

Koc, Alpay, “Functional Hierarchy and Temporal Dynamics of Conscious and Unconscious Processes in Human Vision”

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Despite the fact that the human visual system is one the most extensively studied sensory systems, very little is known about its functional architecture and temporal dynamics. The broad, long term goal of our research is to understand the mechanisms and dynamics underlying conscious and unconscious registration of a visual stimulus. In order to address this question, we have used three paradigms where the degree of conscious registration of a stimulus can be controlled systematically: 1) Binocular rivalry, 2) Visual masking, and 3) Visual attention. In each paradigm, the strategy was either to suppress or enhance the conscious registration of a stimulus by a secondary stimulus and to probe the functional hierarchy or the dynamics of this interaction by varying stimulus parameters. Our results identify a functional hierarchy of unconscious processes in the brain starting with disinhibition in metacontrast followed by binocular rivalry, which in turn is followed by metacontrast masking.

Moreover, our electroencephalography (EEG) results suggest that the parietal areas constitute one of the neural loci where metacontrast interactions take place during a period of 200–400 ms after stimulus onset. Under the framework of a model of masking (RECOD; Ogmen et al., 2003), our results suggest that the transient activity of a stimulus is suppressed mainly by inter-channel inhibition. Our results also suggest that a peripheral cue, which facilitates conscious registration of a stimulus through the deployment of attention mechanisms, also generates feature-based priming. Taken together, these results reveal a functional hierarchy of conscious and unconscious processing in the visual system and characterize some of the dynamics taking place within this hierarchy.