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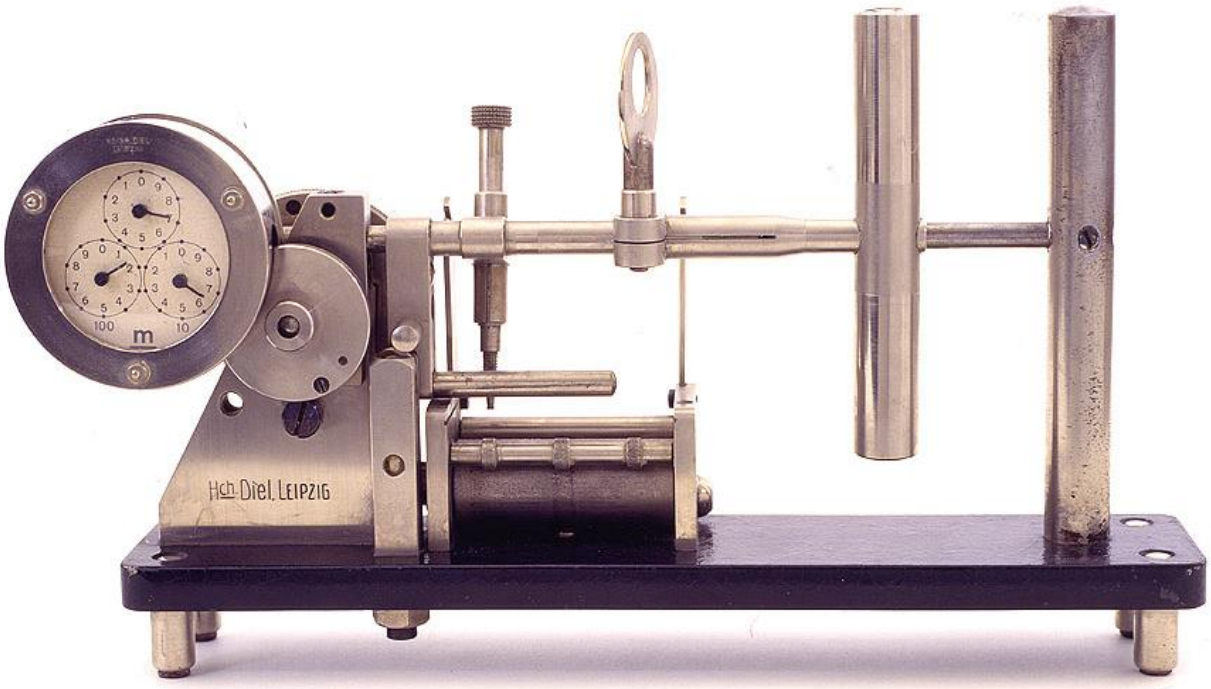

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The Role of Visual Attention in Localization and Identification Processes in Visual Perception

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Abstract

The main goal of this research is to examine the process of localization and identification of simple stimulus through specific experimental procedure of inattentional blindness. With this approach it can be analyzed the role of attention in the processes of visual perception. Also, this study sought to determine whether the localization and identification in inattention condition depend on the characteristic of the stimulus (position). The total number of 126 subjects have participated in experiment. The obtained results show that the localization of critical stimulus is possible in inattention condition. Efficiency in identification of critical stimulus was statistically lower than in localization, but existed. Identification depends on the position of the stimulus.

Keywords: localization, identification, inattentional blindness, stimulus position

Introduction

For people to react adequately in an environment that surrounds them, it is necessary to process visual information's efficiently. First of all, it implies accurate localization in surroundings, as well as accurate identification. Perceptual localization could be defined as an estimate of the stimulus position in the relation to the point of intersection of horizontal and vertical lines at right angles (Vishwanatah & Kowler, 2003), while the identification relates to the extraction of the basic characteristics of the stimuli that set it apart and different from other visual inputs (Ghorashis, Enns, Klein, & Di Lollo, 2010).

