Mensenkennis Blog

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Stepping backwards to move forwards.

New empirical findings on attention require cognitive neuroscientist to take re-evaluate their conclusions.

The broad domain of cognitive science comprises of different approaches to study the specific mechanisms of cognition which together make up the human mind. Guided by theoretical frameworks and empirical evidence, the domain of cognitive neuroscience aims to comprehend the neurobiological mechanisms supporting the different aspects of cognition. One such cognitive mechanism that has intrigued researchers is that of attention.

Several aspects of attention have been linked to neural activity (e.g. P1 and N1 components of ERPs, regions of visual perception and motor control using fMRI,..) in a wide range of research. A special interest goes out to the correlation of attention and changes in oscillatory brain activity. Cortical oscillations are said to reflect the rhythmic activity in the brain, caused by synchronized action within a large number of neurons. Distinguishable types of oscillatory activity can then be observed in an electroencephalogram, classified as delta (1-4 Hz), theta (4-8 Hz), alpha (7-12 Hz), beta (13-30 Hz) and gamma (30-70 Hz) based on differences in frequency range. Especially alpha oscillations have been said to reflect attentional processes since the early days of electroencephalography (EEG).

Although the connection appears clear, not much is known yet regarding the function of oscillations in relation to the different aspects of attention or the attention mechanism in general. The limited understanding we do have is based on empirical fragments correlated with neural activity, resulting in a lack of coherence in the literature. A potential reason for the lack of consistency and contradicting results in the literature could lie in the way attention as a mechanism is perceived. While looking at individual features under controlled conditions is still the recommended approach, the attention features might be more related than originally thought.

Traditionally attention was seen as a system with the purpose of selecting sensory information for further processing. Periods of inefficient selection were then said to be caused by distraction and general failure of the attentional mechanism. However, in a more recent take on the mechanism it has been proposed that attention is not only about selection, but as most evolutionary traits able to change and adapt to our current needs. In the case of attention, two-sided, allowing to distinguish between focused and distributed attention. Each state able to benefit our performance depending on our goals and contextual requirements.

A big problem with flexible and adaptive traits is simultaneity. Meaning, an organisms cannot do everything at once. Choosing one will result in costs elsewhere. Translating to the domain of attention we can speak of a trade-off where: if attention is too task focused, other cues and potential important information might be disregarded and missed. Alternatively, when we focus too little (distribute our attention) a wider scope of information will become available. However, in case of the latter we'll be less likely to process objects individually. Consequentially irrelevant cues might distract us, which can potentially cause failures in the current task performance.

The proposed trade-off in attentional processing became first apparent in the spatial dimension. More recently similar observations support the existence of the trade-off in the dimension of time. Although the idea of a duality in attentional states, contributing to a processing trade-off, is not entirely new. Only recently has the concept as a whole been starting to gain some interest in empirical research. Not surprisingly it has yet to be addressed in relation to the underlying neurobiological mechanism. However, it has been proposed that brain mechanisms might potentially be involved in the occurrence of the trade-off itself. Reassessing some well-known neural correlates of attention, within the framework of attentional trade-off, might generate some clarity on the yet to be fully understood underlying neurobiological mechanisms and their relation to attention. My personal suggestion, let's start with cortical oscillations and sustained attention.

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