Novel research methods in clinical psychology:

Implementation of eye-tracking methodology in the laboratory

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Abstract

Eye-tracking methodology is widely used in research in clinical and cognitive psychology as a tool to explore cognitive processes such as visual attention. When talking about attention it is of big interest to investigate attentional biases, especially toward threatening stimuli. Inhibition of return (IOR) is one of them. It refers to a bias against returning the attention to a previously attended location. This bias serves as a foraging facilitator and is thought to facilitate systematic visual search. In contrast, cognitive theories suggest a hypervigilance towards threatening cues and difficulty for anxious individuals to disengage attention from threat. Since attentional search usually involves discrimination judgments, in this experiment a discrimination task was used and eye movements were recorded. Tracking eye movements is an effective method used to probe the perceptual, cognitive, and motor processing involved during the completion of a computer task. In the present study, a sample of 40 students completed a typical inhibition of return taskincluding schematic representations of spiders and butterflies as targets and a dot as cue. Eye movements were recorded while participants discriminated between spider and butterfly targets. Before the computer task, participants filled in a series of questionnaires and post task, they rated the pictures according to their valence and arousal.

Exemplary data will be presented. It is expected that reaction time data reveals a hypervigilance towards spiders in the spider fearful group (so that they will be faster to detect spiders than butterflies). Further, eye-tracking data is expected to show a robust IOR effect independent of stimuli relevance. Either outcome will be a meaningful contribution to the literature since it would help to clarify the boundary conditions of well-documented attentional processes.

Keywords*:Eye-tracking, emotional pictures processing, specific phobia, attentional allocation.*

Introduction

The human eye is one of the most fascinating and complex wonders of nature. Eye movements are the most frequent of all human behaviors, and they are processing thousands of visual stimuli that we encounter in our everyday lives. In this way, and due to the binocular properties of the eyes, it is possible to explore the visual world, making sense of what we have around us(Holmqvist et al., 2011). This is why eye movements are so fundamental to the operation of our visual system. And due to the very close relation to the attentional mechanisms, saccades and eye movements can provide us with information about cognitive processes such as memory, decision making, attentional biases and so on (Richardson&Spivey 2004). Apart from psychology, neuroscience and psychiatry, eye-tracking is being used also in advertising, design and informatics, especially in human-computer interactions.

Attention bias in specific phobia

Specific phobia is a psychiatric disorder which is quite common across the population and it is characterized by a marked and irrational fear accompanied with a strong desire to avoid the object which is feared(American Psychiatric Association, 2000). It is one of the most prevalent phobias and adults presenting with a specific phobia usually report that they began in early childhood and continued thereafter (Marks & Mataix-Cols, 2004). Often anxious individuals ignore some stimuli and attend to some others. All the bias in the allocation of attention to some threatening cues increases the frequency of anxious episodes (McNally, 1999). It is obvious that threat detection is adaptive, but it produces unnecessary anxiety and this can interfere with the individual's ability to cope with everyday situations.There is a lot of evidence for this attentional bias in processing fear-related stimuli, and this is more pronounced in phobic individuals (for a review see Mogg and Bradley, 1998). It is thought that these attentional biases have a crucial role in the development and maintenance of anxiety disorders, this is why we focus our work in their analysis and our aim is to reach a better understanding so that we can minimize them.

On one hand,Pflugshaupt and colleagues (2004) discuss a hypervigilance-avoidance pattern in spider phobia which is in line with other cognitive theories which suggest that we first are very attentive to phobic stimuli, and then quickly avoid them. On the other hand, Posner offers another paradigm which questions this

hypervigilance-avoidance pattern. Together with his colleagues, they argue that immediately after an event at a peripheral location, there is facilitation for the processing of other stimuli near that location.

But after attention is removed from such location, there is delayed responding to stimuli subsequently displayed there. This phenomenon firstly called 'inhibition of return (IOR)' by Posner encourages our attention to move toward novel locations and optimize visual search (Posner et al., 1985). Being aware of the hypervigilance-avoidance pattern in phobia, and of the Posner paradigm, we tested weather it is true that high fearful individuals show attenuation in this IOR effect in comparison to healthy controls.

