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# **ON THE BORDERS OF CONSCIOUSNESS**

**an evaluation of the delineation between the neural substrates of conscious and  
unconscious cognition.**

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A thesis submitted in partial fulfilment of the requirements of the degree of Doctor of  
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## **Abstract**

The neural mechanism by which the brain creates conscious awareness remains unknown. The present thesis employs electroencephalography to investigate these neural substrates of conscious awareness through an investigation of the distinctions between neural activity associated with conscious awareness and neural activity which is not accompanied by conscious awareness. The temporal dynamics and the complexity of content during the unconscious processing of information are assessed in the first two chapters using the masked presentation of word stimuli. Results reveal that abstract information is extracted from unconsciously presented stimuli more rapidly than is usually associated with the neural indices of the conscious representation of information. It is also shown that the delay between the processing of different elements of word stimuli is such that some form of stable reentrancy is likely established during unconscious neural activity. The third experiment investigate the oscillatory event related beta desynchrony (ERD) preceding movement with and without awareness of the impending movement. The results show that beta ERD, unlike the evoked EEG response, reflects the awareness of the intention to move. It is argued that beta ERD allows the establishment of reverberating neural assemblies that are thought to be necessary for conscious representation. The final experiment uses a binocular rivalry paradigm to investigate the role of synchronous oscillations in determining the contents of consciousness. It is argued on the basis of this chapter that synchrony reflects the reorganisation and coordination of neural activity but is not, in itself, a mechanism for the binding of neural assemblies. The results are discussed in relationship to the distinction between conscious and unconscious cognition existing across a spectrum rather than representing qualitatively different neural states.

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## Abbreviations

AC Anterior Cingulate  
Ag Silver  
BOLD Blood Oxygen Level Dependent  
Cl Chlorine  
CS+ Conditioned Stimulus Paired with a US  
EEG Electroencephalography  
EI Effective Information  
ERD Event Related Desynchronisation  
ERP Event Related Potential  
FFA Fusiform Face Area  
FFS Feed Forward Sweep (model)  
fMRI Functional Magnetic Resonance  
GFP Global Field Power  
GWT Global Workspace Theory  
IFG Inferior Frontal Gyrus  
IIT Information Integration Theory  
ISI Inter-Stimulus Interval  
IT Inferior Temporal Cortex  
LGN Lateral Geniculate Nucleus  
LIP Lateral intra-parietal area  
M1 Primary Motor Cortex  
MEG Magnetoencephalography  
N1/N170 Negative visual evoked response occurring with a latency of approximately 170ms  
N400 Negative scalp deflection with a latency of 400 milliseconds  
NCC Neural Correlates of Consciousness  
P400 Positive intracranial potential with a latency of 400 milliseconds  
PET Positron Emission Tomography  
PFC Prefrontal cortex  
PPA Parahippocampal Place Area  
REM the stage of sleep characterised by Rapid Eye Movement  
RP Readiness Potential  
RPM Recurrent Processing Model  
RS Repetition Suppression  
SMA Supplementary Motor Cortex  
SOA Stimulus Onset Asynchrony  
STS Superior Temporal Sulcus  
US Unconditioned Stimulus  
V1 The primary visual/striate cortex, Brodmann area 17  
V2 Area of the visual cortex the receives input from V1, Brodmann area 18  
VWFA Visual Word Form Area