Although equally important in visual perception, it is not entirely clear whether the localization and identification are functionally independent processes, or whether they are placed in the same stages of perception. Two stages of perception could be distinguished – early or preattentive and late or attentive. If something is seen in regions that have not been attended, it is called preattentive (Treisman & Gelade, 1980; Wolfe, 2015). There are three theoretical approaches to the problem of localization and identification in perception. According to the first approach, known as the Feature integration theory, analysis of visual information in the early stages of perception involves determining the identity of the stimulus without signaling the place where it is located (Treisman & Gelade, 1980). Localization of stimulus takes place in the late, higher phase of perception that requires the engagement of attention. According to the second approach (Sage & Jules, 1985; Newby & Rock, 2001) it is possible to detect the location of stimulus at an early stage, without the participation of attention, while identification is possible only in a phase of focused perception. The third approach that was represented by Wolf (Cave & Wolfe, 1992; Wolfe, 1994) points out that the localization and identification are under the strong influence of attention and that there is interdependence between these processes. Empirical studies did not provide precise results that give dominance and validity of one of these approaches.

This study aims to determine the relationship of localization and identification of the stimulus through specific experimental procedure of inattentional blindness. Inattentional blindness is a phenomenon of unsuccessful perception of visible inputs within the visual field when attention is focused on other inputs (Mack & Rock, 1998). Full involvement in a task that engages the attention, leads to temporary "blindness" and disables the processing of other sensory information. Accordingly, this procedure allows examining the role of attention in various processes in visual perception. In a number of empirical studies it has been found that the amount of inattentional blindness depends on certain characteristics of the stimuli such as: size, shape, color (Mack & Rock, 1998) and position (Most, Simons, Scholl, & Chabris, 2000). Consequently this study is also trying to answer the question whether processes of localization and identification depend on the position of the stimuli that are perceived.

Method

Sample

The final sample consisted of 126 participants (79% female), students of the University of Banja Luka. Their mean age was 20.9 years. All participants had normal or corrected to normal vision and were tested individually.

Design and Procedure

Classical experimental procedure for testing the "inattentional blindness" was applied in this research. Participants were sitting at distance of 50 cm from the computer and head position was not fixed. Before each trial, a fixation point (1°) was presented at the center of the screen for 500 ms. It was followed by a cross centered at fixation for 200 ms. The primary task was to judge which line of the cross was longer – the horizontal one or the vertical one. Each participant completed a total of three trials. In the last trial, an unexpected critical stimulus appeared on the screen at the same time as cross appeared. Appearance of critical stimulus was ended in the same time as the cross. The critical stimulus was square and it was always presented on one of the imaginary 45° line bisecting the quadrants of cross. After the last trial, all participants answered the question whether they had seen something else besides the cross. If the answer was "yes", they were to specify quadrant in which the new

stimulus was shown. This was the localization task. Participants were also given an identification task in which they should identify the correct square in the series of offered stimuli. The order of the tasks was randomized. One group of participants first performed the localization task, and the other group first performed the identification task. These groups were approximately equal. Spatial dimension of unexpected critical stimulus was varied. There were two positions – center and periphery. Central position referred to the presentation of the square within the "zone of attention", whereas the peripheral position referred to the presentation outside the "zone of attention". "Zone of attention" was determined by a circular area around the lines of cross.

Results

The obtained results show that the number of correct answers in localization task is greater than the number of correct answers in identification task (Figure 1). This difference is statistically significant ($\chi^2(1, 126) = 65.470$, $p < .01$).

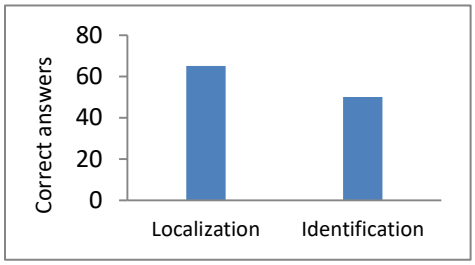

Figure 1: Number of correct answers in localization and identification tasks

Identification is also possible in inattention condition, but this process depends on the position of the stimulus (Figure 2). The stimuli shown near the fixation point are more accurately identified than the stimuli shown outside the "zone of attention" (χ^2 (1, 126) = 4.775, p <.05).

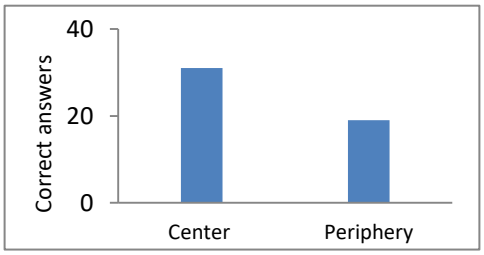

Figure 2. Number of correct answers in identification task in relation to the stimulus position

There was no effect of the task order on the accuracy of localization or identification ($\chi^2(1, 126) = .270$, $p > .05$ for localization; ($\chi^2(1, 126) = 1.226$, $p > .05$ for identification).

