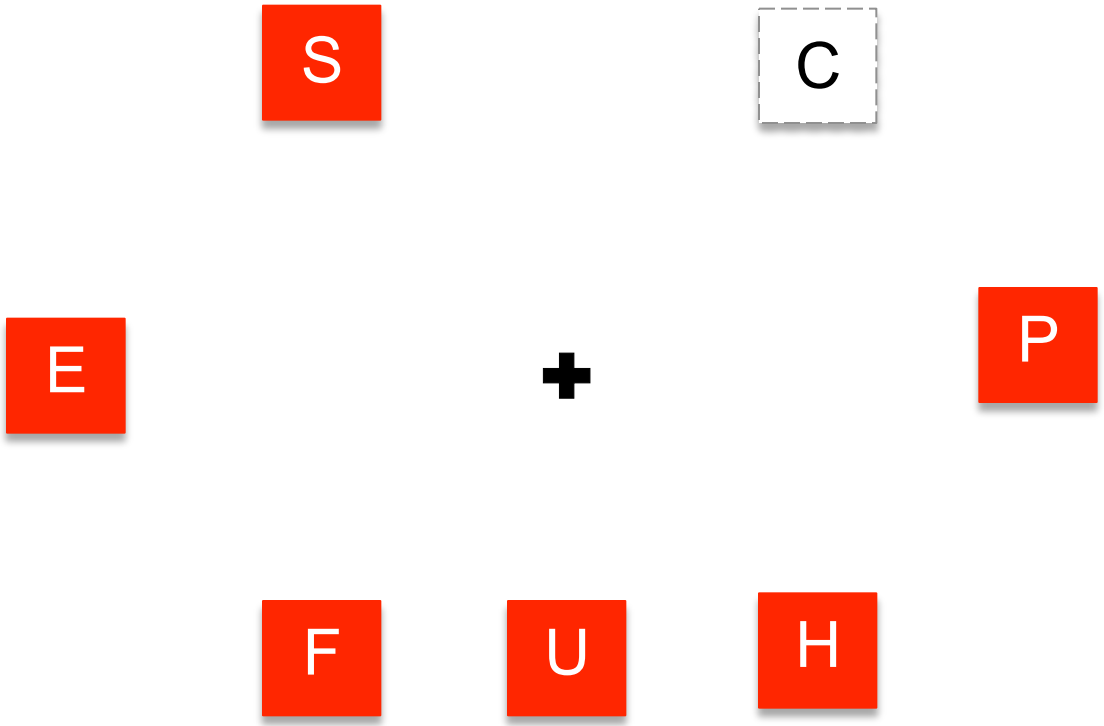
- Results: there was a main effect by the time it took the additional red circle to appear and the distance from the target , $F(2, 14) = 6.8$, $p < .001$.
- Scan paths from the eye movement data showed that eyes would follow the direction of the additional red circle, showing direction deviations if the eye movement had already began towards a target.
- Overall, they demonstrated that the addition of a red circle distracted people during a certain task.

My experiment

- Combining this study showing distraction, and the information of perception and attention, I decided to study how distracting the movement of an additional item could be.
- 2 conditions: 0 seconds (no movement) and 2 seconds (duration of one turn of the square)
- Hypothesis: the movement of the additional item will affect the reaction time of participants, as well as the number of saccades made towards it.

Procedure

- Participants were shown a screen such as the one below with a remaining white square and an additional item (not original scale)



- 10 participants were part of this Pilot Study (5 in each condition)

- As in the original study, the aim was to determine whether the letter inside of the remaining white square was a C or a backwards C.
- Correct/Wrong answers were manually recorded as the participant would give a verbal response.
- The reaction time was recorded using a timer.
- The eye movements were recorded using an ISCAN eye tracker.
- There were a total of 25 trials, taking approximately 5 minutes to complete.

Results

- T-test of Wrong Answers in Each Condition

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Number of Wrong Verbal Answers Given by the Participant Verbally	Equal variances assumed	.000	1.000	.000	8	1.000	.00000	.56569	-1.30447	1.30447
	Equal variances not assumed			.000	8.000	1.000	.00000	.56569	-1.30447	1.30447

  - There was no statistically significant difference in the wrong answers from one condition to the other, $t = 0.000$, $p > 0.05$.

- T-test of Average Reaction Time for Each Participant for Each Condition

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
AVG_RT	Equal variances assumed	1.595	.242	1.183	8	.271	.180904	.152965	-.171833	.533641
	Equal variances not assumed			1.183	6.638	.278	.180904	.152965	-.184840	.546648

  - There was no statistically significant difference in the reaction time from one condition to the other, $t = 1.183$, $p > 0.05$

Results

- T-test of Number of Saccades Made Towards the Additional Square in Each Condition

Group Statistics

	Condition of the Participants (0 = 0s, 2 = 2 s)	N	Mean	Std. Deviation	Std. Error Mean
Number of Saccades Made Towards the Distractor Per Participant	0 seconds	5	5.2000	4.54973	2.03470
	2 seconds	5	13.8000	6.53452	2.92233

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Number of Saccades Made Towards the Distractor Per Participant	Equal variances assumed	1.638	.237	-2.415	8	.042	-8.60000	3.56090	-16.81145	-.38855
	Equal variances not assumed			-2.415	7.140	.046	-8.60000	3.56090	-16.98678	-.21322

- There was a statistically significant difference in the number of saccades made towards the target from one condition to the other, $t = -2.415$, $p < 0.05$.
- The mean number of eye movements to the square with no movement was 5 times, and for the square with movement was 14 times.

- Therefore, there were more eye movements made towards the additional square in the 2 seconds condition than in the 0 seconds condition, meaning that the movement of the additional square increased the number of eye movements to it.
- These results demonstrate that the fact that the additional square (distractor) had movement, it was much more difficult to ignore it.
- Participants were actually 2.5 times more likely to look at the distractor if it was moving.

Conclusion

- This study demonstrated that movement could capture people's attention, even when they were engaging their attention in another task. It demonstrated that movement had the capacity of distracting people.
- For future studies, some improvements are a bigger sample size, simplification of instructions or the task at hand, reprogramming of the task so that participants do not have to control the timer, etc.

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References

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