Dissociating neural activity related to subjective visibility and objective performance with simultaneous EEG/fMRI

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An important question in cognitive neuroscience is whether the neural processes supporting stimulus discrimination are distinct from those underlying conscious stimulus awareness. To better understand the spatial and temporal dynamics of neural activity reflecting both how accurately a stimulus is processed and whether it is subjectively experienced, we recording signals from EEG simultaneously with fMRI while subjects performed a visual discrimination task. Backward-masked images of faces and houses were presented at each subject's threshold for subjective awareness. On each trial, response accuracy (two-alternative forced choice) and subjective visibility (sliding scale representing maximum to minimum visibility) was recorded. Analysis of the EEG data reveal that pre-stimulus oscillatory activity in the alpha-band, measured over posterior sensors, distinguishes between targets subsequently rated as high or low in visibility, but was not predictive of target discrimination accuracy. Further, high vs. low visibility could be successfully decoded from stimulus-evoked BOLD responses in visual and frontal cortices, but stimulus-specific patterns of activity that varied with awareness were present only in inferior temporal cortex. These data suggest that neural processes related to subjective visual awareness can be dissociated from processes driving objective discrimination accuracy.