Discussion and conclusion

The results show that, in inattention condition, significantly more participants accurately determine the location of exposed stimuli in relation to the identification. Based on this we can conclude that the localization process takes place in the early stages of the perception. These results partially confirm the model offered by Sagi and Julesz (1985), as well as subsequent research based on their model (Donk & Meinecke, 2001), as they show that the stimulus localization is performed without attention. According to these authors, our visual system has the capability for early detection of the presence of the stimulus and to determine its position in space. Neri and Heeger (2002) pointed out that in the early stage of perception it comes to contrast energy extraction and that is a strong indicator of salient features presence at particular location in the visual field. Tsal and Bareket (2005) also found that course localization is possible without attention, while the fine localization requires attention. In this study, the determination of the quadrant in which a critical stimulus is presented can be considered as course localization. A fine localization would be a precise indication of the critical stimulus position. But, when it comes to the identification process the results are not fully consistent with the model of Sagi and Julesz (1985) and research of Donk and Meinecke (2001). Although efficiency in identification task was lower than in localization task, there were some correct answers in absence of attention. Such results are consisted with hypothesis that similar processes mediate identification and localization (Busey & Palmer, 2008). Results of this study also show that the identification of the stimulus in inattention condition is under the influence of stimulus characteristics such as position. Distancing of stimuli outside the zone of attention reduces the probability of correct identification. Such results can actually fit into the location-based models of perception (Most, Simons, Scholl & Chabris, 2000). According to these models, attention can function as a reflector (Posner, 1980; Gvozdenovic, 2011), which illuminates and better processes a stimulus, which is in the focus of attention in relation to the less illuminated stimuli in their environment.

References

Busey, T., & Palmer, J. (2008). Set-size effects for identification versus localization depend on the visual search task. *Journal of Experimental Psychology: Human, Perception and Performance*, *34*(4), 790-810.

Cave, K. R., & Wolfe, J. M. (1992). Modeling the role of parallel processing in visual search. *Cognitive Psychology*, *22*, 225-271.

Donk, M., & Meinecke, C. (2001). Feature localization and identification. *Acta Psychologica*, *106*, 97-119.

Ghorashi, S., Enns, J.T., Klein, R.M., & Di Lollo, V. (2010). Spatial selection and target identification are separable processes in visual search. *Journal of Vision*, *10*,1-12.

Gvozdenović, V. (2011). *Vizuelna pažnja*. Beograd: Filozofski fakultet.

Mack, A., & Rock, I. (1998). *Inattentional blindness*. Cambridge, MA: MIT Press.

Most, S., Simons, D., Scholl, B., & Chabris, C. (2000). Sustained inattentional blindness: The role of location in the detection of unexpected dynamic events. *PSYCHE*, *6*(14), 1-12.

Neri, P., & Heeger, D. (2002). Spatiotemporal mechanisms for detecting nad identifying image features in human vision. *Nature Neuroscience*, *5*(8), 812-816.

Newby, E.A., & Rock, I. (2001). Location and attention. *The Quarterly Journal of Experimental Psychology*, *54*(1), 155-168.

Posner, M. (1980). Orienting of attention. *Quarterly Journal of Experimental Psychology*, *32*, 3-25.

Sagi, D., & Julesz, B. (1985). Detection versus discrimination of visual orientation. *Perception*, *14*, 619-628.

Treisman, A. M., & Gelade, G. (1980). A Feature-Integration Theory of attention. *Cognitive Psychology*, *12*, 97-136.

Tsal, Y., & Bareket, T. (2005). Localization judgments under various levels of attention. *Psychonomic Bulletin & Review*, *12*(3), 559-566.

Vishwanath, D., & Kowler, E. (2003). Localization of shapes: eye movements and perception compared. *Vision Research*, *43*(15), 1637-1653.

Wolfe, J. M. (1994). Guided Search 2.0. A revised model of visual search. *Psychonomic Bulletin & Review*, *1*, 202-238.

Wolfe, J. M. (2015). Visual search revived: the slopes are not that slippery: a reply to Kristjansson. *i-Perception*, 1-6.