Relevant eye-tracking studies

When talking about attention in anxiety disorders researchers usually use interference paradigms with the aim to investigate the attentional bias showed by anxious individuals. This approach involves presenting subjects some phobic cues (in the case of special phobias) in the presence of distracting information (MacLeod, 1999). In a study with spider phobic participants, Hermans, Vansteenwegen and Eelen(1999) used on-line registration of eye movements while participants looked at relevant material (spiders) or irrelevant material (flowers). The results showed that spider phobic patients at the beginning of the stimulus presentation looked more at spiders than at flowers, but after this they shifted their viewing pattern away from the spiders. We can consider this a normal reaction because phobic persons tend to avoid looking at phobic cues when this is possible.

Gerdes, Pauli, and Alpers(2009) used eye-tracking to measure the time employed to identify fear-relevant pictures. Spider-fearful participants were faster in looking at a picture of a spider, and they seem to have more difficulties to disengage their attention from the spider picture, rather than the neutral picture.

For a better understanding of the use of eye-tracking methodology in anxiety and mood disorders research, see the meta-analysis from Armstrong and Olatunji, 2012.

Our design/Methodology

Setting up an eye-tracking lab requires a lot of work and people who know how to use it properly. The system that we are using is SMI RED which is fully integrated and flexible. These systems combine the use of high data quality with high speed capabilities; it can measure saccades and shortest latencies very accurately. It

is equipped with binocular gaze and pupil data and has a very high resolution. It can be calibrated very fast and works with glasses and contact lenses. (For more information see: http://www.smivision.com/en/gaze-and-eye-tracking-systems/products/red-red250-red-500.html).

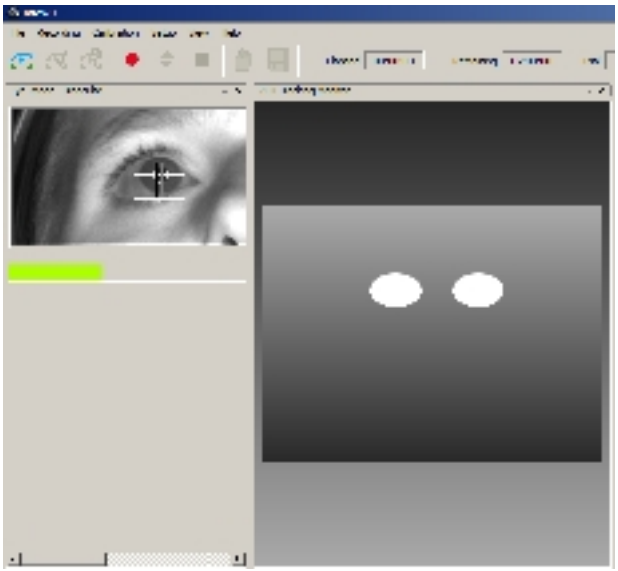

Fig. 1– example of eye view in the eye-tracker

As stated before, eye-tracking technology has a wider range of application areas, from neuroscience to Psychology; Psychiatry and Psycholinguistics.

The study designs are always different in different fields, but in Psychology everything is strictly controlled (Duchowski, 2007). From the formulation of the Hypothesis to the running of the participants is a long procedure which requires effort and combination of a lot of variables. Conducting these experiments in the laboratory allows greater control over experimental conditions than what can be usually achieved in the field. Anyhow, being equipped also with the SMI eye-tracking glasses (http://www.eyetracking-glasses.com/) allows us to expand our research also in more ecologically friendly environments.

In some of these studies investigating attentional bias in anxiety and/or depression, we encounter free viewing tasks and in other studies scientists use visual search tasks. In our research we merge together the

Posner IOR paradigm and a discrimination task. We make use of eye-tracking to record eye movements which provideus with a better data set and a better understanding of these attentional bias in individuals with a specific phobia.

Conclusions

The use of eye-tracking methodology has the potential to help research in clinical and biological psychology, and to give us feedback on a lot of cognitive processes. These findings can be applied in the future to better help focus on the problem and find new ways for treatment.

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