

Comparisons of Stimulus Rivalry to Binocular Rivalry with Functional Magnetic Resonance Imaging

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Introduction

When incompatible stimuli are imaged on the corresponding retinal regions of the two eyes; one stimulus is visible for a few seconds, dominant, while the other stimulus is invisible, suppressed; after a few seconds, visibility reverses. This process continues for as long as one looks. This phenomenon of alternation in perception is as called binocular rivalry. The stimuli can be presented continuously to each eye, or swapped between the eyes which the authors call binocular rivalry and stimulus rivalry respectively. The authors use functional magnetic resonance imaging to compare the cortical activity during the two rivalry conditions. Binocular rivalry showed activity at both low (monocular) and high (binocular) cortical regions. Stimulus rivalry showed weak activity at low than high cortical regions compared to binocular rivalry. The authors suggest that their finding can be explained by hierarchical model of rivalry which explains that the competition at the low level is bypassed during swapping and rivalry is the result of competition only at higher cortical regions.

The study comprises of experiments designed with good control conditions. The authors interpretation of the hierarchical model of rivalry is not satisfactory. Wilson (2003) proposed that during binocular rivalry, competition at the monocular (low) and binocular (high cortical) stage generates rivalry alternations. During stimulus rivalry, Wilson (2003) proposed that the temporal transients bypass the competition at the first stage and that competition at the

second stage produces rivalry alternations. Wilson (2003) assumed that increased inhibition at the second stage is required during stimulus rivalry to generate alternations similar to those of binocular rivalry. Therefore the hypothesis which the authors mentioned

1. Early visual areas (low cortical areas) would show greater activity during binocular than stimulus rivalry.
2. Higher cortical areas also showing greater activity during binocular rivalry than stimulus rivalry.

The first hypothesis seems correct based on Wilson's model however the second hypothesis is not supported by Wilson's model. Moreover, Bhardwaj & O'Shea (2012) using the probe technique have already mentioned that Wilson's model needs to be modified such that swapping does not bypass competition at low cortical areas it just reduces the competition. Thereby giving rise to similar alternation during both rivalry conditions but weak suppression depth during stimulus rivalry. The authors finding are in support of the probe study done by Bhardwaj & O'Shea (2012), even though the author mentions about this study in the discussion it would have been appropriate to mention this study in the introduction and thereby building up the hypothesis.

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1. In the probe paradigm an observer is asked to trigger a probe when one or the other rival stimulus attains dominance. The probe could be a superimposed stimulus different from the rival target or variation in some aspect of one of the rival stimuli. The threshold to see the probe stimulus during dominance and suppression phase of rivalry is measured. The ratio of the dominance to suppression threshold gives an estimate of suppression depth.

Reference:

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2. Bhardwaj, R., & O'Shea, R. P. (2012). Temporal analysis of image-rivalry suppression. *PLoS One*, 7(9), e45407.