C. SHORT POPULAR-SCIENCE DESCRPITION

Our everyday functioning is embedded in multidimensional reality, where some regularities of different kind of complexity are often repeated. Thus, it is crucial to understand how we, as humans, perceive these regularities and how do we use them.

In 2014, a group of researchers from Lousiana State University (Baton Rouge, USA) published an article reporting the results of two experiments. The aim of their research was to find out whether people are able to learn, in an unconscious way, some hidden structure determining time as well as place of simple visual stimuli exposure.

In the first experiment there was a red square appearing on the screen and the task of participants was to press a key as soon as they see the it (detection task). In the second experiment there were two kinds of stimuli and the task was to indicate whether the square was red or green (discrimination task). Unbeknownst to participants, in some trials the stimuli were more predictive than in others, in terms of possible place and time of their exposure. It was hypothesised, that if squares appear in a fixed time intervals and always in the same place, the subjects' reaction times will be decreased in comparison to the reactions to stimuli appearing randomly in four possible places and at four possible time intervals. Moreover, it was expected that in a high predictability condition eye gaze would be fixated faster on expected stimuli even before its appearance.

It came out that high spatial and high temporal predictability resulted in shorter reaction times in both detection and discrimination group. Whereas, the effect of predictability on gaze fixation was visible only in discrimination group. The researchers explain it by the fact that discrimination task was more difficult than detection task. Additionally, temporal regularities might be perceived to a less extent that spatial regularities. It was the first study that showing that humans can in fact detect even unconsciously some hidden spatial along with temporal patterns. We can also use this knowledge in order to direct attention only to these places and only in these moments, in which we expect an important event to happen.

Predictability can refer not only to the frequency of when and where a relevant stimuli appear, but in can be also related to knowledge on a complex order in which sequence of events may follow in space and time. The first type of knowledge is defined as probabilistic predictability, while the second one is called as sequential predictability. As far as its known how does probabilistic predictability in spatio-temporal dimension influence the visual attention, depending on type of task (detection vs discrimination), the relationship between sequential predictability and attention orienting is not yet well understood. The question of which cognitive mechanism enables faster reactions and faster gaze fixating on predictable stimuli is also unexplored.

Studies using the event-related potentials (ERPs) method demonstrated that if one has a cue indicating the left or the right side of the screen where a relevant stimuli would appear, then the regions of cerebral cortex responsible for perception of the cued side of visual field are activated to a grater extent than the contralateral brain hemisphere. Basing on another series of research it was shown that when visual stimuli are exposed in a fixed rhythm, then the brain regions responsible of their perception are actived earlier than when the same stimuli would appear in a random time intervals.

Our research project aims at explaining (1) whether the knowledge about the spatio-temporal structure of the target exposure, acquired in the process of implicit learning, may guide the orienting of visual attention, (2) whether this type of knowledge enables the speeded perception of these stimuli that are attended in a specific place and in a specific time. In order to answer these questions, we plan to conduct four studies. The first and the second one will concern probabilistic predictability and the resting two will concern sequential predictability. The first and the third experiment will consist of detection task and the second as well as the fourth ones will consist of discrimination task. In each single study, the stimuli will be predictable in (1) only spatial dimension, (2) only temporal dimension, (3) spatio-temporal dimension and (4) randomly. We expect that, amongst others, in discrimination task, sequential predictability in spatio-temporal dimension, in contrast to probabilistic predictability, will have a greater effect on attention orienting than predictability in a single dimension. As index of attention orienting will serve reaction times and eye movements (measured with an eyetracker). We also expect differences in ERP components between predictable and random stimuli.